DOE/CF-0138
Volume 1

Department of Energy
FY 2019 Congressional Budget Request

National Nuclear Security Administration

Federal Salaries and Expenses
Weapons Activities
Defense Nuclear Nonproliferation
Naval Reactors

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February 2018 Office of Chief Financial Officer Volume 1

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($K)

Department of Energy Budget by Appropriation	FY 2017 Enacted	FY 2018 Annualized CR*	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted $	FY 2019 Request vs FY 2017 Enacted %
Energy and Water Development, and Related Agencies					
Energy Programs					
Energy Efficiency and Renewable Energy	2,034,582	2,040,249	695,610	-1,338,972	-65.8%
Electricity Delivery and Energy Reliability	229,585	228,026	0	-229,585	-100.0%
Electricity Delivery	0	0	61,309	+61,309	N/A
Cybersecurity, Energy Security, and Emergency Response	0	0	95,800	+95,800	N/A
Nuclear Energy	1,015,821	1,008,922	757,090	-258,731	-25.5%
Fossil Energy Programs					
Fossil Energy Research and Development	421,154	425,093	502,070	+80,916	+19.2%
Naval Petroleum and Oil Shale Reserves	12,005	14,848	10,000	-2,005	-16.7%
Strategic Petroleum Reserve	222,605	221,485	175,105	-47,500	-21.3%
Northeast Home Heating Oil Reserve	6,497	6,456	10,000	+3,503	+53.9%
Total, Fossil Energy Programs	**662,261**	**667,882**	**697,175**	**+34,914**	**+5.3%**
Uranium Enrichment Decontamination and Decommissioning (D&D) Fund	767,929	763,106	752,749	-15,180	-2.0%
Energy Information Administration	122,000	121,171	115,035	-6,965	-5.7%
Non-Defense Environmental Cleanup	246,762	245,324	218,400	-28,362	-11.5%
Science	5,390,972	5,354,362	5,390,972	0	N/A
Advanced Research Projects Agency - Energy	305,245	303,172	0	-305,245	-100.0%
Nuclear Waste Disposal (30M in DNWF 050)	0	0	90,000	+90,000	N/A
Departmental Administration	120,863	120,179	139,534	+18,671	+15.4%
Inspector General	44,424	44,122	51,330	+6,906	+15.5%
Title 17 - Innovative Technology Loan Guarantee Program	139	16,749	7,000	+6,861	+4,936.0%
Advanced Technology Vehicles Manufacturing Loan Program	3,883	4,966	1,000	-2,883	-74.2%
Tribal Energy Loan Guarantee Program	9,000	8,939	-8,500	-17,500	-194.4%
Total, Energy Programs	**10,953,466**	**10,927,169**	**9,064,504**	**-1,888,962**	**-17.2%**
Atomic Energy Defense Activities					
National Nuclear Security Administration					
Weapons Activities	9,240,739	9,241,675	11,017,078	+1,776,339	+19.2%
Defense Nuclear Nonproliferation	1,879,738	1,885,970	1,862,825	-16,913	-0.9%
Naval Reactors	1,419,792	1,410,455	1,788,618	+368,826	+26.0%
Federal Salaries and Expenses	387,366	384,736	422,529	+35,163	+9.1%
Total, National Nuclear Security Administration	**12,927,635**	**12,922,836**	**15,091,050**	**+2,163,415**	**+16.7%**
Environmental and Other Defense Activities					
Defense Environmental Cleanup	5,404,217	5,368,298	5,630,217	+226,000	+4.2%
Other Defense Activities	781,703	778,676	853,300	+71,597	+9.2%
Defense Nuclear Waste Disposal (90M in 270 Energy)	0	0	30,000	+30,000	N/A
Total, Environmental and Other Defense Activities	**6,185,920**	**6,146,974**	**6,513,517**	**+327,597**	**+5.3%**
Total, Atomic Energy Defense Activities	**19,113,555**	**19,069,810**	**21,604,567**	**+2,491,012**	**+13.0%**
Power Marketing Administrations					
Southeastern Power Administration	0	0	0	0	N/A
Southwestern Power Administration	11,057	10,982	10,400	-657	-5.9%
Western Area Power Administration	94,742	94,099	89,372	-5,370	-5.7%
Falcon and Amistad Operating and Maintenance Fund	232	230	228	-4	-1.7%
Colorado River Basins	-23,000	-22,844	-23,000	0	N/A
Total, Power Marketing Administrations	**83,031**	**82,467**	**77,000**	**-6,031**	**-7.3%**
Federal Energy Regulatory Commission (FERC)	**0**	**0**	**0**	**0**	**N/A**
Subtotal, Energy and Water Development, and Related Agencies	**30,150,052**	**30,079,446**	**30,746,071**	**+596,019**	**+2.0%**
Uranium Enrichment D&D Fund Discretionary Payments	-563,000	-559,177	0	+563,000	+100.0%
Defense EM Funded Uranium Enrichment D&D Fund Contribution	563,000	559,177	0	-563,000	-100.0%
Excess Fees and Recoveries, FERC	-16,645	-9,000	-16,000	+645	+3.9%
Title XVII Loan Guarantee Program Section 1703 Negative Credit Subsidy Receipt	-37,000	-37,000	-44,000	-7,000	-18.9%
Sale of Northeast Gas Reserve	0	0	-77,000	-77,000	N/A
Defense Programs Rescission of Balances (Undistributed)	-43	-43	0	+43	+100.0%
Title 17 Loan Guarantee Program Rescission	-9,000	-8,939	0	+9,000	+100.0%
Total, Funding by Appropriation	**30,087,364**	**30,024,464**	**30,609,071**	**+521,707**	**+1.7%**

*Note.—A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115–56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

National Nuclear Security Administration
Overview

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted	
				$	%
National Nuclear Security Administration					
Federal Salaries and Expenses	387,366	384,736	422,529	+35,163	9.1%
Weapons Activities	9,240,739	9,241,675	11,017,078	+1,776,339	19.2%
Defense Nuclear Nonproliferation	1,879,738	1,885,970	1,862,825	-16,913	-0.9%
Naval Reactors[a]	1,419,792	1,410,455	1,788,618	+368,826	26.0%
Total, National Nuclear Security Administation	**12,927,635**	**12,922,836**	**15,091,050**	**+2,163,415**	**16.7%**

Overview

The National Nuclear Security Administration (NNSA) FY 2019 Request is $15,091,050,000, an increase of $2,163,415,000 (16.7 percent) above the FY 2017 Enacted level to sustain and modernize the U.S. nuclear stockpile and aging infrastructure; prevent, counter, and respond to nuclear terrorism and proliferation threats; and provide safe and effective integrated nuclear propulsion systems to the U.S. Navy. The Request also supports efforts to formulate a comprehensive Government-wide Reform Plan to recruit, train, and maintain a highly skilled workforce that effectively and efficiently delivers NNSA programs and achieves the mission aligning the NNSA federal workforce to meet the needs of today and the future. NNSA has pursued a disciplined process in defining the requirements to meet nuclear security and nonproliferation policy goals, support the Navy, and support a highly skilled federal workforce.

NNSA Future-Years Nuclear Security Program

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
National Nuclear Security Administration				
Federal Salaries and Expenses	431,081	439,702	448,496	457,466
Weapons Activities	11,881,884	12,337,495	12,674,586	12,948,598
Defense Nuclear Nonproliferation	1,935,208	1,935,071	1,967,927	2,001,034
Naval Reactors	1,790,897	1,683,823	1,711,104	1,747,037
Total, National Nuclear Security Administation	**16,039,070**	**16,396,091**	**16,802,113**	**17,154,135**

NNSA's FYNSP topline for FY 2020 – FY 2023 is $66.4 billion provides stable and consistent funding, which is key to the current and future nuclear strategy and enterprise. NNSA uses a disciplined budget process where options, supported by cost estimates, are developed and assessed. This budget supports the current stockpile, life extension programs, modernization efforts, and the scientific tools necessary for these efforts and consistent with the 2018 Nuclear Posture Review (NPR). The Nuclear Weapons Council (NWC) will translate NPR's policy initiatives into requirements. This request positions NNSA to support those initiatives while working within the NWC to define the military requirements and strategic direction provided by the NPR. As military requirements are refined, the Administration will work with Congress to ensure that the program of work is properly authorized and funded.

Public Law Authorizations

- P.L. 106-65, National Nuclear Security Administration Act, as amended
- P.L. 115–31, Consolidated Appropriations Act, 2017
- Continuing Appropriations Act, 2018 (Division D of P.L. 115–56, as amended)
- P.L. 115-91, National Defense Authorization Act for Fiscal Year 2018

[a] Funding does not reflect the transfer to the Office of Nuclear Energy for maintenance and operation of the Advanced Test Reactor.

Appropriation Summary by Program
Funding

	(Dollars in Thousands)			
	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Federal Salaries and Expenses				
Program Direction	390,000	387,352	422,529	+32,529
Prior Year Balance Rescission	-2,634	-2,616	0	+2,634
Total, Federal Salaries and Expenses	**387,366**	**384,736**	**422,529**	**+35,163**
Weapons Activities Appropriation				
Directed Stockpile Work	3,308,027	3,285,561	4,666,205	+1,358,178
Science	436,500	433,537	564,860	+128,360
Engineering	132,482	131,582	211,367	+78,885
Inertial Confinement Fusion Ignition and High Yield	522,959	519,408	418,927	-104,032
Advanced Simulation and Computing	663,184	658,680	703,401	+40,217
Advanced Manufacturing Development	87,105	86,514	96,838	+9,733
Infrastructure and Operations	2,808,363	2,789,290	3,002,736	+194,373
Secure Transportation Asset	248,889	247,199	278,639	+29,750
Defense Nuclear Security	685,500	680,845	690,638	+5,138
Information Technology and Cybersecurity	176,592	175,393	221,175	+44,583
Legacy Contractor Pensions	248,492	246,804	162,292	-86,200
Subtotal, Weapons Activities	**9,318,093**	**9,254,813**	**11,017,078**	**+1,698,985**
Use of Prior Year Balances	0	0	0	0
Prior Year Balance Rescission	-77,354	-13,138	0	+77,354
Total, Weapons Activities Appropriation	**9,240,739**	**9,241,675**	**11,017,078**	**+1,776,339**
Defense Nuclear Nonproliferation Appropriation				
Defense Nuclear Nonproliferation Programs				
Global Material Security	367,108	364,615	337,108	-30,000
Material Management and Minimization	288,350	286,391	332,094	+43,744
Nonproliferation and Arms Control	124,703	123,856	129,703	+5,000
Defense Nuclear Nonproliferation R&D	469,750	466,560	456,095	-13,655
Nonproliferation Construction	335,000	332,725	279,000	-56,000
Subtotal, Defense Nuclear Nonproliferation Programs	**1,584,911**	**1,574,147**	**1,534,000**	**-50,911**
Nuclear Counterterrorism and Incident Response Program	271,881	270,035	319,185	+47,304
Legacy Contractor Pensions	83,208	82,643	28,640	-54,568
Subtotal, Defense Nuclear Nonproliferation Appropriat	**1,940,000**	**1,926,825**	**1,881,825**	**-58,175**
Use of Prior Year Balances	-38,000	-37,742	-19,000	+19,000
Prior Year Balance Rescission	-22,262	-3,113	0	+22,262
Total, Defense Nuclear Nonproliferation Appropriation	**1,879,738**	**1,885,970**	**1,862,825**	**-16,913**
Naval Reactors				
Naval Reactors[a]	1,420,120	1,410,476	1,788,618	+368,498
Prior Year Balance Rescission	-328	-21	0	+328
Total, Naval Reactors	**1,419,792**	**1,410,455**	**1,788,618**	**+368,826**
Total, NNSA	**12,927,636**	**12,922,836**	**15,091,050**	**+2,163,415**

[a] Funding does not reflect the transfer to the Office of Nuclear Energy for maintenance and operation of the Advanced Test Reactor.

Outyear Appropriation Summary by Program
Funding

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
	(Dollars in Thousands)			
Federal Salaries and Expenses				
Program Direction	431,081	439,702	448,496	457,466
Prior Year Balance Rescission	0	0	0	0
Total, Federal Salaries and Expenses	**431,081**	**439,702**	**448,496**	**457,466**
Weapons Activities Appropriation				
Directed Stockpile Work	5,097,879	5,412,188	5,635,281	5,838,407
Science	572,292	637,779	604,731	571,666
Engineering	226,486	235,948	245,884	255,711
Inertial Confinement Fusion Ignition and High Yield	428,027	437,486	447,155	457,037
Advanced Simulation and Computing	717,849	703,000	799,747	782,272
Advanced Manufacturing Development	105,108	117,571	119,602	123,209
Infrastructure and Operations (formerly RTBF)	3,233,583	3,343,030	3,357,592	3,440,664
Secure Transportation Asset	339,686	332,433	339,949	347,642
Defense Nuclear Security	796,855	773,087	773,922	785,069
Information Technology and Cybersecurity	291,311	281,223	291,223	291,671
Legacy Contractor Pensions	72,808	63,750	59,500	55,250
Subtotal, Weapons Activities	**11,881,884**	**12,337,495**	**12,674,586**	**12,948,598**
Use of Prior Year Balances	0	0	0	0
Prior Year Balance Rescission	0	0	0	0
Total, Weapons Activities Appropriation	**11,881,884**	**12,337,495**	**12,674,586**	**12,948,598**
Defense Nuclear Nonproliferation Appropriation				
Defense Nuclear Nonproliferation Programs				
Global Material Security	346,850	367,290	375,006	382,881
Material Management and Minimization	357,333	354,300	361,371	368,146
Nonproliferation and Arms Control	132,267	133,700	136,508	139,374
Defense Nuclear Nonproliferation R&D	475,017	460,028	469,689	479,552
Nonproliferation Construction	279,000	279,000	279,000	279,000
Subtotal, Defense Nuclear Nonproliferation Programs	**1,590,467**	**1,594,318**	**1,621,574**	**1,648,953**
Nuclear Counterterrorism and Incident Response Program	331,893	329,503	335,853	342,331
Legacy Contractor Pensions	12,848	11,250	10,500	9,750
Subtotal, Defense Nuclear Nonproliferation Appropriation	**1,935,208**	**1,935,071**	**1,967,927**	**2,001,034**
Use of Prior Year Balances	0	0	0	0
Prior Year Balance Rescission	0	0	0	0
Total, Defense Nuclear Nonproliferation Appropriation	**1,935,208**	**1,935,071**	**1,967,927**	**2,001,034**
Naval Reactors				
Naval Reactors	1,790,897	1,683,823	1,711,104	1,747,037
Prior Year Balance Rescission	0	0	0	0
Total, Naval Reactors	**1,790,897**	**1,683,823**	**1,711,104**	**1,747,037**
Total, NNSA	**16,039,070**	**16,396,091**	**16,802,113**	**17,154,135**

NNSA Overview

Overview

The FY 2019 NNSA Request of $15,091,050,000 implements four major national security endeavors: (1) use science to maintain a safe, secure, and effective nuclear weapons stockpile that deters any adversary and guarantees the defense of the Nation and its allies; (2) reduce the threat posed by nuclear proliferation and terrorism, including unsecured or excess nuclear and radiological materials both domestically and internationally; (3) prepare to respond to, and mitigate, nuclear and radiological incidents worldwide; and (4) support safe and effective integrated nuclear propulsion for the U.S. Navy.

The FY 2019 Budget Request continues to modernize America's nuclear stockpile and infrastructure, and the underlying science that supports strategic decisions and certification of the stockpile. The Request supports the U.S Navy's nuclear fleet through a safe and effective integrated nuclear propulsion systems. The Request also supports the nonproliferation goals outlined in NNSA's *Prevent, Counter, and Respond—A Strategic Plan to Reduce Global Nuclear Threats (NPCR)*.

The FY 2019 Budget Request for **Weapons Activities (WA)** is $11,017,078,000, a $1,776,339,000 (19.2 percent) increase above the FY 2017 Enacted level. Weapons Activities funds programs primarily at eight NNSA Management and Operating (M&O) sites through a workforce of approximately 39,000 people managed by a Federal workforce composed of civilian and military staff. The Request is aligned with Department of Defense (DOD) requirements to ensure the U.S. nuclear deterrent continues to be safe, secure, and effective.

The request supports the current stockpile, life extension programs, modernization efforts, and the scientific tools necessary for these efforts, and is consistent with the 2018 Nuclear Posture Review (NPR). The Request continues the stabilization of deferred maintenance at NNSA's aging facilities and infrastructure, , supports the development and procurement of a new Mobile Guardian Transporter to replace the aging Safeguards Transporter, completes funding for construction for a new facility for about 1,200 federal staff in Albuquerque who currently work in inadequate facilities built in the 1940s and 1950s, continues NNSA's exascale program to ensure the continued viability of future high performance computing platforms and the evaluation of the nuclear deterrent against evolving threats, and increases investments in Research, Development, Test, and Evaluation activities. The Request also invests in NNSA's plutonium capabilities to support requirements for pit production outlined in the FY 2015 National Defense Authorization Act (NDAA), and invests in pre-conceptual design efforts supporting the selection of a single preferred alternative for plutonium pit production beyond 30 war reserve pits per year. The Uranium Processing Facility project remains on track to finish within its $6,500,000,000 cost ceiling and FY 2025 completion date. The Request continues funding for modernized tritium-production capabilities and the enriched uranium necessary for tritium production and supports the design of a Lithium Production Capability. The request supports a new down-blending campaign of available stocks of highly enriched uranium for use in tritium production, which delays the need date for a domestic uranium enrichment capability. The WA Request includes funding for Defense Nuclear Security (DNS) to provide protection for NNSA personnel, facilities, nuclear weapons, special nuclear material, and information from a full spectrum of insider and outsider threats. The Request also enhances the Information Technology and Cybersecurity program and continues cybersecurity recapitalization efforts.

The FY 2019 Budget Request for **Defense Nuclear Nonproliferation (DNN)** is $1,862,825,000, a $16,913,000 (0.9 percent) decrease below the FY 2017 Enacted level. The nuclear nonproliferation strategy is to work to prevent adversaries from acquiring nuclear weapons or weapons-usable materials, technology, and expertise; counter efforts to acquire such weapons or materials; and respond to nuclear or radiological accidents and incidents domestically and abroad. NNSA's nonproliferation and counterterrorism activities extend the nation's defenses far beyond America's borders. The DNN Request provides policy and technical leadership to prevent or limit the spread of materials, technology, and expertise related to weapons of mass destruction; develops technologies to detect nuclear proliferation; secures or eliminates inventories of weapons related materials and infrastructure; ensures technically trained teams and state-of-the-art equipment are prepared to respond to any nuclear or radiological emergency worldwide; and supports emergency management. The DNN program's decrease is mainly due to the termination of construction activities for the Mixed Oxide (MOX) Fabrication Facility project and transitioning to the dilute and dispose option for plutonium disposition, plus a reduction in University of California legacy pension payments.

The FY 2019 Budget Request for **Naval Reactors (NR)** is $1,788,618,000, a $368,826,000 (26.0 percent) increase above the FY 2017 Enacted level. This funding supports operations, infrastructure, and development for the Navy's fleet of nuclear-powered aircraft carriers and submarines and funds three major DOE initiatives – the *Columbia*-class Reactor System Development, Land-based S8G Prototype Refueling Overhaul, and Spent Fuel Handling Recapitalization Project. This funding also provides for Naval Reactors' Federal program direction activities. The NR appropriation provides for safe and effective integrated nuclear propulsion systems for the U.S. Navy.

The FY 2019 Budget Request for **NNSA Federal Salaries and Expenses (FSE)** is $422,529,000, a $35,163,000 (9.1 percent) increase above the FY 2017 Enacted level. The Request provides funding for the salary, benefits, and support expenses of 1,737 federal full-time equivalents (FTEs) (1,715 paid from FSE, 22 paid from WCF for overseas representation) to provide federal program and project management and appropriate oversight of the NNSA nuclear security enterprise responsible for managing and executing NNSA's Weapons Activities and Defense Nuclear Nonproliferation missions. NNSA supports the effort to formulate a comprehensive Government-wide Reform Plan to recruit, train, and maintain a workforce that efficiently deliver NNSA programs; and align the NNSA federal workforce to meet the needs of today and the future. As NNSA enters the next phase of the nuclear modernization efforts, a highly skilled federal workforce is necessary for appropriate oversight principally in Life Extension Programs (LEPs) and major project management. The FY 2019 FSE FTE level is 10 percent lower than FY 2010 levels, while funding has increased 50 percent from FY 2010 Enacted levels to the FY 2019 request for Weapons Activities and Defense Nuclear Nonproliferation, primarily for the nuclear modernization program and supporting infrastructure projects.

Highlights and Major Changes in the FY 2019 Budget
Weapons Activities
The major elements of the FY 2019 Request increases Life Extension Programs (LEP) and Major Alterations (Alt) support planned workscope for the W80-4 LEP, transition of components from design to production scope for the B61-12 LEP, and restart of the Feasibility Study & Design Options for the Interoperable Warhead 1 (IW1). Increases for Plutonium Sustainment support fabrication of four to five development (DEV) W87 pits, continue investments to replace end-of-life equipment for pit production, and installation of critical equipment to increase production capacity. The Tritium Sustainment increase supports increased production of TVA reactor fuel and operational costs. The Domestic Uranium Enrichment funding supports a new campaign to down blend available stocks of highly enriched uranium for use in tritium production, which delays the need date for a domestic uranium enrichment capability. RDT&E increase supports required annual assessments and future LEP options and systems certification. Advanced Simulation and Computing (ASC) funding increase continues NNSA's Exascale activities to include infrastructure upgrade projects to prepare for siting of future Exascale computing platforms. Funding will start to reverse deferred maintenance, create an Infrastructure Modernization Initiative (IMI) program, and increase recapitalization projects to improve the condition and extend the design life of structures, capabilities, and systems. The request supports increases in funding for UPF and CMRR. Increases will support the procurement of long-lead parts and materials for the two full-scale Mobile Guardian Transporter prototype systems; modernizes the federal and site Cybersecurity infrastructure; and will continue protection for NNSA nuclear weapons, special nuclear materials, facilities, and personnel against a full spectrum of threats.

Defense Nuclear Nonproliferation
DNN's efforts reduce the danger that hostile nations or terrorist groups may acquire nuclear devices, radiological dispersal devices, weapons-usable material, nuclear and dual-use commodities and technology, or nuclear-related expertise. The FY 2019 Budget Request supports the independent validation for the dilute and dispose strategy; the conversion or shut-down of research reactors and isotope production facilities that use high enriched uranium (HEU); the removal and disposal of weapons-usable nuclear material; and improvements to the security of vulnerable materials and facilities and to partners' capacity to deter, detect, and investigation of illicit trafficking of these materials. DNN continues to strengthen international nuclear safeguards; control the spread of dual-use WMD material; and ensures technically trained teams and state-of-the-art equipment are prepared to respond to any emergency domestically or aboard. DNN advances U.S. technical capabilities to detect foreign nuclear material production and weapons development activities, the movement and illicit diversion of special nuclear materials, and nuclear explosions globally. The FY 2019 Request also initiates recapitalization of the Aerial Measurement System, which detects, measures, and tracks radioactive material in an emergency to determine contamination levels.

Naval Reactors
The FY 2019 Budget Request continues NR's core objective of supporting the daily safe and reliable operation of the Nation's nuclear fleet (70 submarines, 11 aircraft carriers, and 4 research, development, and training platforms), constituting over 45 percent of the Navy's major combatants. The Request supports three major DOE initiatives: *Columbia*-

class Reactor Systems Development, Land-based S8G Prototype Refueling Overhaul, and Spent Fuel Handling Recapitalization Project. Funding is also requested for the program direction account for NR federal salaries and expenses.

NNSA Federal Salaries and Expenses

The FY 2019 Budget Request builds upon on-going efforts to improve the effectiveness and efficiency of NNSA federal oversight and to meet current and future workforce needs. The Request provides support for 1,737 FTEs (1,715 paid from FSE, 22 paid from WCF). Working with U.S. Office of Personnel Management (OPM) experts, NNSA is developing a Human Capital Management Plan (HCMP) that institutionalizes a consistent staffing analysis and career development methodology to support NNSA responsibilities and prepare for an anticipated wave of retirements. Phase II was initiated in FY 2017. Results are expected summer 2018. Succession planning is critical since 45 percent of the current federal FTEs are eligible to retire by 2023. The HCMP will focus on the level and mix of skills needed of the federal workforce at all levels at present and for the future workforce. Specifically, strategic consideration of each business line and methods to gain efficiencies, eliminate redundancies, and align resources to mission requirements is paramount to an achievable HCMP. This includes a comprehensive recruiting and hiring plan that aligns the NNSA workforce with current and future mission needs.

<u>Entry Level Hires</u>: NNSA supports a variety of programs to help train and recruit the next generation of leaders in managing the nuclear stockpile, nonproliferation, nuclear security, and international security, such as the Presidential Management Fellow (PMF) program, NNSA Graduate Fellowship Program (NGFP), and Minority Serving Institutions Partnership Program (MSIPP). These programs foster the pipeline of qualified professionals who will sustain expertise through future employment in the NNSA nuclear security enterprise.

Department of Energy (DOE) Working Capital Fund (WCF) Support

NNSA's FY 2019 Budget Request includes the following for NNSA's projected support to the DOE Working Capital Fund (WCF): $86,300,000 of which $43,089,000 will be paid out of FSE; $33,389,000 out of WA; $5,892,000 out of DNN; and $3,930,000 out of NR. This funding covers selected shared enterprise activities including managing enterprise-wide systems and data, telecommunications and supporting the integrated acquisition environment.

Legacy Contractor Pensions

NNSA requests $190,932,000 in FY 2019 for Legacy Contractor Pensions split between Weapons Activities and Defense Nuclear Nonproliferation, $140,768,000 less than the FY 2017 Enacted level. This funding provides the annual NNSA share of the DOE's reimbursement of payments made to the University of California (UC) Retirement Plan (UCRP) for former UC employees and annuitants who worked at the Lawrence Livermore National Lab (LLNL) and Los Alamos National Lab (LANL). The UCRP benefit for these individuals is a legacy cost and DOE's annual payment to the UC is required by contract. The amount of the annual payment is based on the actuarial valuation report and is covered by the terms described in the contracts. The decrease is based upon the funded status of the plan. NNSA is also covering the cost of the actuarial report included in this total.

Crosscutting Programs

The FY 2019 Budget Request continues crosscutting programs which coordinate across the Department and seeks to tap DOE's full capability to effectively and efficiently address the United States' energy, environmental, and national security challenges. These initiatives are discussed within the Programs in which they are funded.

<u>Cybersecurity Crosscut</u>

DOE is engaged in two categories of cyber-related activities: protecting the DOE enterprise from a range of cyber threats that can adversely impact mission capabilities, and improving cybersecurity and grid resilience in the energy sector. The cybersecurity crosscut supports central coordination of the strategic and operational aspects of cybersecurity and facilitates cooperative efforts such as the Integrated Joint Cybersecurity Coordination Center (iJC3) for incident response and the implementation of Department-wide Identity, Credentials, and Access Management (ICAM).

<u>Exascale Computing</u>

Exascale systems are needed to improve NNSA weapons design, stewardship and stockpile certification capabilities to ensure the U.S. maintains leadership in high-performance simulations that underpin our nuclear deterrent that are not within the capacities of today's systems. Exascale systems' computational power is needed for increasing capable data-analytic and data-intense applications across the entire Federal complex. Exascale is a component of long-term collaboration between the interagency National Strategic Computing Initiative, the DOE/Office of Science's Advanced

Scientific Computing Research program and NNSA's ASC program. Included in NNSA's Request is $163,073,000 in FY 2019 for activities and research leading to deployment of exascale capability for national security applications in the early 2020s.

Top 15 Property Leases at NNSA

Rebuilding the NNSA nuclear security enterprise infrastructure requires both federal funding and public-private parternships. NNSA has leveraged leasing arrangements, when in the government's best interest, to take advantage of using private sector construction expertise and economies-of-scale to quickly and cost-effectively acquire modern, efficient facilities for public use. The top fifteen leases for NNSA are included below with the property name, annual rent, and usable square feet as well as the funding mechanism of direct or indirect is included.

Direct Funded Leases

Site	Property Name	Annual Rent	Usable Square Feet	Funding Source
Kansas City National Security Campus	National Security Campus NNSA Complex, 14500 Botts Road	$50,859,217.01	977,036	Direct
Kansas City National Security Campus	National Security Manufacturing Center Building, 14500 Botts Road	$13,777,492.63	260,906	Direct
Pantex Plant	John C. Drummond Center Office Building (formerly known as ASC)	$8,546,000.00	342,800	Direct
Kansas City National Security Campus	Building 21	$1,541,290.55	62,527	Direct
Nevada National Security Site – Las Vegas	Southern Nevada Science Center II	$1,140,869.80	32,535	Direct

Indirect Funded Leases

Site	Property Name	Annual Rent	Usable Square Feet	Funding Source
Y-12 National Security Complex	Jack Case Office Building	$8,798,763.96	288,286	Indirect
Sandia National Laboratories – New Mexico	Innovation Parkway Office Center	$3,789,000.00	118,730	Indirect
Y-12 National Security Complex	New Hope Center	$2,924,187.24	96,431	Indirect
Sandia National Laboratories – New Mexico	Center for Global Security and Cooperation	$1,635,117.20	45,617	Indirect
Nevada National Security Site - Los Alamos	Los Alamos Operations	$1,287,074.00	35,980	Indirect
Los Alamos National Laboratory	Office Building	$1,147,965.00	22,659	Indirect
Nevada National Security Site – Santa Barbara	Special Technologies Laboratory	$1,042,075.00	42,465	Indirect
Y-12 National Security Complex	Commerce Park Uranium Processing Facility Design Facility	$998,788.92	49,963	Indirect
Los Alamos National Laboratory	Pueblo School	$885,752.78	37,665	Indirect
Y-12 National Security Complex	Commerce Park Uranium Processing Facility	$864,652.20	43,253	Indirect

Minor Construction

General Plant Projects (GPP)

Pursuant to Section 3121 of the Ike Skelton National Defense Authorization Act for FY 2011 (P.L. 111-383), notification is being provided for general plant projects with a total estimated cost of more than $5 million planned for execution.

General Plant Projects[a]

Weapons Activities – Savannah River Site

Project Title	Program	TEC	Project Description	FY 2017 Enacted	FY 2018 Request[b]	FY 2019 Request	Outyears	Construction Design Estimate
Replace Film Radiography in Finishing Gloveboxes, FL 4/5 Glovebox	Infrastructure and Operations: Capability Based Investments	7,014,000	Digital Radiography installation in Finishing Line 4/5 in Glovebox in HANM. Current x-ray film technology used for reservoir pinch welds will be replaced with Digital Radiography system installed inside the glovebox.	0	0	0	7,014,000	1,473,000
FTS Programmable Controller System Upgrade	Infrastructure and Operations: Capability Based Investments	5,730,000	Replaces and modernizes the Process Control System for the Function Test Stations in HANM. This is the computer control system that "operates" the function test station valves and pump trains.	0	0	920,000	4,810,000	127,000

[a] Execution may be accelerated to FY 2019 depending on conditions.

[b] Due to the nature of reporting requirements for NNSA, the FY 2018 Request was updated to accurately include the list of planned projects for Notification purposes.

Weapons Activities – Y-12 National Security Complex

Project Title	Program	TEC	Project Description	FY 2017 Enacted	FY 2018 Request	FY 2019 Request	Outyears	Construction Design Estimate
Bldg 9212 50-Year Sprinkler Head Replacement (Wet Pipe System 007)	Infrastructure and Operations: Infrastructure and Safety	5,200,000	The project will replace approximately 867 sprinkler heads on WPS-7 in Building 9212. WPS-7 is a Grade 2 system and material purchase is required to meet the requirements of Quality Level Q. This is a continuation of the effort to replace nearing 50-year-old sprinkler heads on Q Level sprinkler systems at Y-12.	0	3,800,000	1,400,000	0	325,000
PIDAS Vehicle Barriers	Defense Nuclear Security	9,300,000	Upgrade vehicle barrier system to replace current cable barrier that is on the security fence with new standalone barrier on secure side of PIDAS	0	0	0	9,300,000	430,000
9212 Decon/Sorting and Segmenting Facility	Directed Stockpile Work: Uranium Sustainment	9,600,000	This project will establish the new decontamination, sorting and segmenting capability needed to support clean-out of Building 9212.	0	600,000	3,000,000	6,000,000	0
HEUMF Rack Reconfiguration Rows B/C	Directed Stockpile Work: Strategic Materials	6,550,000	Reconfigure from drum storage to Rackable Can Storage Box (RCSB) storage in support of future storage	0	2,500,000	4,050,000	0	0

Project Title	Program	TEC	Project Description	FY 2017 Enacted	FY 2018 Request	FY 2019 Request	Outyears	Construction Design Estimate
			requirements. Effort includes the removal and disposition of existing drum "H" assemblies and the installation of the new steel for RCSB storage. This will result in a total of 400 new positions for RCSB.					

Weapons Activities – Nevada National Security Site

Project Title	Program	TEC	Project Description	FY 2017 Enacted	FY 2018 Request	FY 2019 Request	Outyears	Construction Design Estimate
Mercury Modernization Utility Upgrades - Campus	Infrastructure and Operations: Infrastructure and Safety	7,000,000	This project scope is the design and installation of new utilities supporting Mercury and the Modernized Mercury Campus. This project will address aging and failing utilities as well as those needed for Modernized Mercury Campus. Conceptual planning and design of this project will be closely coordinated with the development of a consolidation strategy for the Mercury complex.	0	0	7,000,000	0	1,000,000

Weapons Activities – Pantex

Project Title	Program	TEC	Project Description	FY 2017 Enacted	FY 2018 Request	FY 2019 Request	Outyears	Construction Design Estimate
Zone 4 PIDAS Vehicle Barriers	Defense Nuclear Security	9,300,000	Upgrade vehicle barrier system to replace current cable barrier that is on the security fence with new standalone barrier on secure side of PIDAS	0	0	0	9,300,000	430,000

Weapons Activities – Lawrence Livermore National Laboratory

Project Title	Program	TEC	Project Description	FY 2017 Enacted	FY 2018 Request	FY 2019 Request	Outyears	Construction Design Estimate
Site 300 OFF Firing & Control System Modernization	Infrastructure and Operations: Capability Based Investments	6,000,000	Modernize outdoor firing facility capabilities to include but not be limited to systems such as the following: safety interlock systems, environmental control, diagnostic camera controller upgrade, modernize surveillance CCTV and provide for UPS.	0	900,000	1,200,000	3,900,000	500,000

Weapons Activities – Los Alamos National Laboratory

Project Title	Program	TEC	Project Description	FY 2017 Enacted	FY 2018 Request	FY 2019 Request	Outyears	Construction Design Estimate
TA-72 Outdoor Range Upgrades Project	Defense Nuclear Security	8,000,000	Ensures protective force firearms outdoor training facilities are sufficient to support training of armed protective force	0	1,500,000	5,500,000	1,000,000	1,000,000

Project Title	Program	TEC	Project Description	FY 2017 Enacted	FY 2018 Request	FY 2019 Request	Outyears	Construction Design Estimate
			personnel to maintain required firearms and tactical qualifications and proficiencies.					
Protective Force Battle Training Building	Defense Nuclear Security	7,500,000	Construct a new building dedicated to Protective Force Tactical Simulators. A dedicated building will relocate all Protective Forces simulators under the same roof, thus enabling the Protective Force to better utilize the training staff they have on hand.	0	1,500,000	4,500,000	1,500,000	1,000,000
Detonator/Booster Fabrication, Formulation	Infrastructure and Operations: Capability Based Investments	6,000,000	Production equipment upgrades and augmentation are required to support the parallel manufacture and qualification of multiple detonator materials with the ability to evaluate material formulations.	0	0	0	6,000,000	1,800,000

Weapons Activities – Sandia National Laboratories

Project Title	Program	TEC	Project Description	FY 2017 Enacted	FY 2018 Request	FY 2019 Request	Outyears	Construction Design Estimate
20th St. & G Ave Intersection Relocation	Infrastructure and Operations: Infrastructure and Safety	7,250,000	The intersection at 20th St. at G Ave. is within 400 feet of the Eubanks Gate entry at Sandia is at a failing level of service. A	750,000	0	6,500,000	0	750,000

Project Title	Program	TEC	Project Description	FY 2017 Enacted	FY 2018 Request	FY 2019 Request	Outyears	Construction Design Estimate
			relocation of this intersection will correct conditions and improve travel of the current and future SNL staff.					
B878 (Process Development Lab) Renovation	Infrastructure and Operations: Infrastructure and Safety	9,200,000	Perform a series of recapitalization/ renovation subprojects associated with sustaining core capabilities for Advanced Manufacturing Process Development	0	9,200,000	0	0	900,000
New Z & TA-IV Missions Support Facility	Infrastructure and Operations: Infrastructure and Safety	9,700,000	Construct a new general support facility for the mission critical Z machine.	0	0	9,700,000	0	800,000
Building C914 High Bay Seismic Upgrades	Infrastructure and Operations: Infrastructure and Safety	9,800,000	Modify the structural system of SNL's only machine shop capable of producing classified parts and components to mitigate failure modes in the event of a design basis earthquake.	0	0	9,800,000	0	1,000,000

Naval Reactors

Project Title	Program	TEC	Project Description	FY 2017 Enacted	FY 2018 Request	FY 2019 Request	Outyears	Construction Design Estimate
NRF Security Upgrades	Naval Reactors	8,000,000	NRF Security Upgrades	0	300,000	7,700,000	0	300,000
KS S8G Weather Resistant Enclosure	Naval Reactors	7,700,000	KS S8G Weather Resistant Enclosure	0	500,000	750,000	6,450,000	1,250,000

Project Title	Program	TEC	Project Description	FY 2017 Enacted	FY 2018 Request	FY 2019 Request	Outyears	Construction Design Estimate
KS Service Water and Sanitary Sewer Upgrade	Naval Reactors	5,255,000	KS Service Water and Sanitary Sewer Upgrade	0	0	450,000	4,805,000	450,000
BL AMTL Upgrade EMTF Infrastructure	Naval Reactors	7,900,000	BL AMTL Upgrade EMTF Infrastructure	0	0	500,000	7,400,000	1,060,000
NRF Northeast Boundary Area	Naval Reactors	9,200,000	NRF Northeast Boundary Area	0	0	700,000	8,500,000	700,000

50 US Code 2746 requires that if the total estimated cost for construction design in connection with any construction project exceeds $2,000,000, funds for that design must be specifically authorized by law. NNSA requests Congressional Authorization for 2019 General Plant Projects exceeding the $2,000,000 design threshold for the following project**:**

FY 2019 General Plant Projects – Design Over $2 Million

Weapons Activities – Los Alamos National Laboratory

Project Title	Program	TEC	Project Description	FY 2017 Enacted	FY 2018 Request	FY 2019 Request	Outyears	Construction Design Estimate
Uranium Foundry Modernization	Infrastructure and Operations: Capability Based Investments	9,300,000	Modernization of the Sigma facility to support the depleted uranium foundry capability at a sufficient level to meet the programmatic needs of the NNSA weapons programs	0	0	1,000,000	8,300,000	2,519,000

General Plant Projects Subject to Section 3119 of the FY 2018 National Defense Authorization Act

As directed in the FY 2018 National Defense Authorization Act, this section provides the requested project information for projects with a total project cost (TPC) over $10 million.

Project	Site	Project Description	Program	TPC	Construction Design Estimate	Project Milestones		
						Project Start	Design Complete	Construction Complete
SNL/CA Data Center Replacement Facility	SNL	In its current condition, the primary data center in California (Bldg. 912/basement) is unable to meet current sponsor requirements and future Sandia enterprise direction due to an outdated and deteriorating infrastructure. These problems threaten Division 8000 and the ability of SNL/CA site to effectively support key Sandia strategic objectives. This project will replace the existing data center with new facility.	Infrastructure and Operations: Infrastructure and Safety	14,700,000	900,000	FY 2019	FY 2019	FY 2019
B235 and Ancillary Synthesis Chemistry Lab Refurbishment with Fume Hood Upgrades	LLNL	Project will provide bench and storage space for chemicals, radiological materials and equipments in the labs. The modernized labs will include the replacement of controls and fume hoods. This scope also addresses Cat A seismic deficiencies.	Infrastructure and Operations: Infrastructure and Safety	11,400,000	900,000	FY 2019	FY 2019	FY 2020
B151 High Level Radiochemistry Laboratory Capabilities	LLNL	The refurbishment of radiochemistry laboratories and adjacent anterooms will include the disposal of contaminated materials and hardware, the replacement of radiological fume hoods, and the addition of new fume hoods. The project will provide bench and storage space for chemicals, radiological materials and equipment, and afford engineering controls adapted to state of the art radiochemistry activities.	Infrastructure and Operations: Infrastructure and Safety	14,600,000	900,000	FY 2019	FY 2019	FY 2022

Project	Site	Project Description	Program	TPC	Construction Design Estimate	Project Milestones		
						Project Start	Design Complete	Construction Complete
B341 AME Mechanical Test Capability Consolidation Refurbishment	LLNL	This specific project is renovating 15,000 sq. ft. of an existing facility, B341, to accommodate Mechanical Testing capability, creating more staging and additional laboratory space.	Infrastructure and Operations: Infrastructure and Safety	12,500,000	900,000	FY 2019	FY 2019	FY 2019
Bldg. 12-37 Secondary Electrical Feed Installation	Pantex	This project will install a redundant electrical feed to the Building 12-37 Data Center. The feed will include manual transfer switches, automatic transfer switches, switchboards, un-interruptible power supply, and feeder cable. Substation 75 will be replaced and a Computer Room Air Conditioner will be installed.	Infrastructure and Operations: Infrastructure and Safety	16,300,000	1,400,000	FY 2019	FY 2020	FY 2022
New Gas Analysis Laboratory	Pantex	Construct a new gas analysis laboratory in high security area at Pantex. Will be an 11,000 sq ft structure. Facility will contain a temperature controlled lab with supporting offices, breakroom, restrooms and storage areas	Infrastructure and Operations Infrastructure and Safety:	15,000,000	1,200,000	FY 2019	FY 2019	FY 2021
Mercury Modernization New Building 23-461	Nevada	This project provides new administrative buildings to replace aging and failing infrastructure in support of the Modernized Mercury Campus. Building 23-461 will support relocation of the NNSS Emergency Operations Center and Operations Control Center functions.	Infrastructure and Operations: Infrastructure and Safety	15,000,000	950,000	FY 2019	FY 2020	FY 2022

Project	Site	Project Description	Program	TPC	Construction Design Estimate	Project Milestones		
						Project Start	**Design Complete**	**Construction Complete**
New AME Joining Capabilities and Vapor Disposition Facility	LLNL	Approximately 18,000 sq ft facility will house joining and vapor disposition capabilities as they must relocate from a 60 year old building that is beryllium contaminated and seismically deficient.	Infrastructure and Operations: Infrastructure and Safety	18,000,000	900,000	FY 2019	FY 2019	FY 2021
AME Polymers and Engineering Facility	LLNL	B231 vacating plan is to relocate capabilities by repurposing existing facilities and constructing new laboratory facilities. In total, the capabilities will be housed in enduring facilities with 40% less sq. footage than now, due to major consolidation. This specific project is new GPP construction to house the B231 polymer and other engineering capabilities.	Infrastructure and Operations: Infrastructure and Safety	14,500,000	900,000	FY 2018	FY 2018	FY 2020
LANL TA-16-0303 Renovation for Crystal Lab Relocation	LANL	Renovation upgrades include HVAC, 3 Fume Hoods and associated stacks/vents, 5 extraction arms, compressed air, De-ionized facility water, laboratory plumbing/sinks, eye wash station, Sump pump and 1,000 gal tank for waste. Prepare the 16-303 facility to allow relocation/consolidation of the High Explosive (HE) Crystal Laboratory from a substandard laboratory facilities at TA-40 and TA-9. Perform facility remediation and demolition activities on 16-303, taking it back to basic facility shell.	Infrastructure and Operations: Infrastructure and Safety	12,200,000	1,310,000	FY 2018	FY2019	FY 2021

Project	Site	Project Description	Program	TPC	Construction Design Estimate	Project Milestones		
						Project Start	Design Complete	Construction Complete
DARHT Weather Enclosure Addition[a]	LANL	This project will erect a Weather Enclosure (WE) covering the confinement systems and target of hydrodynamic experiments at the Dual Axis Radiographic Hydrodynamic Test (DARHT) firing point. The WE provides the required protection for the experiment vessels and other confinement systems to ensure they perform as designed to contain the high explosive blast pressure, debris, gases and collection of valuable radiographic data. Furthermore, the enclosure provides environmental protection allowing workers to minimize personal protective equipment, reducing cold and heat stress, and eliminating wind and moisture, all of which makes workers more productive and allows operations proceed more safely with better control of schedule fluctuations due to weather.	Infrastructure and Operations: Infrastructure and Safety	13,113,000	781,000	FY 2016	FY 2019	FY 2020

[a] This project was initiated in FY 2016 under the Recapitalization/Capability Based Investments (CBI) program and $1.313 million was spent under that program before the project was placed on hold due to the risk of Total Project Cost exceeding the $10 million minor construction threshold. The project will resume under the Recapitalization/Infrastructure & Safety program starting in FY 2019.

Institutional General Plant Projects

Los Alamos National Laboratory

Project Title	Program	TEC	Project Description	FY 2017 Enacted	FY 2018 Request	FY 2019 Request	Outyears	Construction Design Estimate
Renovate TA-3 Building 40 Physics Auditorium	Institutional	5,000,000	Renovate auditorium space and related facility infrastructure	0	0	600,000	4,400,000	600,000
TA-3 High Pressure Gas Line	Institutional	5,500,000	Installation of new high pressure gas line for TA-3 Combustion Turbine	0	0	1,000,000	4,500,000	600,000
TA-16 - 0200 HVAC Upgrades	Institutional	5,200,000	Design and install HVAC upgrades to TA-16 building 200	0	0	2,600,000	2,600,000	500,000
TA-16 Building 332 Repurpose	Institutional	7,000,000	Upgrade building HVAC / controls, electrical distribution, fire protection systems, and interior configuration to enable consolidation of operations from other less favorable facilities	0	0	600,000	6,400,000	600,000
TA-16 Building 302 Renovation	Institutional	9,000,000	Renovate TA16 building 302 to consolidate TA33 operations to this facility. Upgrade building HVAC, fire protection, electrical distribution for revised mission utilization	0	0	600,000	8,400,000	600,000
Roof Replacements	Institutional	7,500,000	Replacement of identified building roofing systems at TA-53-2, TA-53-24, and TA-3-16	0	0	500,000	7,000,000	500,000
TA35-213 HVAC & Controls Upgrades	Institutional	8,400,000	Upgrade HVAC and controls systems to meet planned sustainability improvements	0	0	500,000	7,900,000	600,000

Sandia National Laboratories

Project Title	Program	TEC	Project Description	FY 2017 Enacted	FY 2018 Request	FY 2019 Request	Outyears	Construction Design Estimate
SNL/NM TA-I NW New Parking Structure	Institutional	9,700,000	Provide new parking structure in the NW quadrant of Tech Area I to address current parking concerns	0	0	9,700,000	0	970,000

Institutional General Plant Projects – (>$10M)

Project	Site	Project Description	TPC	Construction Design Estimate	Project Milestones		
					Project Start	Design Complete	Construction Complete
Modular Construction Secure Office Building	LANL	Utilize modular construction methodology to procure and erect a new 12,000 sq. ft. facility for office, lab and SCIF operations. LANL Long range infrastructure plan has appropriate sq. ft. offset already planned	15,000,000	1,000,000	FY 2019	FY 2019	FY 2020
Modular Construction Light Manufacturing Laboratory	LANL	Construct a light manufacturing laboratory of approximately 12,000 sq. ft.to provide additional lab and office space for multiple programs	14,000,000	1,000,000	FY 2019	FY 2019	FY 2021
Fire Station 1 Replacement	LANL	Design, construct and commission a new Fire Station #1 of approximately 20,000 sq. ft. The new station will be located within TA-3	16,000,000	1,000,000	FY 2020	FY 2020	FY 2022
New Engineering Office Building	LLNL	Construct an approximately 30,000 SF office building to allow for migration out of substandard space and to create quality new office space for growing mission. The office building will include over 100 offices, conference rooms, restrooms, kitchens, collaborative space, and mechanical/electrical rooms for building services.	18,900,000	900,000	FY 2018	FY 2019	FY 2020

Homeland Security/Safeguards and Security Crosscut
($ in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	$ Change	% Change
Homeland Security Program Unique Elements					
Defense Nuclear Nonproliferation					
Global Material Security					
Domestic Radiological Security	87,199	86,607	90,764	+3,565	4.1%
Subtotal, Global Material Security	87,199	86,607	90,764	+3,565	4.1%
Defense Nuclear Nonproliferation Research and Development					
Proliferation Detection	50,000	50,000	48,000	-2,000	-4.0%
Nuclear Detonation Detection	2,000	2,000	2,000	0	0.0%
Subtotal, Nuclear Nonproliferaiton Research and Development	52,000	52,000	50,000	-2,000	-4.0%
Nuclear Counterterrorism Incident Response (NCTIR)	271,881	270,035	319,185	+47,304	17.4%
Subtotal, HS Program Unique Elements (Not S&S elements)	**411,080**	**408,642**	**459,949**	**+48,869**	**17.5%**
Safeguards and Security Components of Homeland Security					
Weapons Activities					
Defense Nuclear Security					
Protective Forces	393,764	391,090	376,279	-17,485	-4.4%
Physical Security Systems	98,540	97,871	105,193	+6,653	6.8%
Information Security	32,766	32,543	43,011	+10,245	31.3%
Personnel Security	33,516	33,288	40,376	+6,860	20.5%
Material Control and Accountability	26,965	26,782	31,125	+4,160	15.4%
Security Program Operations and Planning	84,449	83,876	94,654	+10,205	12.1%
Construction	15,500	15,395	0	-15,500	-100.0%
Subtotal, Defense Nuclear Security	**685,500**	**680,845**	**690,638**	**+5,138**	**0.8%**
Secure Transportation Asset	**248,889**	**247,199**	**278,639**	**+29,750**	**12.0%**
Information Technology and Cybersecurity					
Cybersecurity					
Infrastructure Program	118,892	118,085	155,175	+36,283	30.5%
Technology Application Development	4,000	3,973	4,000	+0	0.0%
Enterprise Secure Computing	23,700	23,539	25,500	+1,800	7.6%
Subtotal, Information Technology Cyber Security	146,592	145,597	184,675	+38,083	26.2%
Federal Unclassified Information Technology (not Homeland) [non-add]	[30,000]	[29,796]	[36,500]		
Working Capital Fund (CyberOne Contribution)*	12,226	12,143	12,857	631	5.2%
Subtotal, Safeguards and Security (within Homeland Security)	**1,093,207**	**1,085,784**	**1,166,809**	**73,602**	**6.7%**
Total Homeland Security	**1,504,287**	**1,494,426**	**1,626,758**	**122,471**	**24.2%**
Security Investigations	42,853	42,562	43,658	805	1.9%
Total, Safeguards and Security (Inclusive of Security Investigations)	**1,547,140**	**1,536,988**	**1,670,416**	**123,276**	**8.0%**

*CyberOne Initiative is funded from Direct Program NNSA Weapons Activities, Defense Nuclear Nonproliferation, and Naval Reactors, not Information Technology and Cybersecurity.

Site Estimates
(Dollars in Thousands)

	FY 2017	FY 2018	FY 2019 Request				
Site	Enacted	CR Annualized	FSE	WA	NN	NR	Total
Argonne National Laboratory	54,499	54,130	0	820	47,964	0	48,784
Bechtel Marine Propulsion Corporation	456	453	0	0	0	0	0
Bettis Atomic Power Laboratory	500,514	497,115	0	0	0	685,949	685,949
Brookhaven National Laboratory	10,842	10,769	0	325	11,397	0	11,722
Carlsbad Field Office	100	99	0	0	1,500	0	1,500
Chicago Operations Office	1,500	1,490	0	2,000	0	0	2,000
Consolidated Business Center	630	625	0	0	0	0	0
General Atomics	25,020	24,850	0	0	0	0	0
Headquarters	1,170,158	1,162,209	306,224	1,060,657	173,452	145,627	1,685,960
Idaho National Laboratory	240,904	239,268	0	3,368	57,039	195,605	256,012
Kansas City National Security Campus	533,740	530,117	0	770,249	26,568	0	796,817
Kansas City Field Office	242,622	240,974	7,433	0	0	0	7,433
Knolls Atomic Power Laboratory	630,981	626,696	0	0	0	740,237	740,237
Lawrence Berkeley National Laboratory	11,736	11,657	0	650	10,203	0	10,853
Lawrence Livermore National Laboratory	1,377,041	1,367,690	0	1,313,541	118,044	0	1,431,585
Livermore Field Office	18,740	18,612	18,645	0	0	0	18,645
Los Alamos National Laboratory	1,933,197	1,920,066	0	1,906,314	275,721	0	2,182,035
Los Alamos Field Office	16,658	16,544	17,251	0	0	0	17,251
National Energy Technology Laboratory	14,342	14,245	0	21,698	0	0	21,698
Naval Reactors Laboratory Field Office	20,660	20,520	0	0	0	21,200	21,200
Naval Research Laboratory	13,324	13,233	0	4,050	0	0	4,050
Nevada National Security Site	389,008	386,367	0	357,882	89,263	0	447,145
Nevada Field Office	92,768	92,138	17,653	74,470		0	92,123
New Brunswick Laboratory	206	203	0	0	228	0	228
NNSA ABQ Complex (all other sites)	470,960	467,764	0	604,420	153,067	0	757,487
NNSA Production Office	51,841	51,488	26,564	1,250	26,500	0	54,314
Oak Ridge Institute for Science and Engineering	4,794	4,764	0	5,100	3,700	0	8,800
Oak Ridge National Laboratory	151,816	150,786	0	22,331	81,189	0	103,520
Office of Science and Technical Information	461	459	0	433	32	0	465
Pacific Northwest National Laboratory	251,594	249,886	0	41,245	210,393	0	251,638
Pantex Plant	754,327	749,204	0	814,378	10,664	0	825,042
Princeton	100	99	0	0	113	0	113
Richland Operations Office	6,984	6,937	0	0	1,800	0	1,800
Sandia National Laboratories	1,754,671	1,742,754	0	1,923,530	207,788	0	2,131,318
Sandia Field Office	20,353	20,215	22,992	0	0	0	22,992
Savannah River Site	661,624	657,130	0	328,525	326,109	0	654,634
Savannah River Field Office	5,268	5,232	5,767		0	0	5,767
Stanford Linear Accelerator Center	90	89	0	90	0	0	90
University of Rochester/LLE	68,000	67,538	0	45,383	0	0	45,383
Waste Isolation Pilot Plant	1,847	1,834	0	0	0	0	0
Westinghouse TRU Solutions (WIPP)	56	56	0	0	100	0	100
Y-12 National Security Complex	1,563,781	1,553,161	0	1,714,369	48,991	0	1,763,360
Adjustments of Prior Year Balances	-140,578	-56,630	0		-19,000	0	-19,000
Grand Total	12,927,635	12,922,836	422,529	11,017,078	1,862,825	1,788,618	15,091,050

* The FY 2018 Annualized CR amounts reflect the P.L. 115-56 continuing resolution level annualized to a full year. These amounts are shown only at the congressional control level and above, below that level, a dash (-) is shown.

FY 2017 NDAA Requirement
Section 3132—Annual Report on Service Support Contracts of the National Nuclear Security Administration. Requires the Administrator to submit, along with NNSA's annual report on service support contracts, information regarding the cost of service support contracts and identification of the program or program direction accounts that support each such contract.

FY 2016 NDAA Requirement
"…require with each budget submission the NNSA provide a report that provides the number of full time equivalent employees under section 3241A of the NNSA Act (50 U.S.C. 2441a), the number of service support contracts and whether the contracts are funded with program funds, the number of full time equivalent employees under each contract and the number in each contract that have been employed for more than 2 years."

Service support Contracts
SEC. 3138. ANNUAL REPORT ON NUMBER OF FULL-TIME EQUIVALENT EMPLOYEES AND CONTRACTOR EMPLOYEES.
Section 3241A of the National Nuclear Security Administration Act (50 U.S.C. 2441a) is amended by adding at the end the following new subsection:

''(f) ANNUAL REPORT.—The Administrator shall include in the budget justification materials submitted to Congress in support of the budget of the Administration for each fiscal year (as submitted with the budget of the President under section 1105(a) of title 31, United States Code) a report containing the following information as of the date of the report:

''(1) The number of full-time equivalent employees of the Office of the Administrator, as counted under subsection (a).

''(2) The number of service support contracts of the Administration and whether such contracts are funded using program or program direction funds.

''(3) The number of full-time equivalent contractor employees working under each contract identified under paragraph (2).

''(4) The number of full-time equivalent contractor employees described in paragraph (3) that have been employed under such a contract for a period greater than two years.''.

The FSE chapter of the budget provides information for (f)(1). The following table provides information required in paragraphs (f)(2) and (f)(3). NNSA does not have information to address paragraph (f)(4). NNSA is not privy to employment information for contractors performing under service support contracts. As a result, we cannot provide details for subsection paragraph (f)(4) which falls under the responsibility of each individual contractor employer when determining who will perform the scope of work required by the terms and conditions of each contract. The typical length of a service support contract is 5 years. Recurring follow-on contracts may or may not employ the same contractor employees; however, it is the responsibility of the contractor to provide appropriate staff and exercise its best efforts and cooperation to effect an orderly and efficient transition to a successor.

For this Annual Service Support report, the following services were excluded: Management and Operating contracts, as well as contracts for housekeeping, custodial, physical security, and facilities maintenance.

Vendor Name	Order Number	Fund Description	Obligations to Date	Maximum Value (Ultimate Value incl. options)	Total FTEs
ALLEGHENY SCIENCE & TECHNOLOGY CORPORATION	BP0003722	Program	$3,452,738	$5,947,811	4.52
ALUTIIQ COMMERCIAL ENTERPRISES LLC	Unavailable	FSE	$3,224,461	$7,040,109	10.85
AMERICAN FEDERAL SECURITY & K-9 SOLUTIONS - 2, LLC	Unavailable	Program	$2,600,407	$2,919,952	9.04
BANDA GROUP INTERNATIONAL, LLC	Unavailable	Program	$3,657,068	$4,302,674	1.81
BANDA GROUP INTERNATIONAL, LLC	Unavailable	FSE	$390,718	$813,664	1.81
BANDA GROUP INTERNATIONAL, LLC	Unavailable	Program	$1,848,762	$3,810,113	1.81
BANDA GROUP INTERNATIONAL, LLC	Unavailable	Program	$3,334,683	$5,151,756	1.87
CE2 Corporation, Inc.	DT0012670	FSE	$500,254	$3,926,420	3.85
CE2 CORPORATION, INC.	DT0011828	FSE	$310,000	$946,330	0.90
CE2 CORPORATION, INC.	DT0012834	Program	$258,000	$1,848,301	1.81
CE2 CORPORATION, INC.	DT0007776	FSE	$1,893,339	$2,978,812	4.52
CE2 CORPORATION, INC.	DT0007798	FSE	$2,535,683	$2,540,683	6.33
CE2 CORPORATION, INC.	DT0008938	FSE	$5,109,814	$10,786,473	14.46
CE2 CORPORATION, INC.	DT0009471	FSE	$1,243,476	$3,076,651	3.62
CE2 CORPORATION, INC.	DT0009761	FSE	$5,809,317	$12,203,754	12.65
CHENEGA PROFESSIONAL & TECHNICAL SERVICES, LLC	DT0012824	FSE	$1,631,482	$10,181,756	15.37
CHENEGA PROFESSIONAL & TECHNICAL SERVICES, LLC	Unavailable	Program	$933,962	$9,620,304	12.65
COHNREZNICK LLP	BP0005348	Program	$796,234	$798,999	2.71
CORPORATE ALLOCATION SVCS, INC.	DT0011033	Program	$2,851,097	$4,412,995	5.42
CORPORATE ALLOCATION SVCS, INC.	DT0012654	Program	$149,387	$462,065	0.90
CORPORATE ALLOCATION SVCS, INC.	BP0003654	Program	$6,115,000	$8,349,531	7.68
CORPORATE ALLOCATION SVCS, INC.	BP0005605	Program	$296,989	$894,192	0.90
COUNTY OF NYE	Unavailable	Program	$2,249,357	$3,070,953	5.42
CRITERION SYSTEMS, INC.	BP0005221	Program	$3,261,625	$9,443,316	10.84
DOXCELERATE CORPORATION	Unavailable	FSE	$294,064	$687,892	1.35
FILIUS CORPORATION	Unavailable	FSE	$21,379	$21,379	0.23
FOX ROTHSCHILD LLP	DT0014083	Program	$264,625	$264,625	0.90
FOX ROTHSCHILD LLP	DT0014087	Program	$351,825	$351,825	1.36
HENRY L STIMSON CENTER	Unavailable	Program	$1,570,700	$2,211,230	2.26
INNOVATIVE REASONING LLC	DT0008760	Program	$18,377,877	$33,386,921	65.98
INNOVATIVE TECHNOLOGY PARTNERSHIPS LLC	DT0014072	FSE	$330,000	$2,928,208	2.71
INTERNATIONAL SERVICES AND ADVISORS, INC	Unavailable	Program	$2,854,698	$7,702,036	3.62
Intuitive Information Systems Technologies, LLC	DT0013389	Program	$1,309,406	$3,999,474	10.39
J.G. MANAGEMENT SYSTEMS, INC.	BP0005948	FSE	$312,842	$805,352	0.90
J.G. MANAGEMENT SYSTEMS, INC.	DT0011413	Program	$674,427	$1,754,467	2.71
J.G. MANAGEMENT SYSTEMS, INC.	DT0011516	Program	$3,313,382	$8,725,667	6.33
J.G. MANAGEMENT SYSTEMS, INC.	DT0012665	Both Program & F	$483,237	$2,729,405	3.62
J.G. MANAGEMENT SYSTEMS, INC.	DT0009287	Program	$371,366	$405,127	0.45
J.G. MANAGEMENT SYSTEMS, INC.	DT0009288	Program	$533,522	$582,023	0.90
JDG ASSOCIATES, INC.	DT0005869	Program	$299,005	$356,500	0.90
LAKEWORTH GROUP, LLC, THE	Unavailable	Program	$251,443	$3,990,443	0.23
LINK TECHNOLOGIES INC	DT0013473	Program	$1,329,000	$8,002,098	15.36
LONGENECKER & ASSOCIATES, INC.	DT0014047	FSE	$1,274,150	$1,759,352	1.36

Vendor Name	Order Number	Fund Description	Obligations to Date	Maximum Value (Ultimate Value incl. options)	Total FTEs
LONGENECKER & ASSOCIATES, INC.	DT0014162	Program	$249,134	$278,345	1.81
LONGENECKER & ASSOCIATES, INC.	DT0007874	FSE	$526,920	$847,456	6.33
LONGENECKER & ASSOCIATES, INC.	DT0008761	Program	$5,688,373	$9,574,329	18.98
LONGENECKER & ASSOCIATES, INC.	DT0009564	FSE	$1,399,568	$3,340,491	5.87
LONGENECKER & ASSOCIATES, INC.	BP0003739	Program	$1,908,056	$4,766,388	2.26
LTD GLOBAL, LLC	Unavailable	FSE	$2,536,925	$2,839,418	4.07
LTD GLOBAL, LLC	Unavailable	Program	$1,347,338	$2,826,021	0.90
LTD GLOBAL, LLC	Unavailable	FSE	$656,442	$1,804,106	3.62
LTD GLOBAL, LLC	Unavailable	FSE	$512,152	$1,841,106	3.16
Mele Associates, Inc.	DT0013157	Program	$8,805,000	$47,295,853	18.98
Mele Associates, Inc.	DT0013826	Program	$1,000,000	$13,670,121	7.23
MELE ASSOCIATES, INC.	DT0009595	Program	$4,516,497	$6,230,526	5.42
MELE ASSOCIATES, INC.	BP0003375	Program	$23,095,727	$32,407,341	28.47
MELE ASSOCIATES, INC.	BP0003826	Program	$24,356,601	$46,292,334	16.72
MELE ASSOCIATES, INC.	BP0004561	Program	$7,950,134	$14,560,733	10.40
MONTECH INC.	Unavailable	Program	$700,000	$1,257,170	2.53
MONTECH INC.	Unavailable	FSE	$159,376	$917,017	1.81
PARSONS GOVERNMENT SERVICES INC.	DT0007897	Both Program & F	$2,909,714	$2,909,714	2.26
PARSONS GOVERNMENT SERVICES INC.	DT0007936	Both Program & F	$3,220,912	$3,220,912	4.97
PARSONS GOVERNMENT SERVICES INC.	DT0008737	FSE	$6,652,485	$7,170,557	6.32
PARSONS GOVERNMENT SERVICES INC.	DT0009614	Program	$5,947,898	$13,486,351	7.23
PARSONS GOVERNMENT SERVICES INC.	DT0009966	Program	$1,689,847	$1,689,847	3.16
PARSONS GOVERNMENT SERVICES INC.	DT0010584	FSE	$1,997,763	$2,997,751	1.36
PARSONS GOVERNMENT SERVICES INC.	DT0010585	Program	$1,649,117	$3,069,493	0.45
PARSONS GOVERNMENT SERVICES INC.	DT0010586	FSE	$3,084,956	$5,551,869	7.23
PARSONS GOVERNMENT SERVICES INC.	DT0010869	Program	$773,062	$1,183,334	0.90
PARSONS GOVERNMENT SERVICES INC.	DT0011023	Program	$724,928	$1,634,927	0.90
PARSONS GOVERNMENT SERVICES INC.	DT0011056	Program	$526,730	$526,730	0.90
PARSONS GOVERNMENT SERVICES INC.	DT0011157	Program	$1,136,778	$1,381,930	1.35
PARSONS GOVERNMENT SERVICES INC.	DT0011750	Program	$710,313	$3,125,149	0.90
PARSONS GOVERNMENT SERVICES INC.	DT0011766	Program	$3,174,095	$3,210,947	2.71
PARSONS GOVERNMENT SERVICES INC.	DT0011792	Program	$499,965	$499,965	1.36
PARSONS GOVERNMENT SERVICES INC.	DT0012090	Program	$634,547	$634,715	0.90
PARSONS GOVERNMENT SERVICES INC.	DT0012532	Program	$160,247	$160,247	0.45
PARSONS GOVERNMENT SERVICES INC.	DT0012626	Program	$2,432,092	$2,432,092	4.07
PARSONS GOVERNMENT SERVICES INC.	DT0012681	FSE	$895,700	$2,799,187	4.07
PARSONS GOVERNMENT SERVICES INC.	DT0012856	Program	$225,142	$225,142	0.45
PARSONS GOVERNMENT SERVICES INC.	DT0013042	Program	$141,046	$319,875	0.90
PARSONS GOVERNMENT SERVICES INC.	DT0013106	Program	$1,439,220	$1,439,220	3.62
PARSONS GOVERNMENT SERVICES INC.	BP0005844	Program	$149,574	$178,652	2.26
PARSONS GOVERNMENT SERVICES INC.	BP0005895	Program	$800,469	$1,985,198	3.62
PARSONS GOVERNMENT SERVICES INC.	BP0005907	Program	$320,000	$352,445	7.23
PERTEK 2, LLC	Unavailable	Program	$2,276,374	$3,677,166	6.78
PERTEK, LLC	Unavailable	Program	$2,724,691	$3,574,485	6.33
PERTEK, LLC	Unavailable	Program	$2,269,702	$3,967,309	2.71
PMTECH, INC.	Unavailable	Program	$5,230,967	$7,287,396	13.56
PROJECT ENHANCEMENT CORPORATION	DT0009849	Program	$3,228,488	$8,504,469	7.23
PROJECT ENHANCEMENT CORPORATION	DT0011426	Program	$19,595,668	$67,234,289	32.54
RHINOCORPS, LTD CO.	Unavailable	Program	$565,795	$565,795	0.90
RHINOCORPS, LTD CO.	Unavailable	Program	$2,702,490	$6,963,815	13.56

Vendor Name	Order Number	Fund Description	Obligations to Date	Maximum Value (Ultimate Value incl. options)	Total FTEs
SIGMA SCIENCE INC	DT0009748	Program	$1,153,589	$1,153,589	0.90
SIGMA SCIENCE INC	DT0010601	Program	$491,615	$491,615	0.45
SIGMA SCIENCE INC	DT0010751	Program	$854,011	$854,011	0.90
SIGMA SCIENCE INC	DT0011966	Program	$359,617	$359,617	0.90
SIGMA SCIENCE INC	DT0013011	FSE	$249,850	$249,850	0.45
SIGMA SCIENCE, INC.	DT0010322	Program	$522,215	$522,215	0.90
SIGMA SCIENCE, INC.	DT0012297	Program	$174,037	$174,037	0.90
SIGMA SCIENCE, INC.	DT0013869	Program	$99,822	$99,822	0.90
STRATA G, LLC	BP0003210	Program	$4,982,295	$9,739,060	1.81
TECHSOURCE, INC.	DT0010708	Program	$1,023,744	$4,591,096	3.16
TECHSOURCE, INC.	DT0011223	Program	$2,421,313	$5,421,459	2.26
TECHSOURCE, INC.	DT0011895	Program	$1,897,309	$8,194,040	2.71
TECHSOURCE, INC.	DT0012050	Program	$1,500,000	$3,396,990	3.62
TECHSOURCE, INC.	DT0012211	Program	$650,182	$3,280,698	2.26
TECHSOURCE, INC.	DT0012554	Program	$916,078	$2,826,958	4.07
TECHSOURCE, INC.	DT0013032	Program	$2,515,140	$11,281,778	5.42
TECHSOURCE, INC.	DT0013055	Program	$2,771,793	$13,574,881	9.04
TECHSOURCE, INC.	DT0013256	Program	$735,000	$3,475,138	2.26
TECHSOURCE, INC.	DT0013337	Program	$1,390,000	$7,173,479	2.26
TECHSOURCE, INC.	DT0013591	Program	$800,000	$4,232,011	2.71
TECHSOURCE, INC.	DT0014080	Program	$1,650,000	$8,997,165	10.85
TECHSOURCE, INC.	BP0004171	FSE	$2,743,426	$3,133,150	3.62
TECHSOURCE, INC.	BP0004181	Program	$5,817,613	$12,734,986	18.98
TECHSOURCE, INC.	BP0004432	Program	$8,316,477	$18,987,109	14.46
TECHSOURCE, INC.	BP0005608	Program	$2,418,794	$12,846,466	9.04
TIME SOLUTIONS, LLC	DT0004308	FSE	$2,306,295	$2,479,244	2.71
TUVA, LLC	Unavailable	Program	$3,600,000	$24,997,054	36.15
VECTOR RESOURCE, INC	DT0012209	FSE	$398,977	$814,475	3.62
VECTOR RESOURCE, INC	89233118FNA400(	Program	$300,000	$2,538,581	2.71
VECTOR RESOURCE, INC	DT0012067	Program	$1,833,000	$2,974,878	3.16
VECTOR RESOURCE, INC	DT0012586	Program	$6,651,858	$29,716,897	23.50
VECTOR RESOURCE, INC	DT0008266	FSE	$6,459,868	$6,820,850	5.42
VETERAN SOLUTIONS, INC	Unavailable	Program	$666,229	$2,452,751	2.08
WYANT DATA SYSTEMS, INC	DT0010108	Both Program & F	$5,500,000	$6,952,743	8.13
TOTAL:			**$328,739,967**	**$768,440,063**	**747.35**

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Federal Salaries and Expenses

Federal Salaries and Expenses

Federal Salaries and Expenses
Proposed Appropriation Language

For expenses necessary for Federal Salaries and Expenses in the National Nuclear Security Administration, $422,529,000, to remain available until September 30, 2020, including official reception and representation expenses not to exceed $17,000.

Note.—A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

Explanation of Changes

The FY 2019 Budget Request for NNSA Federal Salaries and Expenses (FSE) supports recruitment, training, and retention of a highly skilled federal workforce for effective program and project management of $13 billion in NNSA funding to maintain the safety, security, and effectiveness of the U.S. nuclear weapons stockpile without nuclear testing; support the nuclear modernization program, principally in Life Extension Programs (LEPs) and major construction projects; and execute NNSA's prevent, counter, and response nonproliferation efforts. The FY 2019 Budget Request for NNSA FSE is $422,529,000, a $35,163,000 (9.1 percent) increase above the FY 2017 Enacted level for the salaries, benefits, and other expenses of 1,737 federal full-time equivalents (FTEs) (1,715 paid from FSE, 22 paid from Working Capital Fund). The Request includes 5.5 percent benefit escalation, provides additional funding to the Department's Working Capital Fund, includes funding for headquarters facility upgrades, and per Congressional direction, includes headquarters security investigations costs. These increases are partially offset by reductions in projected field security investigation requirements and Corporate Project Management, consistent with the plan to transition from contractor support to federal support.

NNSA is continuing disciplined efforts to support a lean, accountable, efficient government; effectively and efficiently deliver NNSA programs; and align the NNSA federal workforce to meet the needs of today and the future. As NNSA continues the nuclear modernization efforts, a highly skilled federal workforce is required for appropriate oversight principally in LEPs, program management, and major project management. The FY 2019 FSE FTE level is 10 percent lower than FY 2010 levels, while funding has increased 50 percent from FY 2010 Enacted levels to the FY 2019 request for Weapons Activities and Defense Nuclear Nonproliferation, primarily for the nuclear modernization program and supporting infrastructure projects. NNSA projects a total FSE workforce of 1,690 FTEs by the end of FY 2018 and 1,737 FTEs by the end of FY 2019 (1,715 paid from FSE, 22 FTEs paid from Department's WCF).

Working with U.S. Office of Personnel Management (OPM) experts, NNSA is developing a Human Capital Management Plan (HCMP) that institutionalizes a consistent staffing analysis and career development methodology to support NNSA responsibilities and prepare for an anticipated wave of retirements. Phase II was initiated in FY 2017. Results are expected summer 2018. Succession planning is critical since 45 percent of the current federal FTEs are eligible to retire by 2023. The HCMP will focus on the level and mix of skills needed of the federal workforce at all levels at present and for the future workforce. Specifically, strategic consideration of each business line and methods to gain efficiencies, eliminate redundancies, and align resources to mission requirements is paramount to an achievable HCMP. This includes a comprehensive recruiting and hiring plan that aligns the NNSA workforce with current and future mission needs.

Public Law Authorizations

- P.L. 106-65, National Nuclear Security Administration Act, as amended
- P.L. 115–31, Consolidated Appropriations Act, 2017
- Continuing Appropriations Act, 2018 (Division D of P.L. 115–56, as amended)
- P.L. 115-91, National Defense Authorization Act for Fiscal Year 2018

Federal Salaries and Expenses

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
NNSA Federal Salaries and Expenses	390,000	387,352	422,529	+32,529
Rescission of Prior Year Balances	-2,634	-2,616	0	2,634
Total, Federal Salaries and Expenses, Net of Rescissions	**387,366**	**384,736**	**422,529**	**+35,163**

Note: A full year FY 2018 appropriation was not enacted at the time the budget was prepared; therefore, the budget assumes operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56). The amounts included for FY 2018 reflect the annualized level provided by the continuing resolution.

Outyears for Federal Salaries and Expenses

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Total, Federal Salaries and Expenses	**431,081**	**439,702**	**448,496**	**457,466**

Overview

NNSA FSE pays for recruiting, training, and retaining a federal staff to perform program and project management and appropriate oversight of $13 billion in Weapons Activities and Defense Nuclear Nonproliferation funding across the nuclear security enterprise. FSE provides for the salaries and benefits of 1,737 FTEs (1,715 paid from FSE, 22 paid from WCF), space and occupancy needs, travel costs, support service contractors, training, and other related expenses. Seventy-four percent of FSE funds are for employee salaries and benefits.

The NNSA workforce consists of a diverse cadre of engineers, project managers, scientists, foreign affairs specialists, and highly technical support staff. The workforce is also comprised of mission support staff in information technology and cybersecurity, technical program management, corporate project management, procurement and contract management, safety and health, cost estimating and program evaluation, financial management, human capital management, and legal services. NNSA is physically disbursed throughout the United States, reflecting NNSA's work with the nuclear security enterprise. FSE funds federal staff geographically located in Washington, DC; Germantown, Maryland; Albuquerque, New Mexico; and at seven federal field offices: Kansas City Field Office (Missouri); Lawrence Livermore Field Office (California); Los Alamos Field Office (New Mexico); Nevada Field Office (Nevada); NNSA Production Office (Texas and Tennessee); Sandia Field Office (New Mexico); and Savannah River Field Office (South Carolina).

NNSA also manages the Department's overseas presence, including placing DOE staff in 13 foreign countries. NNSA supervises both federal employees and locally employed staff, and reimburses the Department of State for International Cooperative Administrative Support Services (ICASS) and Capital Security Cost Sharing (CSCS) charges. DOE funds its overseas presence through the Working Capital Fund (WCF) for consistent administrative and operational support to Departmental personnel.

Highlights of the FY 2019 Budget Request

NNSA's FY 2019 Request supports a federal staff level of 1,715 FTEs for the effective program and project management and appropriate oversight of the nuclear security enterprise. NNSA's FY 2017 Federal Management Financial Integrity Act (FMFIA) report repeated prior year findings that NNSA's current staffing levels pose a high risk to the success of the NNSA mission. NNSA has also benchmarked its current staffing profile for the LEPs and contract management against comparable programs in the Department of Defense, and the results demonstrate NNSA is understaffed to meet its mission in an effective and efficient manner. In FY 2017, NNSA partnered with OPM to develop an HCMP that institutionalizes a consistent staffing analysis and career development methodology to support NNSA management responsibilities and prepare for an anticipated wave of retirements.

Major Outyear Priorities and Assumptions
Outyear funding levels for the NNSA Federal Salaries and Expenses appropriation total $1,776,745,000 for FY 2020 through FY 2023. The five-year funding plan supports a federal staff level of 1,762 FTEs (1,740 paid from FSE, 22 paid from WCF). Funding for additional FTEs may be required pending the OPM staffing study.

Department of Energy (DOE) Working Capital Fund (WCF) Support
FSE funds a majority of NNSA contributions to the Department's WCF, a financial management tool for improving the delivery of common administrative services. NNSA's FY 2019 projected FSE contribution to the WCF is $43,089,000, an increase of $6,937,000 from FY 2017 Enacted level to primarily reflect an increase in building occupancy and telecommunications. The Department's WCF budget chapter details the programs funded through the WCF.

Entry Level Hires
The NNSA supports programs, including OPM's Presidential Management Fellows (PMF) program, NNSA's Graduate Fellowship Program (NGFP), Minority Serving Institutions Partnership Program (MSIPP), and the Presidential Management Fellows Program (PMF) to recruit and train the next generation of professionals at NNSA and the nuclear security enterprise. These programs foster the pipeline of qualified, skilled specialists who will sustain expertise in the nuclear security enterprise.

In FY 2019, the FSE appropriation will provide up to $1,600,000 for NGFP support and development activities.

Federal Salaries and Expenses
Funding by Congressional Control

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
NNSA Federal Salaries and Expenses	390,000	387,352	422,529	+32,529
Rescission of Prior Year Balances	-2,634	-2,616	0	2,634
Total, Federal Salaries and Expenses, Net of Rescissions	**387,366**	**384,736**	**422,529**	**+35,163**

Overview

Salaries and Benefits: Provides $313,022,000 for the federal staff that performs program and project management and appropriate oversight of the national security missions related to the safety, security, and effectiveness of the nuclear weapons stockpile; supporting the nuclear modernization program; nuclear nonproliferation efforts; emergency response; safeguards and security oversight; strategic coordination of counterterrorism and counter-proliferation initiatives; and safe, secure, and compliant facilities and infrastructure. Also provides federal staff for mission support to include: information technology and cybersecurity, cost estimating and program evaluation, procurement, budget and financial management, human capital, legal services, and safety and health.

Travel: Provides $14,332,000 for travel necessary to conduct NNSA business. Domestic travel provides management oversight, public outreach, travel related to training, and national security assistance and interface between NNSA Headquarters, NNSA Field Offices, DOE laboratories and production facilities, and local governments. International travel is a key element of the nonproliferation work.

Support Services: Includes $26,474,000 for Management and Professional Services to assist or train staff to achieve efficient and effective management and operation of organizations, activities, and systems, including administrative support, funding for Environmental Safety and Health activities, Corporate Project Management program, and the NGFP.

Other Expenses: Provides $68,701,000 for the following items:

Training: Provides $3,629,000 for necessary learning, career development, and skills maintenance of the NNSA Federal staff. Includes valuable learning activities for NNSA Headquarters and Field Offices, and corporate training, as managed by the NNSA's Chief Learning Officer. The NNSA corporate training program encompasses the Technical Qualification Program (TQP) and federal and agency mandated training (such as executive, managerial, and supervisory training). It also funds: Leadership Development Programs; Mid-Level Leadership Development Program; Executive Development Program; 360 Assessments; Rotations; NNSA 1st Year (Onboarding) Program; Mentoring; Coaching; and other learning events. Funding is also provided for each NNSA organization training plan with an emphasis on individual employees' training and developmental needs.

Space and Occupancy: Supports $17,650,000 in Space and Occupancy costs for Headquarters and the field.

Working Capital Fund: Provides $43,089,000 for FSE’s contribution to the Department’s WCF.

Other Expenses: Provides $4,333,000 in funding for activities required for NNSA’s federal personnel, including field site investigations in coordination with the DOE General Counsel, headquarters security investigations costs, and other miscellaneous procurements, such as potential settlements. Also provides $17,000 for Reception and Representation funds.

Federal Salaries and Expenses

Program Direction

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 vs FY 2017 Enacted
	(Dollars in Thousands)			
NNSA Federal Salaries and Expenses				
Headquarters				
Salaries and Benefits	193,844	189,491	215,336	+21,492
Travel	12,369	11,428	11,874	-495
Support Services	27,530	24,501	24,311	-3,219
Other Related Expenses	45,992	45,338	54,703	+8,711
Total, Headquarters	279,735	270,758	306,224	+26,489
Total, Full Time Equivalents	1,102	1,155	1,187	85
Livermore Field Office				
Salaries and Benefits	14,320	15,615	16,277	+1,957
Travel	514	345	398	-116
Support Services	528	541	621	+93
Other Related Expenses	2,532	1,624	1,349	-1,183
Total, Livermore Field Office	17,894	18,125	18,645	+751
Total, Full Time Equivalents	73	78	81	8
Los Alamos Field Office				
Salaries and Benefits	13,661	15,169	16,191	+2,530
Travel	442	286	298	-144
Support Services	559	322	337	-222
Other Related Expenses	591	527	425	-166
Total, Los Alamos Field Office	15,253	16,304	17,251	+1,998
Total, Full Time Equivalents	77	83	88	11

Federal Salaries and Expenses
Program Direction, Continued

	(Dollars in Thousands)			
	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Sandia Field Office				
Salaries and Benefits	14,058	14,711	14,682	+624
Travel	305	254	264	-41
Support Services	179	154	162	-17
Other Related Expenses	5,811	7,970	7,884	+2,073
Total, Sandia Field Office	20,353	23,089	22,992	+2,639
Total, Full Time Equivalents	83	84	83	0
Nevada Field Office				
Salaries and Benefits	14,191	14,840	15,552	+1,361
Travel	284	284	295	+11
Support Services	332	322	337	+5
Other Related Expenses	2,362	1,698	1,469	-893
Total, Nevada Field Office	17,169	17,144	17,653	+484
Total, Full Time Equivalents	75	76	79	4
NNSA Production Office (NPO)				
Salaries and Benefits	21,706	22,732	23,220	+1,514
Travel	651	608	633	-18
Support Services	450	377	377	-73
Other Related Expenses	2,309	2,495	2,334	+25
Total, NNSA Production Office	25,116	26,212	26,564	+1,448
Total, Full Time Equivalents	126	128	130	4

Federal Salaries and Expenses[a]
Program Direction, Continued

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 vs FY 2017 Enacted
Kansas City Field Office				
Salaries and Benefits	5,761	6,208	6,308	+547
Travel	252	199	414	+162
Support Services	128	318	250	+122
Other Related Expenses	437	710	461	+24
Total, Kansas City Field Office	6,578	7,435	7,433	+855
Total, Full Time Equivalents	37	38	38	1
Savannah River Field Office				
Salaries and Benefits	4,871	5,338	5,456	+585
Travel	167	150	156	-11
Support Services	69	75	79	+10
Other Related Expenses	161	106	76	-85
Total, Savannah River Field Office	5,268	5,669	5,767	+499
Total, Full Time Equivalents	28	29	29	1
NNSA Federal Salaries and Expenses				
Salaries and Benefits	282,412	284,104	313,022	+30,610
Travel	14,984	13,554	14,332	-652
Support Services	29,775	26,610	26,474	-3,301
Other Related Expenses	60,195	60,468	68,701	+8,506
Total, NNSA Federal Salaries and Expenses	387,366	384,736	422,529	+35,163
FTEs (paid from FSE)	1,601	1,670	1,715	114
FTEs (paid from WCF)	18	20	22	4
Total FTEs	1,619	1,690	1,737	118

[a] The FY 2017 Enacted includes a one-time rescission of Federal Salaries and Expenses prior year balances of $2,634,000. A full year FY 2018 appropriation was not enacted at the time the budget was prepared; therefore, the budget assumes operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56). The amounts included for FY 2018 reflect the annualized level provided by the continuing resolution.

Federal Salaries and Expenses

Support Services and Other Related Expenses

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Support Services				
Management and Professional Services	19,629	16,909	18,185	-1,444
Environmental Safety and Health Support	175	175	175	0
Corporate Project Management Support	9,971	9,526	8,114	-1,857
Total, Support Services	**29,775**	**26,610**	**26,474**	**-3,301**
Other Related Expenses				
Training	2,552	3,802	3,629	+1,077
Space and Occupancy Costs	15,539	14,972	17,650	+2,111

Federal Salaries and Expenses

Support Services and Other Related Expenses, Continued

(Dollars in Thousands)

Headquarters Working Capital Fund (WCF)	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Supplies	502	423	423	-79
Mail Services	676	0	0	-676
Copying Service	730	0	0	-730
Printing and Graphics	367	0	0	-367
Building Occupancy	11,443	13,084	19,424	+7,981
Telecommunications	5,160	10,130	8,879	+3,719
Procurement (DCAA)	210	0	0	-210
Corporate Training Services	218	429	429	+211
Project Management (PMCDP)	368	0	0	-368
iMANAGE	3,463	2,405	2,405	-1,058
Financial Statement Audits	77	0	0	-77
Internal Control (A-123)	36	0	0	-36
Pensions	65	0	0	-65
Overseas Representation	10,246	11,259	11,259	+1,013
Interagency Transfers to GSA	2,199	0	0	-2,199
Health Services	392	270	270	-122
TOTAL, Headquarters Working Capital Fund (WCF)	36,152	38,000	43,089	+6,937
Other Expenses				
Other Services	5,940	3,682	4,316	-1,624
Reception and Representation	12	12	17	+5
Subtotal, Other Expenses	5,952	3,694	4,333	-1,619
Total, Other Related Expenses	**60,195**	**60,468**	**68,701**	**+8,506**

Federal Salaries and Expenses
NNSA Program Direction
Outyears

	(Dollars in Thousands)			
	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
NNSA Federal Salaries and Expenses				
Headquarters				
Salaries and Benefits	218,734	224,422	230,258	236,246
Travel	12,123	12,353	12,588	12,827
Support Services	24,822	25,308	25,628	25,952
Other Related Expenses	56,180	55,430	54,791	54,091
Total, Headquarters	311,859	317,513	323,265	329,116
Total, Full Time Equivalents	1,212	1,212	1,212	1,212
Livermore Field Office				
Salaries and Benefits	16,700	17,134	17,579	18,036
Travel	406	414	422	430
Support Services	634	646	658	671
Other Related Expenses	1,376	1,402	1,429	1,456
Total, Livermore Field Office	19,116	19,596	20,088	20,593
Total, Full Time Equivalents	81	81	81	81
Los Alamos Field Office				
Salaries and Benefits	16,612	17,044	17,487	17,942
Travel	304	310	316	322
Support Services	344	351	358	365
Other Related Expenses	434	442	450	459
Total, Los Alamos Field Office	17,694	18,147	18,611	19,088
Total, Full Time Equivalents	88	88	88	88

Outyears, Continued

	(Dollars in Thousands) FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Sandia Field Office				
Salaries and Benefits	15,064	15,456	15,858	16,270
Travel	270	275	280	285
Support Services	178	181	184	187
Other Related Expenses	8,029	8,182	8,337	8,495
Total, Sandia Field Office	23,541	24,094	24,659	25,237
Total, Full Time Equivalents	83	83	83	83
Nevada Field Office				
Salaries and Benefits	15,956	16,371	16,797	17,234
Travel	301	307	313	319
Support Services	344	351	358	365
Other Related Expenses	1,498	1,526	1,555	1,585
Total, Nevada Field Office	18,099	18,555	19,023	19,503
Total, Full Time Equivalents	79	79	79	79
NNSA Production Office (NPO)				
Salaries and Benefits	23,824	24,443	25,079	25,731
Travel	646	658	671	684
Support Services	385	392	399	407
Other Related Expenses	2,381	2,426	2,472	2,519
Total, NNSA Production Office	27,236	27,919	28,621	29,341
Full Time Equivalents	130	130	130	130

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
	(Dollars in Thousands)			
Kansas City Field Office				
Salaries and Benefits	6,472	6,640	6,813	6,990
Travel	423	431	439	447
Support Services	255	260	265	270
Other Related Expenses	470	479	488	497
Total, Kansas City Field Office	7,620	7,810	8,005	8,204
Total, Full Time Equivalents	38	38	38	38
Savannah River Field Office				
Salaries and Benefits	5,598	5,744	5,893	6,046
Travel	159	162	165	168
Support Services	81	83	85	87
Other Related Expenses	78	79	81	83
Total, Savannah River Field Office	5,916	6,068	6,224	6,384
Total, Full Time Equivalents	29	29	29	29
NNSA Federal Salaries and Expenses				
Salaries and Benefits	318,960	327,254	335,764	344,495
Travel	14,632	14,910	15,194	15,482
Support Services	27,043	27,572	27,935	28,304
Other Related Expenses	70,446	69,966	69,603	69,185
Total, NNSA Federal Salaries and Expenses	431,081	439,702	448,496	457,466
FTEs (paid from FSE)	1,740	1,740	1,740	1,740
FTEs (paid from WCF)	22	22	22	22
Total FTEs	1,762	1,762	1,762	1,762

Outyears
Support Services and Other Related Expenses

	(Dollars in Thousands)			
	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Support Services				
Management and Professional Services	18,567	18,920	19,279	19,646
Environmental Safety and Health Support	179	180	183	187
Corporate Project Management Support	8,297	8,472	8,472	8,472
Total, Support Services	**27,043**	**27,572**	**27,935**	**28,304**
Other Related Expenses				
Training	3,705	3,775	3,847	3,920
Space and Occupancy Costs	18,324	18,672	19,027	19,389

Support Services and Other Related Expenses, Continued

	(Dollars in Thousands)			
	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Headquarters Working Capital Fund (WCF)				
Supplies	432	440	448	457
Mail Services	0	0	0	0
Copying Service	0	0	0	0
Printing and Graphics	0	0	0	0
Building Occupancy	19,831	18,391	17,047	15,631
Telecommunications	9,065	9,238	9,413	9,592
Procurement (DCAA)	0	0	0	0
Corporate Training Services	438	446	455	463
Project Management (PMCDP)	0	0	0	0
iMANAGE	2,456	2,502	2,550	2,598
Financial Statement Audits	0	0	0	0
Internal Control (A-123)	0	0	0	0
Indirect	0	0	0	0
Pensions	0	0	0	0
Overseas Representation	11,495	11,714	11,936	12,163
Interagency Transfers to GSA	0	0	0	0
Health Services	276	281	286	292
TOTAL, Headquarters Working Capital Fund (WCF)	43,993	43,012	42,136	41,197
Other Expenses				
Other Services	4,407	4,490	4,576	4,663
Reception and representation	17	17	17	17
Subtotal, Other Expenses	4,424	4,507	4,593	4,680
Total, Other Related Expenses	**70,446**	**69,966**	**69,603**	**69,185**

Federal Salaries and Expenses
Program Direction

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Salaries and Benefits $282,412,000	**Salaries and Benefits $313,022,000**	**Salaries and Benefits +$30,610,000**
• Provided support for an NNSA federal staff of 1,601 full-time equivalents (FTEs) • Included 1.9% COLA, other pay escalation, and 5.5% benefit escalation	• Provides support for an annualized NNSA federal staff of 1,715 full-time equivalents (FTEs) • Includes 5.5% benefit escalation	• Increase reflects 114 FTEs above the FY 2017 actual FTE level and 5.5% benefit escalation • As NNSA enters the next phase of the nuclear modernization efforts, a highly skilled federal workforce will be required for appropriate program and project oversight principally in LEPs and major project management • NNSA staffing levels are low compared to other DOE Program Offices and Department of Defense offices • Working with OPM, NNSA is developing a Human Capital Management Plan that will institutionalize a consistent staffing analysis and career development methodology to support NNSA management responsibilities and prepare for an anticipated wave of retirements, with 45 percent of the current workforce eligible to retire by 2023.
Travel $14,984,000	**Travel $14,332,000**	**Travel -$652,000**
• Supports domestic and foreign travel necessary as part of NNSA's mission	• Supports domestic and foreign travel necessary as part of NNSA's mission	• Decrease reflects efficiencies.
Support Services $29,775,000	**Support Services $26,474,000**	**Support Services -$3,301,000**
• Includes Management and Professional Services; Environment Safety and Health support; NGFP support; and the Corporate Project Management program	• Includes Management and Professional Services; Environment Safety and Health support; NGFP support; and the Corporate Project Management program	• Decrease to Corporate Project Management reflects plan to transition from contractor support to federal support (-$1,857,000) • Decrease to Management and Professional Services reflects planned efficiencies (-$1,444,000)

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Other Expenses $60,195,000	**Other Expenses $68,701,000**	**Other Expenses +$8,506,000**
• Provides funding for Space and Occupancy costs at Headquarters and field sites • Includes FSE's contribution to the DOE WCF • Provides necessary training and skills maintenance of the NNSA federal staff; and miscellaneous procurements	• Provides funding for Space and Occupancy costs at Headquarters and field sites • Includes FSE's contribution to the DOE WCF • Provides necessary training and skills maintenance of the NNSA federal staff; and miscellaneous procurements	• Increase reflects $6,937,000 in WCF for building occupancy and telecommunications, $1,077,000 in training of the federal workforce, $1,050,000 for headquarters security investigations costs per Congressional direction, $2,111,000 for headquarters facility upgrades • Partially offset by a $2,669,000 decrease for projected field security investigation requirements and other miscellaneous procurements

National Nuclear Security Administration Federal Salaries and Expenses
Performance Measures

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Federal Administrative Costs - Maintain NNSA Federal Salaries and Expenses federal administrative costs as a percentage of total Weapons Activities and Defense Nuclear Nonproliferation program costs at less than 6%.							
Target	≤5.9 %	≤5.9%	≤5.9%	≤5.9%	≤5.9%	≤5.9%	≤5.9%
Result	**Exceeded** - 3.8						
Endpoint Target	In keeping with OMB and DOE expectations that administrative costs be minimized, maintain the NNSA Federal Salaries and Expenses federal administrative costs as a percentage of total Weapons Activities and Defense Nuclear Nonproliferation program costs at less than 6%.						

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Weapons Activities

Weapons Activities

FY 2019 Congressional Budget Request

Weapons Activities

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Weapons Activities
Proposed Appropriation Language

For Department of Energy expenses, including the purchase, construction, and acquisition of plant and capital equipment and other incidental expenses necessary for atomic energy defense weapons activities in carrying out the purposes of the Department of Energy Organization Act (42 U.S.C. 7101 et seq.), including the acquisition or condemnation of any real property or any facility or for plant or facility acquisition, construction, or expansion, $11,017,078,000, to remain available until expended: Provided, That of such amount, $102,022,000 shall be available until September 30, 2019, for program direction.

Note.—A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

Explanation of Change

The FY 2019 Budget Request provides a 19.2% increase from the FY 2017 Enacted Level to support the current stockpile, life extension programs, modernization efforts, and the scientific tools necessary for these efforts, and is consistent with the 2018 Nuclear Posture Review (NPR). The Nuclear Weapons Council (NWC) will translate the NPR's policy initiatives into requirements. This request positions NNSA to support those initiatives while working within the NWC to define the military requirements and strategic direction provided by the NPR. As military requirements are refined, the Administration will work with Congress to ensure that the program of work is properly authorized and funded.

A number of areas request FY 2019 funding increases, including:

- **Directed Stockpile Work (DSW)** to support Life Extension Programs (LEP) and Major Alterations (Alt) including the W80-4 LEP, transition from design to production for the B61-12 LEP, and restart of the Feasibility Study & Design Options for Interoperable Warhead 1 (IW1) to remain aligned with the Department of Defense (DOD) current nuclear modernization plans, including those applying to IW2. The Request includes increases for strategic materials to meet future pit production and tritium requirements.

- **Research, Development, Testing, and Evaluation (RDT&E)** to support the recapitalization of NNSA's plutonium experimental capabilities via the Enhanced Capabilities for Subcritical Experiments project to conduct plutonium experiments. The Advanced Simulation and Computing funding supports Exascale projects to improve NNSA weapons design, stewardship and stockpile certification capabilities to ensure the U.S. maintains leadership in high-performance simulations that underpin our nuclear deterrent; and, accommodate the infrastructure demands of next- generation computing platforms. The increase in Engineering supports weapon aging studies, experimental test facilities for future delivery systems and survivability, surety technologies, and stockpile responsiveness.

- **Infrastructure and Operations (I&O)** is increased to continue the long-term effort to reverse the declining state of NNSA infrastructure, improve working conditions of NNSA's aging facilities and equipment, and address safety and programmatic risks. The Request includes increases to Operations of Facilities to provide for transitioning new facilities to operations, lease payments, and programmatic tempo increases. The Request also includes increases to Recapitalization to continue the stabilization of deferred maintenance and improve the condition of NNSA infrastructure. The Request supports increases in funding for the Uranium Processing Facility (UPF) and Chemistry & Metallurgy Research Building Replacement (CMRR) projects to support ceasing operations in existing aged facilities by 2025 and 2019, respectively. Funding is requested for general-purpose construction projects including the construction of the Albuquerque Complex Project to replace the current aging and degrading federal facilities in Albuquerque and the 138kV Power Transmission System Replacement project to replace and upgrade the current power transmission system for the Mission Corridor at the Nevada National Security Site (NNSS).

- **Secure Transportation Asset (STA)** increases includes the completion of both Mobile Guardian Transporter (MGT) Prototypes. In addition, funding will support Safeguards Transporter (SGT) Risk Reduction Initiatives to maintain the SGT beyond its 20-year useful life, performance of deferred maintenance and minor construction projects of existing facilities, purchase of Federal Agent equipment and vehicles, procurement of upgraded long-lead communications equipment, and the First Production Units of the Next Generation Armored Tractor.

- **Information Technology and Cybersecurity** increases continue recapitalization of the Enterprise Secure Network, modernize the federal and site Cybersecurity infrastructure, and implement the Identity Control and Access Management project at NNSA Headquarters and site elements.

Public Law Authorizations
- P.L. 106-65, National Nuclear Security Administration Act, as amended
- P.L. 115–31, Consolidated Appropriations Act, 2017
- Continuing Appropriations Act, 2018 (Division D of P.L. 115–56, as amended)
- P.L. 115-91, National Defense Authorization Act for Fiscal Year 2018

Weapons Activities

	(Dollars in Thousands)			
	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Weapons Activities	9,318,093	9,254,813	11,017,078	+1,698,985
Rescission of Prior Year Balances	-77,354	-13,138	0	+77,354
Total, Weapons Activities	**9,240,739**	**9,241,675**	**11,017,078**	**+1,776,339**

Overview

Programs funded in the Weapons Activities appropriation support the Nation's current and future defense posture and necessary nationwide infrastructure of science, technology and engineering capabilities without conducting underground testing. Weapons Activities provides for the maintenance and refurbishment of nuclear weapons to continue sustained confidence in their safety, reliability, and performance; investment in scientific, engineering, and manufacturing capabilities for certification of the enduring nuclear weapons stockpile; and manufacture of nuclear weapon components. Weapons Activities also provides for maintenance and investment in the NNSA nuclear complex infrastructure to be more responsive and cost effective.

NNSA's Management and Operating (M&Os) contractors employ approximately 39,000 people to deliver these programs, predominantly at eight geographical sites. NNSA M&O contractors, managed by a Federal workforce, is composed of civilian and military staff. Additional details about these programs will be included in the FY 2019 Stockpile Stewardship and Management Plan (SSMP), planned for release in March 2018.

Highlights and Major Changes in the FY 2019 Budget

Directed Stockpile Work (DSW)

DSW encompasses activities that support the nuclear weapons stockpile. These activities include maintenance and surveillance; planned refurbishment; reliability assessments; weapon dismantlement and disposition; research, development, and certification of technology efforts to meet stockpile requirements and strategic materials. Requested increases in Life Extension Programs (LEP) and Major Alterations (Alt) support planned work scope for the W80-4 LEP, transition of components from design to production scope for the B61-12 LEP, and restart of the Feasibility Study & Design Options for IW1. This funding is vital to remain aligned with Department of Defense schedules. Increases for Plutonium Sustainment support fabrication of four to five development (DEV) W87 pits, continue investments to replace end-of-life equipment for pit production, installation of critical equipment to increase production capacity, and Other Project Costs associated with pre-conceptual design efforts supporting the selection of a single preferred alternative for plutonium pit production beyond 30 war reserve pits per year. The Tritium Sustainment increase supports increased production of Tennessee Valley Authority (TVA) reactor fuel and operational costs. The Domestic Uranium Enrichment funding increase supports the start of an effort to down blend available stocks of highly enriched uranium for use in tritium production, which delays the need date for a domestic uranium enrichment capability.

Research, Development, Test, and Evaluation (RDT&E) Programs

RDT&E will continue to develop and maintain critical capabilities, tools, and processes needed to support science-based stockpile stewardship, refurbishment, and continued certification of the stockpile without the use of underground nuclear testing. The FY 2019 request supports required annual assessments and future LEP options and systems certification, including Hydrodynamic and subcritical experiments and Enhanced Capabilities for Subcritical Experiments. As the nuclear weapons stockpile ages, NNSA requires powerful computers to address increasingly challenging certification requirements to meet the Stockpile Stewardship Program mission. These next-generation computers will require unprecedented electrical power and cooling. Advanced Simulation and Computing funding increase supports Exascale projects to improve NNSA weapons design, stewardship and stockpile certification capabilities to ensure the U.S. maintains leadership in high-performance simulations that underpin our nuclear deterrent; accommodate the infrastructure demands of Exascale computing platforms; maintenance of computing resources and facilities; and provides resources to collaborate with industry addressing NNSA requirements as high-performance computing evolves. The FY 2019 budget request reflects the critical need to maintain required experimental capabilities and expertise in high-energy-density (HED) science, while slowing R&D efforts toward the development of an ignition-based high-yield platform for the Stockpile Stewardship

Program (SSP); to support Defense Programs higher priority and shorter term LEP and infrastructure needs. The Inertial Confinement Fusion Ignition and High Yield program will transition from NNSA operations at three major high energy density facilities to two – National Ignition Facility (NIF) at Lawrence Livermore National Laboratories (LLNL), Z Pulsed Power facility at Sandia National Laboratories (SNL). As part of rebalancing the ICF Program to strengthen long-term support for Stockpile Stewardship Program efforts, as well as responding to higher NNSA priorities, the FY 2019 Request initiates a three-year ramp-down in NNSA's financial commitment to the University of Rochester's Laboratory for Laser Energetics, including the Omega Laser Facility, resulting in the cessation of the financial assistance agreement. These programs continue to provide essential data and supporting expertise required for the ongoing assessment and certification of the nuclear weapon stockpile

Infrastructure and Operations (I&O)
I&O maintains, operates, and modernizes the NNSA infrastructure in a safe, secure, and cost-effective manner. Provides a comprehensive approach to arresting the declining state of NNSA infrastructure while maximizing return on investment, supporting program deliveries, and reducing enterprise risk. The program also plans, prioritizes, and constructs state-of-the-art facilities, infrastructure, and scientific tools through Capabilities Based Investments and line item construction projects. The Request also includes increases to Recapitalization to continue the stabilization of deferred maintenance and improve the condition of NNSA infrastructure. For FY 2019, funding will continue the stabilization of deferred maintenance, execute Recapitalization projects to improve the condition and extend the design life of structures, capabilities, and systems to meet program demands; decrease overall operating costs; and reduce safety, security, environmental, and program risk. The request supports increases in funding for UPF and CMRR per the respective project execution plans and efforts to phase out mission dependency in the existing aged facilities. Increased funding also provides for general-purpose construction projects including the construction of the Albuquerque Complex Project to replace the aging and degrading Federal facilities and the 138kV Power Transmission System Replacement project to replace and upgrade the current power transmission system for the Mission Corridor at NNSS.

Infrastructure Modernization Initiative
The FY 2018 National Defense Authorization Act (NDAA) directed the creation of the Infrastructure Modernization Initiative (IMI) program, which the NNSA Administrator created in December 2017. The IMI will use the current budget structure with emphasis on the Recapitalization: Infrastructure & Safety and Maintenance and Repair of Facilities programs. The initial plan is currently under development and transmission to Congress will occur once completed.

Secure Transportation Asset (STA)
STA supports the safe and secure transportation of nuclear weapons, special nuclear material, and weapon components to meet projected DOE, DOD, and other customer requirements. Program Direction provides for the secure transportation workforce, including Federal agents. FY 2019 requested funding increases support critical workforce capability, and asset modernization initiatives. These initiatives include a project to increase the number of Federal Agent applicants for hire, Safeguards Transporter (SGT) Risk Reduction Initiatives to manage the SGT beyond its design life, the completion of two Mobile Guardian Transporter (MGT) Prototypes, and deferred facilities maintenance and minor construction projects at multiple sites.

Defense Nuclear Security (DNS)
DNS provides protection for NNSA nuclear weapons, special nuclear materials, facilities, and personnel against a full spectrum of threats, ranging from local security incidents to terrorism. This program employs over 1,500 protective force officers, plus 1,100 additional security professionals and support staff responsible for meeting all security requirements at NNSA sites. The FY 2019 Request includes funding for protective forces and other key security program areas at the sites, such as classified matter protection, technical surveillance countermeasures, and nuclear materials measurements, accounting, and physical inventory. It also includes preliminary planning and conceptual design funds for future projects to sustain and recapitalize the Perimeter Intrusion Detection and Assessment Systems (PIDAS) at the Pantex and Y-12 sites.

Information Technology and Cybersecurity
IM provides a range of IT and Cybersecurity support functions, activities and manages cybersecurity operations and program areas within NNSA's M&O contractors. The FY 2019 Request continues recapitalization of the Enterprise Secure Network, modernizes the federal and site Cybersecurity infrastructure, and implements the Identity Control and Access

Management project at NNSA Headquarters and site elements. Additionally, executes and coordinates Public Key Infrastructure and other Committee on National Security Systems requirements, and leverages IT Modernization efforts across the NNSA nuclear security enterprise to increase the efficiency and cost-effectiveness of NNSA IT services consistent with the DOE Strategies.

Crosscutting programs

The FY 2019 Budget Request continues crosscutting programs across the Department to improve the overall efficiency and effectiveness of DOE's mission.

Cybersecurity Crosscut

DOE is engaged in two categories of cyber-related activities: protecting the DOE enterprise from a range of cyber threats that can adversely influence mission capabilities, and improving cybersecurity and grid resilience in the energy sector. The cybersecurity crosscut supports central coordination of the strategic and operational aspects of cybersecurity and facilitates cooperative efforts such as the Integrated Joint Cybersecurity Coordination Center (iJC3) for incident response and the implementation of Department-wide Identity, Credentials, and Access Management (ICAM).

Exascale Computing

Exascale systems are needed to improve NNSA weapons design, stewardship and stockpile certification capabilities to ensure the U.S. maintains leadership in high-performance simulations that underpin our nuclear deterrent that are not within the capacities of today's systems. Exascale systems' computational power is needed for increasing capable data-analytic and data-intense applications across the entire Federal complex. Exascale is a component of long-term collaboration between the interagency National Strategic Computing Initiative, the DOE/Office of Science's Advanced Scientific Computing Research program and NNSA's ASC program.

DOE Working Capital Fund (WCF) Support

NNSA Weapons Activities appropriation projected contribution to the DOE WCF for FY 2019 is $33,389,000. This funding covers certain shared enterprise activities including managing enterprise-wide systems, data, and telecommunications and supporting the integrated acquisition environment.

Legacy Contractor Pensions

This funding provides the annual Weapons Activities share of the DOE's reimbursement of payments made to the University of California (UC) Retirement Plan (UCRP) for former UC employees and annuitants who worked at the Lawrence Livermore National Laboratory (LLNL) and Los Alamos National Laboratory (LANL). The UCRP benefit for these individuals is a legacy cost and DOE's annual payment to the UC is required by contract. The amount of the annual payment is based on the actuarial valuation report and is covered by the terms described in the contracts. NNSA's budget request supports the increased costs and readjusted the split between Weapons and DNN to reflect the changes in relative shares of total NNSA funding in FY 2019. These contracts will be paid through the Legacy Contractor Pensions line item.

Entry Level Hires

The NNSA supports a variety of programs to help train and recruit the next generation of leaders in managing the nuclear stockpile, nonproliferation, nuclear security, and international security, such as the NNSA Graduate Fellowship Program (NGFP), the Minority Serving Institutions Partnership Program (MSIPP), and, where appropriate, the Presidential Management Fellows (PMF) program. These programs foster the pipeline of qualified professionals who will sustain expertise in these areas through future employment in the NNSA nuclear security enterprise. In FY 2019, the Weapons Activities appropriation anticipates spending about $4,300,000 on the NGFP program.

Weapons Activities
Funding by Program

	(Dollars in Thousands)			
	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Directed Stockpile Work				
Life Extension Programs and Major Alterations				
B61 Life Extension Program	616,079	611,895	794,049	+177,970
W76 Life Extension Program	222,880	221,366	113,888	-108,992
W88 Alt 370 (W88 Alteration Program)	281,129	279,220	304,285	+23,156
W80-4 Life Extension Program	220,253	218,757	654,766	+434,513
IW1	0	0	53,000	+53,000
Total, Life Extension Programs and Major Alterations	**1,340,341**	**1,331,238**	**1,919,988**	**+579,647**
Stockpile Systems				
B61 Stockpile Systems	57,313	56,924	64,547	+7,234
W76 Stockpile Systems	38,604	38,342	94,300	+55,696
W78 Stockpile Systems	56,413	56,030	81,329	+24,916
W80 Stockpile Systems	64,631	64,192	80,204	+15,573
B83 Stockpile Systems	41,659	41,376	35,082	-6,577
W87 Stockpile Systems	81,982	81,425	83,107	+1,125
W88 Stockpile Systems	103,074	102,374	180,913	+77,839
Total, Stockpile Systems	**443,676**	**440,663**	**619,482**	**+175,806**
Weapons Dismantlement and Disposition	**56,000**	**55,620**	**56,000**	**0**
Stockpile Services				
Production Support	447,527	444,488	512,916	+65,389
Research and Development Support	34,187	33,955	38,129	+3,942
Research and Deveopment Certification and Safety	156,481	155,418	216,582	+60,101
Management, Technology, and Production	251,978	250,267	300,736	+48,758
Total, Stockpile Services	**890,173**	**884,128**	**1,068,363**	**+178,190**
Strategic Materials				
Uranium Sustainment	20,988	20,845	87,182	+66,194
Plutonium Sustainment	184,970	183,714	361,282	+176,312
Tritium Sustainment	109,787	109,041	205,275	+95,488
Lithium Sustainment	0	0	29,135	+29,135
Domestic Uranium Enrichment	50,000	49,660	100,704	+50,704
Strategic Materials Sustainment	212,092	210,652	218,794	+6,702
Total, Strategic Materials	**577,837**	**573,912**	**1,002,372**	**+424,535**
Total, Directed Stockpile Work	**3,308,027**	**3,285,561**	**4,666,205**	**+1,358,178**

	(Dollars in Thousands)			
	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Research, Development, Test and Evaluation (RDT&E)				
Science				
Advanced Certification	60,000	59,593	57,710	-2,290
Primary Assessment Technologies	99,000	98,328	95,057	-3,943
Dynamic Materials Properties	106,000	105,280	131,000	+25,000
Advanced Radiography	45,700	45,390	32,544	-13,156
Secondary Assessment Technologies	76,000	75,484	77,553	+1,553
Academic Alliances and Partnerships	49,800	49,462	53,364	+3,564
Enhanced Capabilities for Subcritical Experiments	0	0	117,632	+117,632
Total, Science	**436,500**	**433,537**	**564,860**	**+128,360**
Engineering				
Enhanced Surety	37,196	36,943	43,226	+6,030
Weapon Systems Engineering Assessment Technology	16,958	16,843	27,536	+10,578
Nuclear Survivability	36,100	35,855	48,230	+12,130
Enhanced Surveillance	42,228	41,941	58,375	+16,147
Stockpile Responsiveness	0	0	34,000	+34,000
Total, Engineering	**132,482**	**131,582**	**211,367**	**+78,885**
Inertial Confinement Fusion Ignition and High Yield				
Ignition	77,932	77,403	22,434	-55,498
Support of Other Stockpile Programs	23,363	23,204	17,397	-5,966
Diagnostics, Cryogenics and Experimental Support	64,196	63,760	51,453	-12,743
Pulsed Power Inertial Confinement Fusion	5,616	5,578	8,310	+2,694
Joint Program in High Energy Density Laboratory Plasmas	9,492	9,428	0	-9,492
Facility Operations and Target Production	342,360	340,035	319,333	-23,027
Total, Inertial Confinement Fusion Ignition and High Yield	**522,959**	**519,408**	**418,927**	**-104,032**
Advanced Simulation and Computing				
Integrated Codes	145,830	144,840	146,645	+815
Physics and Engineering Models	65,196	64,753	63,565	-1,631
Verification and Validation	50,428	50,086	51,814	+1,386
Advanced Technology Development and Mitigation	95,299	94,652	95,073	-226
Computational Systems and Software Environment	131,736	130,841	123,645	-8,091
Facility Operations and User Support	174,695	173,509	175,659	+964
Construction	0	0	47,000	+47,000
Total, Advanced Simulation and Computing	**663,184**	**658,680**	**703,401**	**+40,217**
Advanced Manufacturing Development				
Additive Manufacturing	12,000	11,919	17,447	+5,447
Component Manufacturing Development	46,583	46,267	48,477	+1,894
Process Technology Development	28,522	28,328	30,914	+2,392
Total, Advanced Manufacturing Development	**87,105**	**86,513**	**96,838**	**+9,733**
Total, RDT&E	**1,842,230**	**1,829,721**	**1,995,393**	**+153,163**

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
	(Dollars in Thousands)			
Infrastructure and Operations				
Operating				
Operations of Facilities	824,000	818,404	891,000	+67,000
Safety and Environmental Operations	110,000	109,253	115,000	+5,000
Maintenance and Repair of Facilities	324,000	321,800	365,000	+41,000
Recapitalization				
Infrastructure and Safety	430,509	427,585	431,631	+1,122
Capability Based Investments	112,639	111,874	109,057	-3,582
Bannister Federal Complex Disposition	200,000	198,642	0	-200,000
Subtotal, Recapitalization	**743,148**	**738,101**	**540,688**	**-202,460**
Total, Operating	**2,001,148**	**1,987,558**	**1,911,688**	**-89,460**
Construction	807,215	801,732	1,091,048	+283,833
Total, Infrastructure and Operations	**2,808,363**	**2,789,290**	**3,002,736**	**+194,373**
Secure Transportation Asset				
Operations and Equipment	151,771	150,741	176,617	+24,846
Program Direction - Albuquerque	97,118	96,458	102,022	+4,904
Total, Secure Transportation Asset	**248,889**	**247,199**	**278,639**	**+29,750**
Defense Nuclear Security				
Operations and Maintenance				
Protective Forces	393,764	391,090	376,279	-17,485
Physical Security Systems	98,540	97,871	105,193	+6,653
Information Security	32,766	32,543	43,011	+10,245
Personnel Security	33,516	33,288	40,376	+6,860
Materials Control and Accountability	26,965	26,782	31,125	+4,160
Security Program Operations and Planning	84,449	83,876	94,654	+10,205
Total, Operations and Maintenance	**670,000**	**665,450**	**690,638**	**+20,638**
Construction	15,500	15,395	0	-15,500
Total, Defense Nuclear Security	**685,500**	**680,845**	**690,638**	**+5,138**
Information Technology and Cybersecurity	**176,592**	**175,393**	**221,175**	**+44,583**
Legacy Contractor Pensions	**248,492**	**246,804**	**162,292**	**-86,200**
Subtotal, Weapons Activities	**9,318,093**	**9,254,813**	**11,017,078**	**+1,698,985**
Rescission of Prior Year Balances	**-77,354**	**-13,138**	**0**	**+77,354**
Total, Weapons Activities	**9,240,739**	**9,241,675**	**11,017,078**	**+1,776,339**

Outyears for Weapons Activities
Funding

	(Dollars in Thousands)			
	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Directed Stockpile Work				
Life Extension Programs and Major Alterations				
B61 Life Extension Program	792,611	750,663	667,450	539,900
W76 Life Extension Program	0	0	0	0
W88 Alt 370 (W88 Alteration Program)	304,186	249,283	201,802	127,708
W80-4 Life Extension Program	713,551	770,485	804,008	803,268
IW1	112,011	363,260	393,701	488,300
IW2	0	0	0	56,900
Total, Life Extension Programs and Major Alterations	**1,922,359**	**2,133,691**	**2,066,961**	**2,016,076**
Stockpile Systems				
B61 Stockpile Systems	79,967	109,900	115,715	107,262
W76 Stockpile Systems	104,378	103,513	105,723	95,086
W78 Stockpile Systems	75,900	77,600	82,600	78,900
W80 Stockpile Systems	73,811	73,921	77,618	76,281
B83 Stockpile Systems	22,421	22,876	10,800	15,825
W87 Stockpile Systems	83,500	89,700	95,200	99,900
W88 Stockpile Systems	159,667	125,936	120,075	137,700
Total, Stockpile Systems	**599,644**	**603,446**	**607,731**	**610,954**
Weapons Dismantlement and Disposition	**56,000**	**56,000**	**56,000**	**56,000**
Stockpile Services				
Production Support	533,964	538,973	549,812	570,964
Research and Development Support	39,339	47,833	48,527	49,169
Research and Deveopment Certification and Safety	239,235	248,456	252,619	269,921
Managemement, Technology, and Production	305,000	304,000	319,500	321,168
Total, Stockpile Services	**1,117,538**	**1,139,262**	**1,170,458**	**1,211,222**
Strategic Materials				
Uranium Sustainment	94,146	96,753	98,793	100,824
Plutonium Sustainment	691,284	745,485	978,889	1,189,491
Tritium Sustainment	213,000	226,000	236,000	222,447
Lithium Sustainment	28,800	29,404	30,022	30,653
Domestic Uranium Enrichment	140,000	145,000	150,000	155,000
Strategic Materials Sustainment	235,108	237,147	240,427	245,740
Total, Strategic Materials	**1,402,338**	**1,479,789**	**1,734,131**	**1,944,155**
Total, Directed Stockpile Work	**5,097,879**	**5,412,188**	**5,635,281**	**5,838,407**

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
	(Dollars in Thousands)			
Research, Development, Test and Evaluation (RDT&E)				
Science				
Advanced Certification	57,710	62,658	64,068	66,062
Primary Assessment Technologies	95,169	125,661	128,951	127,409
Dynamic Materials Properties	136,000	159,767	162,914	134,428
Advanced Radiography	32,544	55,989	67,375	68,789
Secondary Assessment Technologies	77,553	82,104	83,952	85,841
Academic Alliances and Partnerships	53,364	55,052	55,993	56,726
Enhanced Capabilities for Subcritical Experiments	119,952	96,548	41,478	32,411
Total, Science	**572,292**	**637,779**	**604,731**	**571,666**
Engineering				
Enhanced Surety	46,500	49,626	51,710	56,785
Weapon Systems Engineering Assessment Technology	35,945	36,735	37,485	38,252
Nuclear Survivability	48,932	51,000	53,000	55,000
Enhanced Surveillance	60,279	62,260	63,546	64,860
Stockpile Responsiveness	34,830	36,327	40,143	40,814
Total, Engineering	**226,486**	**235,948**	**245,884**	**255,711**
Inertial Confinement Fusion Ignition and High Yield				
Ignition	29,942	36,578	37,386	38,213
Support of Other Stockpile Programs	17,397	16,759	17,130	17,508
Diagnostics, Cryogenics and Experimental Support	47,128	62,859	64,248	65,668
Pulsed Power Inertial Confinement Fusion	9,476	8,748	8,942	9,139
Joint Program in High Energy Density Laboratory Plasmas	10,000	0	0	0
Facility Operations and Target Production	314,084	312,542	319,449	326,509
Total, Inertial Confinement Fusion Ignition and High Yield	**428,027**	**437,486**	**447,155**	**457,037**
Advanced Simulation and Computing				
Advanced Simulation and Computing	649,258	676,000	786,747	782,272
Construction	68,591	27,000	13,000	0
Total, Advanced Simulation and Computing	**717,849**	**703,000**	**799,747**	**782,272**
Advanced Manufacturing Development				
Additive Manufacturing	18,500	19,761	19,761	20,205
Component Manufacturing Development	58,410	68,566	70,006	71,476
Process Technology Development	28,198	29,244	29,835	31,528
Total, Advanced Manufacturing Development	**105,108**	**117,571**	**119,602**	**123,209**
Total, RDT&E	**2,049,762**	**2,131,784**	**2,217,119**	**2,189,895**

	(Dollars in Thousands)			
	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Infrastructure and Operations				
Operating				
Operations of Facilities	925,000	945,000	971,000	986,000
Safety and Environmental Operations	119,000	120,000	122,000	122,000
Maintenance and Repair of Facilities	390,000	407,000	419,000	432,000
Recapitalization				
Infrastructure and Safety	474,642	477,245	504,926	508,160
Capability Based Investments	121,341	123,679	126,066	128,504
Subtotal, Recapitalization	**595,983**	**600,924**	**630,992**	**636,664**
Total, Operating	**2,029,983**	**2,072,924**	**2,142,992**	**2,176,664**
Construction	1,203,600	1,270,106	1,214,600	1,264,000
Total, Infrastructure and Operations	**3,233,583**	**3,343,030**	**3,357,592**	**3,440,664**
Secure Transportation Asset (STA)				
Operations and Equipment	226,882	215,801	220,089	224,860
Program Direction - Albuquerque	112,804	116,632	119,860	122,782
Total, Secure Transportation Asset	**339,686**	**332,433**	**339,949**	**347,642**
Defense Nuclear Security				
Operations and Maintenance	692,325	708,863	724,722	736,863
Construction	104,530	64,224	49,200	48,206
Total, Defense Nuclear Security	**796,855**	**773,087**	**773,922**	**785,069**
Information Technology and Cybersecurity	**291,311**	**281,223**	**291,223**	**291,671**
Legacy Contractor Pensions	**72,808**	**63,750**	**59,500**	**55,250**
Subtotal, Weapons Activities	**11,881,884**	**12,337,495**	**12,674,586**	**12,948,598**
Rescission of Prior Year Balances	**0**	**0**	**0**	**0**
Total, Weapons Activities	**11,881,884**	**12,337,495**	**12,674,586**	**12,948,598**

Research and Development

The Office of Management and Budget (OMB) Circular No. A-11, "Preparation, Submission, and Execution of the Budget," requires the reporting of research and development (R&D) data. Consistent with this requirement, R&D activities funded by NNSA Weapons Activities programs are displayed below.

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Research and Development (R&D)				
Basic	0	0	0	0
Applied	4,460,000	4,460,000	4,398,000	-62,000
Development	105,000	105,000	87,000	-18,000
Subtotal, R&D	**4,565,000**	**4,565,000**	**4,485,000**	**-80,000**
Equipment	123,000	123,000	134,000	+11,000
Construction	12,000	12,000	127,000	+115,000
Total, R&D	**4,700,000**	**4,700,000**	**4,746,000**	**+46,000**

Directed Stockpile Work (DSW)

Overview

The Directed Stockpile Work (DSW) program encompasses five major subprograms that sustain the nation's nuclear weapons stockpile. The subprograms are: (1) Life Extension Programs (LEPs) which extend the lifetime of the nation's nuclear stockpile while addressing defects, improving safety features, and enhancing security, and Major Alterations (Alts), which address aging or obsolete components to ensure continued service life; (2) Stockpile Systems, which directly executes sustainment activities for all enduring weapons systems in the stockpile (B61, W76, W78, W80, B83, W87, and W88); (3) Weapons Dismantlement and Disposition (WDD), which dismantles retired weapons and dispositions retired components from the stockpile; (4) Stockpile Services, which provides the foundation, skills, and capabilities for the research, development, production, and maintenance activities within the NNSA nuclear security enterprise to meet national requirements; and (5) Strategic Materials, which ensures sustainment of nuclear material processing capabilities and funds the stabilization, consolidation, disposition, tracking, and accounting of nuclear materials. DSW contributes to meeting the enhancement of nuclear security through defense, nonproliferation, and environmental efforts by sustaining the safety, security, and effectiveness of the Nation's nuclear deterrent without nuclear testing as described in the National Nuclear Security Administration (NNSA) Stockpile Stewardship and Management Plan (SSMP).

DSW executes the program to keep the stockpile safe, secure, and reliable. DSW: (1) provides unique skills, equipment, testers, and logistics to enable nuclear weapons operations; (2) extends the life of existing weapons systems through authorized modifications and alterations to address technical issues and to enhance their safety, security, and effectiveness; (3) modernizes, produces and replaces limited life components (LLCs); (4) conducts other scheduled weapons maintenance; (5) conducts surveillance and evaluations to assess weapons reliability as well as detect and anticipate potential weapons issues; (6) quantifies margins of uncertainty in order to assess and certify the nuclear stockpile; (7) develops technology for enhanced safety, security, and effectiveness for insertion during weapon modifications/alterations; (8) provides dismantlement and disposition of weapons and components for weapons retired from the stockpile, thereby supporting nonproliferation and international goals; (9) compiles and analyzes information during the Annual Assessment process to identify and address issues; (10) develops new technologies, conducts systems engineering, matures appropriate replacements for sunset technologies, and enhances system capabilities for multi-system applications including neutron generators (NGs), gas transfer systems (GTSs), power sources, explosives, detonators, initiation systems, surety systems, and Arming, Fuzing & Firing (AF&F) systems, to reduce lifecycle costs and address near-term and long-term stockpile needs; (11) enhances NNSA transportation safety and security by implementing new weapon shipping configurations; (12) sustains the nuclear materials production, handling, and storage capabilities to meet long-term national requirements; (13) produces tritium necessary to maintain the inventory and meet national security requirements; (14) ensures development of a reliable and economic supply of enriched uranium; and (15) mitigates the risk of adversarial subversion of the stockpile susceptible to foreign capability by providing Nuclear Enterprise Assurance (NEA) and hedging against technological risks.

The DSW Budget Request for FY 2019 is $4,666,205. This represents a 41% or a $1,358,178 increase above the FY 2017 Enacted Appropriation. Within DSW, the budget request for LEPs increases by $579,647 primarily due to planned ramp-up of production activities for the B61-12 LEP and the W80-4 LEP. The request for Stockpile Systems increases by $175,806 due to the: (1) B61-12 coming into the stockpile and having associated stockpile systems funding needs, (2) B61 and W80 beginning Integrated Surety Architecture (ISA) development, (3) B61-11 neutron generator now in full production, (4) W76 completing its production run and associated sustainment costs now fully in the stockpile systems funding line, (5) W76 and W78 undergoing joint test assembly (JTA) upgrades, (6) W80 Alt 369 moving from development to production, (7) W87 Alt 360 now in full production, (8) W88 neutron generator, gas transfer system, and Alt 940 in full production, (9) W88 container upgrades, (10) surveillance and assessment increases to ensure adequate understanding of the health of the stockpile. The WDD program, per the FY 2017 and FY 2018 NDAA, is capped at $56,000 for FY 2019. The request for Stockpile Services represents a $178,190 increase mainly due to ramped up Production Support activities for continued growth of base capabilities required for increased LEP workload, Research Development Certification and Safety capability enhancements for weapons and LEPs, and Management, Technology, and Production activities supporting multi-weapon and LEP activities. Strategic Materials increased by $424,535 for tritium-producing burnable absorber rod (TPBAR) fabrication, staffing, and operational costs at the Tritium Extraction Facility (TEF), ramp up of pit production to meet requirements, initiation of the uranium down blending campaign, initiation of efforts to reestablish or optimize supply chains for strategic materials, and the establishment of a Lithium Sustainment funding line consolidating lithium related work transferred from other DSW programs.

Highlights of the FY 2019 Budget Request
Life Extension Programs and Major Alterations

- Complete Phase 6.4 for B61-12 LEP and receive Phase 6.5 authorization by 4th Quarter FY 2019.
- Complete Phase 6.4 for W88 Alterations program and receive Phase 6.5 authorization by September FY 2019.
- Complete the last W76-1 LEP production deliverables in agreement with the Department of the Navy.
- Execute Phase 6.2A and entry into Phase 6.3 activities for the W80-4 LEP in support of the Air Force Long Range Stand-Off (LRSO) program.
- Re-start the Interoperable Warhead 1 (IW1) Phase 6.2 activities in FY 2019.

Stockpile Systems

- Complete development, qualification, production and delivery of all scheduled LLCs for the B61, W76, W78, W80, B83, W87, and W88. LLCs include GTSs, NGs, and alteration kits delivered to sustain the nuclear weapons stockpile.
- Conduct surveillance programs for all weapon systems using data collection from flight tests, laboratory tests, and component evaluations to assess stockpile reliability, performance and safety.
- Conduct Annual Assessment activities for all weapon systems including the in-depth testing and analysis of systems, subsystems, and components.
- Continue to analyze, evaluate, and close high priority Significant Finding Investigations (SFIs) in accordance with the currently approved baseline closure plans.
- Complete qualification activities, achieve FPU, and continue production activities for the new electronic neutron generator (ELNG) for the B61-11 program.
- Complete qualification activities, achieve FPU, and continue production for Alt 360 on the W87 program.
- Complete Baseline Design Review and start Final Design Review for JTA6R for the W78 program.
- Begin full-scale development for the W76 Joint Test Assembly (JTA) 3 (JTA1 refresh).
- Continue development and qualification activities toward implementing W88 surety improvements for the Alt 370 December 2019 FPU through the ISA initiative.

Weapons Dismantlement and Disposition

- Continue weapon dismantlements to ensure material and component requirements are met.
- Continue CSA dismantlements while providing feedstock to internal and external customers.
- Continue legacy component disposition activities.

Stockpile Services (provides the foundation, skills, and capabilities for the research, development, production, and maintenance within the NNSA nuclear security enterprise to meet national requirements)

- For Production Support, the budget represents workforce growth, and increased equipment management to support an increasing LEP workload. In FY 2019, Production support will start funding two long-term initiatives including Electronic Work Instructions, and NEA investments.
- Research Development and Support increases provides additional investments in weapon data archiving activities, initial investment to implement nuclear enterprise assurance and supply chain risk management for R&D activities, continues support for the Joint Integrated Lifecycle Surety (JILS) tool to evaluate potential surety improvements and provides scientific and technical support to the production plants to help achieve weapon production directives.
- Research Development Certification and Safety maintains and modernizes the base capability to execute hydrodynamic and subcritical experiments that are needed by the existing stockpile, LEPs and other future stockpile systems, and science to assure the safety, effectiveness and responsiveness of the US nuclear deterrent and increases investments in technology maturation for future systems and new alternatives for technology demonstrations/experiments. Management, Technology and Production (MTP) increases Weapon Response staffing and nuclear safety studies to support uninterrupted manufacturing operations, aka "any weapon, any day"; supports increased surety studies; develops surveillance testers for weapons including stronglinks, environmental conditions, and centrifuges; and provides Logistics, Accountability, Planning and Scheduling (LAPS) software suite to support increasing LEP workload and intra-site logistical support. In FY 2019, MTP will start funding a new Models-Based Environment initiative.

- Production Support
  - Provide the manufacturing capabilities (e.g., engineering, manufacturing, quality assurance) and capacity for LEP production, enduring stockpile weapon assembly, weapon disassembly, weapon safety and surveillance testing, and reliability testing as required to meet directive schedules and meet DOD delivery schedules. Demands on Production Support continue to increase as the enterprise ramps up to meet LEP production schedules. Production Support's FY 2019 request represents an increase to ensure manufacturing capabilities and capacity are aligned to support the additional LEP scope for FY 2019.
  - Support manufacturing investments for detonator and detonator cable assemblies (DCA) production, and Neutron Generator Enterprise. Detonator production is expanding to encompass eight product lines and the neutron generator line is maintaining five product lines, using new equipment to enable higher yield rates, increased maintenance/calibration services, and improving shop floor efficiency.
  - Expand engineering and quality assurance processes at for B61-12 LEP non-nuclear component production. NEA investments will focus on supply chain management of out-sourced components used in weapon assemblies.
  - Continue the Manufacturing Modernization Project (MMP) to support digital product production and acceptance, specifically completing the upgrade for the detonator manufacturing line completing in FY 2021.
  - Continue NEA processes at all production sites and refine procedures to maximize effectiveness.
  - Develop Electronic Work Instruction processes and procedures for the visual factory shop floor, migrating from a paper-based product lifecycle management system to electronic media to document and collect "day zero" weapon assembly informatics.
- Research and Development Support
  - Continue archiving weapons data to preserve information from the nuclear testing era and to make this data available to researchers at the national laboratories.
  - Continue supporting legacy testing heritage commitments at Nevada.
  - Utilize and maintain the JILS tool to evaluate potential surety improvements to the NNSA nuclear security enterprise.
  - Provide scientific and technical support to the production plants to help achieve weapon production directives.
  - Execute nuclear enterprise assurance and supply chain risk management for research and development activities.
- Research and Development Certification and Safety
  - Continue to provide the capabilities and capacity necessary to sustain DSW activities.
  - Continuing maintaining and modernizing the base capability to execute hydrodynamic and subcritical experiments that are needed by the existing stockpile, LEPs and other future stockpile systems, and science to assure the safety, effectiveness and responsiveness of the US nuclear deterrent.
  - Complete the Annual Assessment Process for the stockpile, deliver the Laboratory Director Letters to the President, support the Independent Nuclear Weapons Assessment program, and support development of the Weapons Reliability Report (WRR) to DOD.
  - Continue development of multi-system engineering analysis models and configuration management of baseline models used in assessment activities.
  - Develop multiple-system technologies and conduct exploratory studies to address current and emerging stockpile issues, as well as develop replacement LLCs due to sunset technologies.
  - Execute the Joint Technology Demonstrator (JTD) project, a US-UK strategic collaboration to explore technology applications in a systems-context, reduce risks for future insertion, enhance workforce design and production skills, and identify process improvements for the NNSA nuclear security enterprise.
  - NNSA/US Air Force partnership to conduct multiple technology maturation risk reduction flight tests under the JTD program.
  - Explore alternative technology maturation demonstrators for future systems.
- Management, Technology, and Production
  - Continue stockpile sustainment activities providing products, components, and/or services for multi-weapon surveillance, weapons reliability reporting to DOD, weapon logistics and accountability, special materials (including depleted uranium processing), and stockpile planning.
  - Support development of multi-system surveillance testers (stronglink, environmental testing equipment and centrifuges) required to support LEP testing requirements.
  - Support additional multi-system weapon response and external production resources to conduct nuclear safety studies to ensure un-interrupted nuclear explosive operations at production plants.

- Increase in Use Control studies and equipment procurements to align with nuclear weapon FPUs and enduring stockpile refresh opportunities.
- Continue the multi-year effort to upgrade and integrate the weapons LAPS system used throughout the enterprise. Specifically, Phase 3, starting in FY 2019, will focus on replacing, consolidating and enhancing the logistics and accountability functionality.
- Continue efforts to re-establish special nuclear material manufacturing capability and capacity at Y-12.
- Continue upgrading flight testing support and related equipment at Tonopah Test Range.
- Invest in Models-Based Environment to allow NNSA to seamlessly exchange classified 3-dimensional product definition via common CADD architecture from weapon component sourcing to quality inspection.

Strategic Materials

- Uranium Sustainment
  - Phase out mission dependency on Building 9212 by supporting the transition of enriched uranium capabilities into existing and new-build facilities.
  - Develop plans and execute actions to implement the Building 9212 Exit Strategy.
  - Continue Area 5 de-inventory efforts to reduce safety and security risks; achieve and maintain target working inventory levels, and optimize the material composition of the uranium inventory.
  - Develop, sustain, and increase the reliability of uranium scientific and manufacturing capabilities to reduce mission risks.
  - Extend the operational lifetime of existing enriched uranium facilities.
- Plutonium Sustainment
  - Fabricate five development (DEV) W87-like pits.
  - Continue investments to replace equipment for pit production that is at end-of-life, install equipment to meet production capacity requirements and support certification activities to reduce mission risk.
  - Fund other project costs associated with pre-conceptual design efforts supporting the selection of a single preferred alternative for plutonium pit production beyond 30 war reserve pits per year.
- Tritium Sustainment
  - Commence irradiation TPBARs in the Watts Bar Unit 1 (WBN1).
  - Continue preparing Watts Bar Unit 2 (WBN2) to commence tritium production in November 2020.
  - Submit a License Amendment Request (LAR) to the Nuclear Regulatory Commission (NRC) to provide improved operating margins and reactor fuel efficiency for the Watts Bar units.
  - Conduct two extraction at the TEF, beginning the ramp-up to full operations mode.
- Lithium Sustainment
  - Produce and maintain the lithium material supply to meet Defense Programs (DP) mission and other customer deliverables, including the execution of the Material Conversion Equipment Restart project and maintenance of a configuration controlled lithium supply and demand model.
  - Continue to pursue options to reestablish conversion and purification capabilities.
  - Maintain and recapitalize program equipment to support the Lithium Bridging Strategy (LBS) and reduce risk of single-point failures.
  - Mature and deploy lithium technology alternatives to improve processing efficiencies in support of the LBS and a new Lithium Production Capability (LPC) design.
- Domestic Uranium Enrichment (DUE)
  - Preserve and advance uranium enrichment expertise and technology to meet current and future U.S. Government needs.
  - Continue the acquisition process towards Approval of Alternative Selection and Cost Range (Critical Decision (CD)-1) for a domestic uranium enrichment capability.
  - Support and manage down-blending of Highly Enriched Uranium (HEU) from the uranium inventory.
- Strategic Materials Sustainment
  - Sustain effective and efficient processes for recycling and recovery of plutonium, enriched uranium, tritium, and other materials from fabrication, assembly, and dismantlement operations. Invest in capabilities to establish a high purity depleted uranium (HPDU) supply chain that will support sustained procurements of HPDU feedstock to meet the mission requirements.
  - Sustain and improve Storage Program processes to meet the process supply chain and mission requirements.

- Meet the directive schedule for tritium reservoir refills.
- Continue de-inventory of Chemistry and Metallurgy Research (CMR) and improve PF-4 vault facilities efficiency through inventory work off and optimization of footprint to support the transition to plutonium production and improve Material at Risk (MAR) posture.
- Increase effectiveness and efficiency of MRR processes through deployment of comprehensive recapitalization strategies.
- Continue increase in purified metal production and the processing and disposition of legacy materials toward the goal to phase out mission dependency on Building 9212.
- Leverage opportunity to improve HEU feedstock quality through effective and efficient exercise of capabilities preceding and during transition to new and enduring facilities.
- Provide for receipt, storage, inventory, and management of pits HEU, and other weapon nuclear and non-nuclear materials.
- Improve effectiveness and efficiency of Storage capabilities through the use of recapitalization strategies that utilize a comprehensive assessment of storage system and feedstock health.
- Completion of the disassembly and treatment of the Sandia Sodium Bonded Spent Fuel at the Idaho National Laboratory (INL).
- Modernize the Nuclear Materials Management and Safeguard System (NMMSS) to support changes in NNSA IT infrastructure.
- Continue the recovery of Pu-244 through the implementation of the MK-18a Program.

Major Outyear Priorities and Assumptions
Outyear funding levels for DSW total $21,983,755 for FY 2020 through FY 2023. DSW priorities include the following:
Life Extension Programs and Major Alterations

- Execute the B61-12 LEP, W88 alteration program, and W80-4 LEP scheduled deliverable.
- Closeout the W76-1 LEP and all associated production.
- Maintain existing B61 military capability with integration of a USAF Tail Kit.
- Restart IW1 6.2 work in FY 2019 and complete 6.2A by the end of FY 2022.
- Begin IW2 start up activities in FY 2023 if it remains aligned with the Department of Defense (DOD) current nuclear modernization plans.

Stockpile Systems

- Execute production and delivery of all scheduled LLCs for the active stockpile. LLCs include GTSs, NGs, and alteration kits to maintain the nuclear weapons stockpile.
- Execute surveillance programs for all weapon systems using data collection from flight tests, laboratory tests, and component evaluations to assess stockpile reliability without nuclear testing.
- Execute all Annual Assessment Reports and Laboratory Director Letters to the President.
- Continue implementation to the surety configurations for the W88 Stockpile System.
- Continue full-scale development of JTA6R for the W78 Stockpile System to include support for final design, production engineering and first production unit and fielding of JTA6R.
- Continue production and fielding of the W88 ALT 940 surety solution, Neutron Generator and H1514 shipping containers.
- Continue full scale development of the W76 JTA1 refresh.
- Inclusion of appropriate activities of the B61-12 into Stockpile Systems.

Weapons Dismantlement and Disposition

- NNSA's WDD program, per the FY 2017 and FY 2018 NDAA, is capped at $56M throughout the FYNSP. NNSA will execute a dismantlement program consistent with this cap putting priority on the needs of the LEPs, stockpile, and naval reactor material commitments.

Stockpile Services

- Design, manufacture, and produce the 3-way test valve as a mark-quality component that is an essentially utilized during GTS stockpile-surveillance testing as specified by each system's program control document (PCD) and the integrated weapon evaluation team (IWET) schedule requirements.

- LAPS will be completed and go-live by Q4 FY 2018. This software will modernize the supply chain management software.
- The Manufacturing modernization project (MMP) will be completed and go-live by Q4 FY 2021. This software will automate collection of digital data for product acceptance for the balance of PF-4. Note MMP on pits will be complete in FY 2018.
- WRR issued to DOD in September each Fiscal Year.
- The policy, technology, and threat environments in which the nuclear deterrent must operate will continue to evolve and to drive changes in the stockpile in response.
- Continue development of multi-system technologies and conduct exploratory studies to address current and emerging stockpile issues, vulnerabilities, and capability shortfalls.
- Execute the Joint Technology Demonstrator (JTD) project, a U.S.-UK strategic collaboration to explore technology applications in a systems-context, reduce risks for future insertion, enhance workforce design and production skills, and identify process improvements.
- Continue the development and demonstration of technologies that enable modular, adaptable, affordable, and survivable system architectures able to respond quickly to changing policy, technology, and threat environments.
- Continue the development of low-cost, high operational tempo demonstrators that will demonstrate technologies in a system context in relevant environments.
- Continue annually assessing the safety, security, and effectiveness of the enduring stockpile and report weapon status to the President.
- Support and maintain the base capabilities to execute hydrodynamic and subcritical experiments.
- Address and resolve SFIs and emerging stockpile issues.
- Support dual validation teams and assessments that support the Annual Assessment process.
- Accelerate investments in archiving of historical nuclear weapon data.
- Maintain and upgrade computation/simulation systems and licenses and develop R&D staff with technical skills and knowledge required to be proficient at core testing and experimentation.
- Provide program management support to enable the initiating, planning, execution, monitoring and controlling, and closing of R&D program activities.
- Provide resources that enable on-site support of JTD activities.
- Continue development and support of the Joint Integrated Lifecycle Surety (JILS) database.
- Manage the implementation of Nuclear Enterprise Assurance for R&D activities.
- Foster communication and integration between design agencies (DAs) and production agencies (PAs).
- Continue support for the infrastructure that is needed for the execution of R&D activities.

Strategic Materials

- Uranium Sustainment – Continue to reduce technology risks and transition risks as key Building 9212 capabilities are relocated to existing facilities and to the Uranium Process Facility.
- Uranium Sustainment – Continue inventory management through Area 5 Deinventory and additional stockpile optimization measures.
- Plutonium Sustainment – Continue to invest in personnel and equipment to meet Nuclear Weapons Council pit production requirements.
- Plutonium Sustainment – Continue to fund other project costs associated with pre-conceptual design of the selected alternative for pit production beyond 30 war reserve pits per year.
- Tritium Sustainment – Continue to provide an assured supply of tritium to meet national defense needs and increase production capacity necessary to meet national security requirements.
- DUE – Continue progress towards re-establishment of a domestic uranium enrichment capability under DOE O413.3B, manage down-blending of HEU material to support the tritium production mission.
- Lithium Sustainment – Continue to maintain an adequate lithium supply for Defense Program needs and recapitalize or restart process equipment to bridge the current lithium manufacturing capability until the new Lithium Production Capability achieves beneficial occupancy.
- Strategic Materials Sustainment – Re-establish the high purity depleted uranium (DU) feedstock capability to enable enduring procurements in support DSW. Support MAR reduction, de-inventory, and material processing efforts at Y-12 and LANL designed to provide smooth transition into new and enduring facility operations. In addition, continues to

recycle and recover material for limited life component requirements and complete recapitalization work designed to effectively and efficiently sustain capabilities at the SRS. Continue to develop and implement comprehensive storage health assessment to better identify and mitigate operational risk at the sites, including optimizing existing footprints and improve overall supply chain flow.

FY 2017 Accomplishments

Life Extension Programs and Major Alterations

- The B61-12 LEP completed first three system qualification flight tests, in addition to the three development flight tests completed in 2015, with the USAF at Tonopah Test Range.
- The B61-12 LEP conducted over 10 system ground qualification tests, including two hydrodynamic physics tests to verify functional performance in both normal and abnormal environments.
- The B61-12 LEP continued aircraft compatibility testing including the first set of compatibility tests with the B-2A.
- The B61-12 LEP continued fabrication of pre-production (Process Prove-In (PPI) and Qualification Evaluation (QE)) functional hardware to validate and qualify production processes.
- The B61-12 LEP completed over 41 Final Design Review for major components to support FY 2018 System Final Design Review.
- The W76-1 LEP continued to be ahead of cumulative production and deliveries to the Navy within allocated budgets.
- The W88 Alt 370 Program continued fabrication of Pre-production PPI and QE functional hardware at component, sub-assembly, and AF&F level for final qualification and validation.
- The W88 Alt 370 Program received authorization to proceed entry into Phase 6.4.
- The W88 Alt 370 Program successfully completed the Follow-on Commander Evaluation Test (FCET) -53 final development flight test.
- The W88 Alt 370 Program updated the cost estimate for the program by publishing the Baseline Cost Report.
- The W80-4 LEP successfully completed an Internal Requirements Gate Review.
- The W80-4 LEP released the first revisions of the overarching Program Plan, Phase 6.2/6.2A Plan, Risk management, Requirements, Configuration Item Master List, Weapons Design and Cost Report (WDCR) Requirements, System Engineering Management Plan, Government WBS, Major Impact Report and Volumes 0-2 of the Program Controls Plans. Additionally, updated versions were released for Integrated Phase Gates and Program Protection Plans. First drafts of the Configuration Management, Program Control Plan Volumes 3-4 are in the process of completion.
- The W80-4 LEP completed all Feasibility Study and Option Down-Select activities and obtained Phase 6.2A, Cost Study, authorization on Sept 28, 2017.

Stockpile Systems

- Delivered all scheduled LLCs for the B61, W76, W78, W80, B83, W87, and W88.
- Conducted surveillance activities for all weapon systems using data collection from flight tests, laboratory tests, and component evaluations to assess stockpile reliability without nuclear testing which culminated in completion of all Annual Assessment Reports and generation of Laboratory Director Letters to the President.
- Completed the FPU of new B61 Joint Test Assembly (JTA) configurations via successful conduct of the JTA Modernization project.
- Conducted successful Cable Pull Down test of B61-11.
- Continued planning and early development for the W76 JTA 3 (JTA1 refresh)
- Completed renewal of the W76 10-Year Nuclear Explosive Safety Study (NESS) for assembly and disassembly to allow continuation of nuclear explosive operation.
- Successful startup of one W78 Repair to support out year repairs.
- Completed W80-1 Alt 369 FPU.
- Completed B83 component testing and final report for Cycle 113 Canned Subassembly (CSA) and completed nondestructive evaluation (NDE) and Disassembly & Inspection (D&I) for Cycle 114 CSA.
- Completed Customer Requirements Review and Preliminary Design Review for JTA6R development and started the Telemetry Preliminary Design Review on the W78 program.
- Met DOD requirements for W87 Small Ferroelectric Neutron Generator retrofits.
- Successful MC-level Final Design Review for the W87 Alt 360.

- Initiated W87 Joint Environmental Test Unit (JETU) Product Realization Team (PRT) to support Ground Based Strategic Deterrent (GBSD) and performed W87 Repairs retrofits.
- Continued development of W88 Alt 940 ISA transportation surety solution.
- Continued development for next W88 NG/GTS LLC cycle.

Weapons Dismantlement and Disposition
- Completed 100% of the planned weapon dismantlements and completed 105% of the planned CSA dismantlements.
- Reduced legacy part inventories throughout the enterprise in accordance with site-specific disposition plans.
- Exceeded Component Disposition Goals for FY 2017.
- W80 Legacy operations were authorized and the program exceeded the requirement.
- All W84 Disassembly and Inspection (D&I) deliverables for FY 2017 were accomplished and several parts shipped to safety testing location.
- The W76 and W84 programs recovered from multiple technical issues, including facility safety related down time, rain event related down time, and several unit specific technical issues including an Anomalous Unit recovery on each program.

Stockpile Services
Production Support
- Continued improving detonator and DCA manufacturing and inspection processes to improve yield to 82% at LANL in FY 2017 (improving from 44% in FY 2016).
- Continued execution of the Manufacturing Modernization Project (MMP), a multi-year project to transition to digital product acceptance.
- Conducted required maintenance and calibration actions on process equipment to ensure required availability to meet production deliverables. Specifically, executed emergent repairs to a 60-year old hydraulic isostatic press, ensuring that this sole-source of material processing capability continued supporting stockpile systems and Life Extension Program deliverables.
- Completed the first restart of equipment supporting the Lithium Bridging Strategy ahead of schedule.
- Continued efforts to remove single points of failure throughout production operations. For example, deployed a 2 Million Electron Volt X-ray machine supporting quality assurance inspections, which removed a single point of failure and improved equipment reliability.
- Initiated an Environmental Room Controls Upgrade Project that will play a crucial role in extending the life of the Assembly and Disassembly operations area.
- Completed 100% of required NG builds and executed 100% of required NG shipments and met W80 NG First Shipped Unit in December 2016.
- Completed tooling design for all loading and unloading of AWG-711 containers supporting the partnership with the United Kingdom's Atomic Weapons Establishment.
- Completed facility modifications and implemented disposal of unloaded tritium reservoirs directly from the unloading process, a critical step to concluding operations in the 238-H Reclamation Facility.
- Completed conceptual designs and planning estimates for three upgrade projects (unloading lasers, function test data acquisition system, and digital radiography in glovebox) critical to sustaining the LLC Production and GTS Surveillance.
- Reduced product acceptance time by 60% to 1.5 days for the ASIC (Sentinel) products by certifying more inspectors and deploying the "bar-coded processing" Electronic Production Control System.
- Implemented the Common Tester Architecture allowing for "plug and play" testers on the shop floor.
- Completed approximately 50,000 analytical tests for production quality assurance and reduced average backlog of work orders from 737 days to 174 days.

Research and Development Support
- Archived past weapons data and converted sunset technology files to modern data storage/security systems.
- Continued to develop indexing and search tools to make legacy weapons accessible by the cleared stockpile stewardship community.

Research and Development Certification and Safety

- Developed a more accurate method to ensure nuclear explosives are initiated uniformly.
- Performed analyses in conjunction with the DOD to support key surety decisions for both NNSA and the DOD, and added new capabilities to accommodate cyber and insider threats.
- Successfully fired 21 hydrodynamic integral weapon tests including a qualification experiment at the Dual-Axis Radiographic Hydrodynamic Test Facility (DARHT) supporting the W88 legacy and W88 Alteration Program.
- Completed the Annual Assessment Process and scheduled Independent Nuclear Weapon Assessment Process (INWAP) activities.
- Upgraded the U1a Complex facility hazard categorization from a Category 3 to Category 2 in support of planned subcritical experiments.
- Provided direct support to Stockpile Systems for flight tests and development for new high explosives (HE) for flight test diagnostics and qualification activities.
- Completed planning phase of the Joint Technology Demonstrator (JTD) and transitioned the project into the execution phase consisting of reference system design validation and ground testing.
- Transitioned matured ISA capability to stockpile systems for further development and integration activities.
- Executed the W88 Alt 940 ISA selection review and issued decision memorandum.
- Transitioned technology maturation of the ISA multi-application transportation attachment device (MTAD) for all air-delivered weapons to Component Manufacturing Development for further development. Demonstrated electrical functionality of a modular weapons controller technology that will enable agility and adaptability for the stockpile.
- Progressed the development of new initiation systems and materials to enhance the safety of the detonation train.
- Completed aero-ballistic modeling and assessment and implemented architectural design changes based on results for the JTD Workstream 2 design.
- Completed design baselines and System Technical Reviews to validate Work Stream 1 (WS1) reference design meets customer requirements.

Management, Technology, and Production

- Delivered Weapons Reliability Reports (WRRs) to DOD. Established agreement with STRATCOM to publish WRR once per year for necessary targeting update.
- Completed significant progress towards re-establishing depleted uranium machining capabilities. Specifically, restarted the argon pre-heat furnaces and grit blaster, completed required training for the large casting furnaces, and ordered a Water Jet machine to ensure the capability and capacity to manufacture cases and CSAs for the LEPs and enduring stockpile is in place in time to meet deliverables.
- Successfully executed multiple depleted uranium rolling mill operations supporting DSW deliverables.
- Procured and began installation of a Scanning Electron Microscope to improve power supply surveillance throughput.
- Installed and certified a replacement centrifuge arm on the QU2777 centrifuge at the Weapons Evaluation Test Laboratory (WETL).
- Completed all FY 2017 Gas Transfer Function Test and Destructive Examinations and recovered FY 2016 deferrals.
- Completed the development and final report with respect to the "Falling Man Scenario," ensuring that all weapon programs and sites can consistently apply a uniform model to ensure safe nuclear explosive operations for all tooling and procedures.
- Completed all required FY 2016 shelf-life power supply surveillance following the Plutonium Facility (PF)-4 restart.
- Provided all required base spares including test equipment, handling gear, and Code Management System items to DOD.
- Completed all stronglink safety testing ahead of schedule at Weapons Evaluation Test Laboratory (WETL).
- Realized a 66% improvement in Engineering Authorization release efficiency (relative to the legacy system) with the newly released Product Realization Information Management Enterprise (PRIME) application. This release expedited throughput of product definition to the Production Agencies and was critical to support the modernization programs.

Strategic Materials

- Initiated planning and prioritization efforts to implement the Building 9212 Exit Strategy.
- Continued casting sustainment and machining sustainment investments to increase reliability of existing uranium capabilities.

- Achieved Area 5 De-inventory milestone to remove enriched uranium material and continued enabling efforts to establish and maintain target working inventory levels.
- Established CD-0, Approval of Mission Need, for a domestic uranium enrichment capability.
- Successfully produced two DEV W87-like pits.
- Completed Plutonium Pit Production Analysis of Alternatives (AoA).
- Completed irradiation of 704 TPBARs in Cycle 14 in the WBN1 reactor and commenced irradiation of 1104 TPBARs in Cycle 15.
- Completed the TVA executive review draft of the License Amendment Request for tritium production in TVA's WBN2 reactor.
- Conducted three back-to-back extractions of 300 TPBARs each at the TEF.
- Completed a formal AoA and downselected an alternative for the Lithium Production Capability (LPC) capital project.
- Lithium supply and demand model was updated and managed under formal configuration control.
- Accelerated the schedule to complete restart of lithium salvage operation efforts.
- Completed the recycle and recovery of tritium ahead of schedule in support of DSW requirements and improved operational interface managing tritium production by-products intrinsically valuable to our Nation.
- Increase production of purified enriched uranium metal to meet Defense Program requirements replenish purified metal working inventory, and provide a risk mitigation inventory.
- Reducing operational risk in the storage program through improving consumables inventory management (e.g., Rackable Can Storage Box (RCSB)), re-containerizing 120 carbon steel cans in support of a Defense Nuclear Facilities Safety Board commitment to remove all carbon steel cans from long-term storage in HEUMF, and continued improvements in non-enriched uranium storage areas.
- Accomplished work on risk reduction activities and vault material disposition, including reducing Material at Risk (MAR) on the PF-4 main floor by 68% since the beginning of FY 2016.
- Reduced legacy hazardous material inventory through the Confinement Vessel Disposition project, demonstrating sound integrated safety management and Conduct of Operations performance.
- Storage Program installed equipment to better evaluate container performance and support reduced risk in employee exposure and realized a reduction of operational risk through an accelerated effort to characterize legacy items.
- Demonstrated significant diagnostic capability sustainment/ improvement progress with the installation of the CoLOSSIS II equipment. CoLOSSIS II is a new high-resolution imaging system used to scan weapons components to identify any anomalies that require additional attention.
- Completed design and issued procurement for the on-site shipping cask needed in support of the MK-18a program.
- Completed the disassembly of ten Sodium Bonded Spent Fuel assemblies.

Directed Stockpile Work
Funding

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Directed Stockpile Work				
Life Extension Programs and Major Alterations				
B61 Life Extension Program	616,079	611,895	794,049	+177,970
W76 Life Extension Program	222,880	221,366	113,888	-108,992
W88 Alt 370 (W88 Alteration Program)	281,129	279,220	304,285	+23,156
W80-4 Life Extension Program	220,253	218,757	654,766	+434,513
IW1	0	0	53,000	+53,000
Total, Life Extension Programs and Major Alterations	**1,340,341**	**1,331,238**	**1,919,988**	**+579,647**
Stockpile Systems				
B61 Stockpile Systems	57,313	56,924	64,547	+7,234
W76 Stockpile Systems	38,604	38,342	94,300	+55,696
W78 Stockpile Systems	56,413	56,030	81,329	+24,916
W80 Stockpile Systems	64,631	64,192	80,204	+15,573
B83 Stockpile Systems	41,659	41,376	35,082	-6,577
W87 Stockpile Systems	81,982	81,425	83,107	+1,125
W88 Stockpile Systems	103,074	102,374	180,913	+77,839
Total, Stockpile Systems	**443,676**	**440,663**	**619,482**	**+175,806**
Weapons Dismantlement and Disposition	**56,000**	**55,620**	**56,000**	**0**
Stockpile Services				
Production Support	447,527	444,488	512,916	+65,389
Research and Development Support	34,187	33,955	38,129	+3,942
Research and Deveopment Certification and Safety	156,481	155,418	216,582	+60,101
Management, Technology, and Production	251,978	250,267	300,736	+48,758
Total, Stockpile Services	**890,173**	**884,128**	**1,068,363**	**+178,190**
Strategic Materials				
Uranium Sustainment	20,988	20,845	87,182	+66,194
Plutonium Sustainment	184,970	183,714	361,282	+176,312
Tritium Sustainment	109,787	109,041	205,275	+95,488
Lithium Sustainment	0	0	29,135	+29,135
Domestic Uranium Enrichment	50,000	49,660	100,704	+50,704
Strategic Materials Sustainment	212,092	210,652	218,794	+6,702
Total, Strategic Materials	**577,837**	**573,912**	**1,002,372**	**+424,535**
Total, Directed Stockpile Work	**3,308,027**	**3,285,561**	**4,666,205**	**+1,358,178**

Outyears for Directed Stockpile Work
Funding

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Directed Stockpile Work				
Life Extension Programs and Major Alterations				
B61 Life Extension Program	792,611	750,663	667,450	539,900
W76 Life Extension Program	0	0	0	0
W88 Alt 370 (W88 Alteration Program)	304,186	249,283	201,802	127,708
W80-4 Life Extension Program	713,551	770,485	804,008	803,268
IW-1	112,011	363,260	393,701	488,300
IW-2	0	0	0	56,900
Total, Life Extension Programs and Major Alterations	**1,922,359**	**2,133,691**	**2,066,961**	**2,016,076**
Stockpile Systems				
B61 Stockpile Systems	79,967	109,900	115,715	107,262
W76 Stockpile Systems	104,378	103,513	105,723	95,086
W78 Stockpile Systems	75,900	77,600	82,600	78,900
W80 Stockpile Systems	73,811	73,921	77,618	76,281
B83 Stockpile Systems	22,421	22,876	10,800	15,825
W87 Stockpile Systems	83,500	89,700	95,200	99,900
W88 Stockpile Systems	159,667	125,936	120,075	137,700
Total, Stockpile Systems	**599,644**	**603,446**	**607,731**	**610,954**
Weapons Dismantlement and Disposition	**56,000**	**56,000**	**56,000**	**56,000**
Stockpile Services				
Production Support	533,964	538,973	549,812	570,964
Research and Development Support	39,339	47,833	48,527	49,169
Research and Deveopment Certification and Safety	239,235	248,456	252,619	269,921
Management, Technology, and Production	305,000	304,000	319,500	321,168
Total, Stockpile Services	**1,117,538**	**1,139,262**	**1,170,458**	**1,211,222**
Strategic Materials				
Uranium Sustainment	94,146	96,753	98,793	100,824
Plutonium Sustainment	691,284	745,485	978,889	1,189,491
Tritium Sustainment	213,000	226,000	236,000	222,447
Lithium Sustainment	28,800	29,404	30,022	30,653
Domestic Uranium Enrichment	140,000	145,000	150,000	155,000
Strategic Materials Sustainment	235,108	237,147	240,427	245,740
Total, Strategic Materials	**1,402,338**	**1,479,789**	**1,734,131**	**1,944,155**
Total, Directed Stockpile Work	**5,097,879**	**5,412,188**	**5,635,281**	**5,838,407**

Directed Stockpile Work
Explanation of Major Changes
(Dollars in Thousands)

	FY 2019 Request vs FY 2017 Enacted
Directed Stockpile Work	
Life Extension Programs and Major Alteration: The increase to begin Phase 6.3 for the W80-4 LEP, transition of components from design to production scope for the B61-12 LEP, restart of the Feasibility Study and Design Options work on the IW1 program, offset by a decrease due to the ramp-down and completion of remaining W76 warhead refurbishments and associated deliveries to the Navy.	+579,647
Stockpile Systems: The request for Stockpile Systems increases by $175,806 due to the: (1) B61-12 coming into the stockpile and having associated stockpile systems funding needs, (2) B61 and W80 beginning Integrated Surety Architecture (ISA) development, (3) B61-11 neutron generator now in full production, (4) W76 completing its production run and associated sustainment costs now fully in the stockpile systems funding line, (5) W76 and W78 undergoing joint test assembly (JTA) upgrades, (6) W80 Alt 369 moving from development to production, (7) W87 Alt 360 now in full production, (8) W88 neutron generator, gas transfer system, and Alt 940 in full production, (9) W88 container upgrades, (10) surveillance and assessment increases to ensure adequate understanding of the health of the stockpile.	+175,806
Weapons Dismantlement and Disposition: NNSA's WDD program, per the FY 2017 and FY 2018 NDAA, is capped at $56,000. The funding represents dismantlement activities that support the stockpile/LEPs and Naval Reactors requirements.	0
Stockpile Services: The funding represents an increase to Production Support for continued growth of base capabilities, both workforce and equipment, required to support the increased LEP workload; to Research and Development Support for expanded investment in weapon data archiving activities, including preservation of testing data and computer platforms for making this data available to weapon scientists and support of implementation for nuclear enterprise assurance and supply chain risk management for R&D activities; in Research Development Certification and Safety for investments in low cost alternative demonstrators for future systems (e.g. IW series) to demonstrate capability enhancements; and to Management, Technology, and Production for growth in multi-weapon activities needed to support fielding the LEPs following FPU.	+178,190
Strategic Materials: The increase represents TPBAR fabrication, staffing and operational costs at the TEF, ramp up of pit production to meet requirements, initiation of the down blending campaign, initiation of efforts to re-establish or optimize supply chains for strategic materials, and the establishment of a Lithium Sustainment funding line consolidating lithium related work currently in other DSW programs.	+424,535
Total, Directed Stockpile Work	**+1,358,178**

Directed Stockpile Work
Life Extension Programs and Major Alterations

Description
Life Extension Programs (LEPs) and Major Alterations (ALTs) is the stockpile management subprogram necessary to extend the expected life of stockpile systems for an additional 20 to 30 years. NNSA, in conjunction with DOD, executes a LEP following the Phase 6.X process guidelines, which is an expanded subset of the traditional Phase 6 process and has been termed the Phase 6.X process. Provides a framework to conduct and manage refurbishment activities for existing weapons. Phase 6.1 (Concept Assessment) should provide sufficient information for the NWC to authorize Phase 6.2 (Feasibility Study and Design Options). Follow-on phases include: Phase 6.2A (Design Definition and Cost Study), Phase 6.3 (Development Engineering), Phase 6.4 (Production Engineering), Phase 6.5 (First Production) and Phase 6.6 (Full-Scale Production). All phases are conducted in accordance with the joint DOD/DOE Procedural Guidelines for the Phase 6.X Process. For the purposes of this justification, the term "refurbishment" refers to all nuclear weapon alterations and modifications to include life extension, modernization, and revised military requirements. It makes the maximum use of the established structure, flow, and practices from the traditional phased process for new warheads. This process is not intended to replace Phase 6, Quantity Production and Stockpile, activities such as routine maintenance, stockpile evaluation, enhanced surveillance, baselining, and annual certification.

B61-12 Life Extension Program
The B61-12 LEP will address multiple components nearing their end of life, as well as military requirements for reliability, service life, field maintenance, safety, and use control. NNSA, in coordination with the Air Force, studied a number of design alternatives to address the military's requirements, ranging from component replacement alterations to full-scope nuclear and non-nuclear refurbishments. The joint effort also included a separate study to assess the schedule and costs for each alternative. The selected option includes refurbishment of both nuclear and non-nuclear components to address aging, to assure extended service life, and to improve the safety, effectiveness, and security of the bomb. It also incorporates component reuse where possible and omits higher-risk technologies to reduce costs and schedule risks. With these upgrades and the addition of new Air Force components, the B61-12 LEP will consolidate and replace the B61-3, -4, -7, and -10 bombs variants and will reduce the number of gravity bombs. In June 2016, NNSA authorized the program to transition into Phase 6.4. The FPU is scheduled for FY 2020.

W76-1 Life Extension Program
The W76-1 LEP extends the life of the weapon for an additional 30 years. NNSA completed the FPU in FY 2008 and is providing the reentry body assembly and delivery components to DOD for integration into the Trident II D5 Strategic Weapon System, which is part of the submarine-launched ballistic missile (SLBM) force. Warhead refurbishments and associated deliveries to the Navy are scheduled to complete in FY 2019.

The 2018 Nuclear Posture Review states that the United States will modify a small quantity of existing SLBM warheads to provide a low-yield option in the near-term. As the Nuclear Weapons Council translates policy into military requirements, the Administration will work with Congress for appropriate authorizations and appropriations to develop options that support the modification.

IW1
The Program will replace the W78 warhead by 2030 and support fielding of the USAF Ground Based Strategic Deterrent missile system planned to replace the current Minuteman III ICBM force. Additionally, the program will investigate the feasibility of deploying the replacement warhead's nuclear explosive package (NEP) in a US Navy flight body. Not only will the program replace one of the oldest warheads in the stockpile, it will provide improvement in warhead security, safety, and use control.

W88 Alteration Program
The W88 Alteration Program addresses lifetime requirements by modernizing the AF&F system, improving surety, and incorporating a lightning arrestor connector. It also provides required logistical spares for sustaining the life of the system. As planned, the design of the arming and fuzing portion of the AF&F will be forward compatible with future Air Force fuze requirements and/or LEPs. The maintenance programs for NG and GTS replacement will be funded under the W88 enduring stockpile system, but actual replacement will be performed concurrently with the Alt 370 conversion. In

November 2014, the NWC authorized replacement of the CHE and associated materials on the W88 coincident with the Alt 370 activities, which is referred to as CHE Refresh. The CHE Refresh scope is included in the W88 Alteration Program and leverages existing tests to the maximum extent possible to minimize costs and reduce logistical impacts to the Navy. In February 2017, NNSA authorized the program to transition into Phase 6.4, Production Engineering. The FPU is scheduled for 1st Quarter FY 2020.

W80-4 Life Extension Program

The W80-4 LEP will consider W80-1 based reuse, refurbishment, and replacement options for nuclear and non-nuclear components to provide a warhead for the Air Force LRSO cruise missile – the replacement for the current, aging Air-Launched Cruise Missile. The program will integrate the warhead with the replacement missile platform; address warhead component aging concerns, military requirements for reliability, service life, field maintenance, and surety. Key design requirements established for this LEP include using insensitive high explosives for the primary; maximizing use of common non-nuclear components, including common approaches from other designs such as the B61-12 and W88 Alteration Program; exploring options for enhanced surety; and parallel development with the Air Force on Warhead/Missile interface. In July 2015, the NWC authorized the program to transition into Phase 6.2, Feasibility Study and Option Down-select. The program received Phase 6.2A, Design Definition and Cost Study, authorization on September 28, 2017, during which the design will continue to be refined and the NNSA team will continue to work closely with the LRSO missile development team and contractors. The primary 6.2A deliverable will be the W80-4 LEP Weapon Design and Cost Report, which will describe the estimated cost and schedule range, whereby NNSA will further refine a baseline and inform stakeholders on critical decisions.

FY 2020 - FY 2023 Key Milestones

B61-12 Life Extension Program

- Demonstrate aircraft compatibility with existing dual capable aircraft (U.S. and NATO), including the B-2A bomber as well as future compatibility with USAF F-35 and B-21.
- Achieve the First Production Unit in March 2020.
- Authorize Phase 6.6 Full Rate Production in September 2020.
- Conduct First System Retrofit Evaluation System Test (REST) in March 2021.
- Meet FY 2021, FY 2022 and FY 2023 production ship requirements to USAF IAW B61-12 Program Control Document (PCD).
- Last Production Unit in September 2024.

W76-1 Life Extension Program

- Complete component rebuilds and overbuilds to support life of program surveillance and maintenance.
- Formally document programmatic close out of the W76-1 LEP.

W88 Alt 370 Program

- A First Production Unit will occur in FY 2020.
- Phase 6.6 will begin in FY 2020, following completion of a production readiness review and the Pre Pilot Production Gate Reviews in FY 2019.
- A system qualification report documenting the qualification of the W88 Alt 370 weapon system in preparation for the FPU will be published in FY 2020.
- The final DRAAG review will occur in FY 2020.
- The final weapon development report will be released in FY 2021.

W80-4 Life Extension Program

- Phase 6.2A started in September 2017, during which the FPO will perform a detailed cost study of selected design options, identify potential production issues, and develop workload and process development plans to meet critical USAF requirements dates and quantities. Phase 6.2A will see the formation of system and component product realization teams and the development of technical and programmatic documents needed to develop a program baseline early in Phase 6.3. At the conclusion of Phase 6.2A along with estimated warhead-related DOD costs, will be presented to the NWC with a final warhead option down-select and a recommendation to proceed to Phase 6.3.
- Phase 6.3 will start in FY 2019 and is projected to be complete in FY 2022. Phase 6.3 will complete a detailed

design that is demonstrated to be feasible and certifiable with regard to critical safety, performance, and production considerations; produce the final draft version of the Military Characteristics and Stockpile-to-Target Sequence; perform an integrated baseline review (IBR), develop the selected acquisition report (SAR) baseline and annual updates, as well as another bottom-up cost and schedule estimate in the Baseline Cost Report; and produce a draft addendum to the Final Weapon Development Report for review by the DRAAG.

- Phase 6.4 begins in late FY 2022. In FY 2022 and FY 2023 Phase 6.4 will perform the formal production process prove-in and qualification builds, tests and preparation for final assembly and shipment of finished warheads to the DOD: as well as the development of the joint test assemblies and other products required to maintain and consistently evaluate the condition of the system throughout its expected lifetime.

IW1 Program

- **Restart and Complete Feasibility Study and Design Option Work:** Work starting in FY 2019 will be to establish federal and contractor programs that Identify and develop design options and analyze options against military requirements, manufacturability, and technology maturity. The Feasibility Study will conclude with a written report in FY 2022 identifying preferred design option.
- **Complete Design Definition and Cost Study:** The work planned to start in FY 2022 includes a detailed cost study of selected design option, identify production strategy, and develop workload and process development plans to accomplish design and production. At the conclusion of Design Definition and Cost Study work, a Weapon Design and Cost Report will be completed.
- **Start Development Engineering:** Development Engineering work will begin no later than the start of FY 2023 and include the formal implementation of earned value management, program baseline establishment, and completion of the Baseline Cost Report and Selected Acquisition Report.

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
B61-12 Life Extension Program $616,079,000	**B61-12 Life Extension Program $794,049,000**	**B61-12 Life Extension Program +$177,970,000**
• **System Engineering & Integration:** FY 2017 was the first full year of Phase 6.4 after the completion of the system baseline design review, and the completion of the Air Force Preliminary Design Review and Acceptance Group (PDRAAG) in FY 2016. System design and integration of nuclear bomb components and the Air Force tail kit assembly continued in FY 2017 toward validating the final design in FY 2018. NNSA continued work on NNSA and DOD trainers, including delivery of prototype trainers and SS-21 production readiness activities. • **Component Development & Production**: Phase 6.4 activities continued for all major components in FY 2017. Production Plants focused on procurement of tooling, testers, and materials to fabricate production representative hardware to validate and qualify production processes. All components are executing or completing PPI and starting QE in late FY 2017 and will complete in FY 2019. • **System Testing & Qualification:** NNSA continued system testing in FY 2017. Conducted over 25 system-level joint, ground, and aircraft integration tests, including completion of the first three system qualification drop tests at Tonopah Test Range. Conducted five system-level physics tests in FY 2017. Joint tests utilized production representative functional hardware. Continued modeling and simulations of the final system design that will be validated in system tests as part of the overall system qualification.	• **System Engineering & Integration**: The program will enter Phase 6.5 in fourth quarter FY 2019, following completion of readiness activities, including a Nuclear Explosives Safety Study and NNSA Readiness Review. The reviews will also enable NNSA to authorize a Master Authorization Agreement (MAA) for the B61-12 Assembly and Disassembly Operations. NNSA will continue shipment of Type 3 C/E trainers to the DOD for first generation training in preparation for B61-12 IOC. NNSA will produce additional Type 5B/D Trainers to support production activities. The program is on track for FPU in FY 2020. • **Component Development & Production**: Components will enter and complete QE in FY 2019 and NNSA will complete quality acceptance activities to enable shipment of War Reserve (WR) hardware. Components will continue to ramp production activities in FY 2019 to meet FPU and system production requirements documented in the B61-12 Production Control Document. • **System Testing & Qualification**: Joint qualification activities will continue in FY 2019 to enable release of system qualification and aircraft compatibility documents to support FPU and a FY 2020 Final Design Review and Acceptance Group (DRAAG) Review. NNSA will conduct seven joint flight tests with the USAF on the F-15, F-16, and B-2A including the final weapons certification drops on the F-15. In addition, NNSA will conduct 16 ground tests to	• The increase supports the transition of components from design to production scope, including completion of component readiness activities, qualification of production plant processes and initiation of component production and shipment to meet the B61-12 assembly schedule.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
	complete final qualification of performance in normal and abnormal environments. Final system hydrodynamic physics test to support nuclear certification will be conducted. Finalize modeling and simulation analysis to support system design qualification and margin assessments will also be completed.	
W76-1 Life Extension Program $222,880,000	**W76-1 Life Extension Program $113,888,000**	**W76-1 Life Extension Program -$108,992,000**
• Perform the Annual Assessment for the W76-1 LEP. • Complete REST of W76-1 LEP production components and war reserve hardware. Produce REST unique hardware required for testing. • Complete production of surveillance replacement components destructively tested; rebuild war reserve after REST and stockpile surveillance through the life of the program. • Perform purchases of vendor materials to support production rates contained in the Requirements and Planning Document (RPD) and schedules to meet the current deliverables in agreement with the Department of the Navy and in support of submarine deployment requirements. • Continue executing production builds at the approved rate and produce surveillance replacement components (including • NEP components, the AF&F assembly, 2X Acorn GTS, NG, as well as associated cables, elastomers valves, pads, cushions, foam supports telemetries, and miscellaneous parts) aligned with the production.	• Perform the Annual Assessment for the W76-1 LEP. • Complete remaining purchases of vendor materials to support FY 2019 approved production rates. • Complete remaining production builds at the FY 2019 approved rate and complete production of surveillance replacement components including NEP components, the AF&F assembly, 2X Acorn GTS, NG, as well as associated cables, elastomers, valves, pads, cushions, foam supports, telemetries, and miscellaneous parts aligned with the production schedule. • Complete last warhead deliveries for LEP in FY 2019 in agreement with the Department of the Navy and in support of submarine deployment requirements. • Complete production of REST unique hardware required for testing. • Complete FY 2019 REST Surveillance of W76-1 LEP production components and war reserve hardware. • Complete FY 2019 production of surveillance replacement components destructively tested; rebuild war reserve units after REST surveillance.	• The decrease represents the ramp-down and completion of remaining LEP warhead refurbishments and associated deliveries to the Navy in FY 2019.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
W88 Alteration Program $281,129,000	**W88 Alteration Program $304,285,000**	**W88 Alteration Program +$23,156,000**
• **System Engineering & Integration:** Phase 6.4 activities continue to mature production processes in preparation for production qualification and eventual war reserve production. The CHE refresh portion of the program is fully integrated including the addition of Hydro Tests. Design laboratories will generate final system-level production specifications for the Re-Entry Body and JTAs. Production authorization activities will continue to support production readiness and NESS. • **Component Development & Production:** Final component qualification activities will be conducted leading to Final Design Reviews for all major components, AF&F and at the RB-level. The production plants will be continuing or initiating Production PPI and begin the production process qualification for the ALT and CHE Refresh portions of the program. Long-lead purchases and assemblies will also continue and/or be initiated. Component testing and qualification activities for the CHE Refresh portion of the program will also continue. • **System Testing & Qualification:** Although Phase 6.4 activities began in FY 2017, there are final activities under development engineering including the addition of tests to integrate CHE Refresh. NNSA will support the flight test program including testing a Joint Test Assembly (JTA) on the Commander Evaluation Test (CET)-1. The design laboratories will continue modeling and simulations of the final system design that will be validated in ground tests as part of the overall system.	• **System Engineering & Integration:** Phase 6.4 activities will be in the final stages of pre-production. FPU of the AF&F is planned in late FY 2019, which supports the Re-Entry Body Assembly (RBA)-level FPU in the 1st quarter of FY 2020. System-level War Reserve integration activities will be in the final authorization stage for production of the RBA, including all tooling, testers, equipment, facilities, technicians, safety bases, and Nuclear Explosive Safety Reviews. NNSA approval of Phase 6.5 along with the Master Authorization Agreement (MAA) is expected to be approved at the end of FY 2019, providing authorization to begin the FPU. • **Component Development & Production:** Remaining component hardware production qualification activities will be completed in FY 2019. All components will be either entering or continuing full scale production to support the Alt 370 conversion provisioning needs derived from the NNSA production schedules. Long-lead hardware purchases and assemblies from vendors will also continue and/or be initiated. Component testing and qualification activities for the CHE Refresh portion of the program will also continue. • **System Testing & Qualification:** Final activities during the later stages of Phase 6.4 include system-level qualification and testing. The Design laboratories will conduct the system-level qualification evaluations for the RBA and JTA and publish Qualification Evaluation Release • (QERs). NNSA will support the two Navy-required qualification flight tests with JTAs for Demonstration and Shakedown Operation (DASO) – 29 and CET-2. The design laboratories	• The increase represents a ramp-up of production agency activities offset by a reduction in design agency activities. All QE builds on all components will be completed, with all components reaching Technology Readiness Level (TRL) 8 or 9 by the end of FY2019. Other activities will include qualifying the NEP and System Assemblies, Authorization Basis updates for safety, and ramping to full-rate AF&F production.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
	will continue modeling and simulations of the final component and system designs to support weapon assessments, certification, and reliability. Stockpile Surveillance activities begin with initiation of a shelf life program and early planning for stockpile returns.	
W80-4 Life Extension Program $220,253,000	**W80-4 Life Extension Program $654,766,000**	**W80-4 Life Extension Program +$434,513,000**
• Publish a Phase 6.2A Report and WDCR. This report will document the conceptual designs, program costs, and schedules associated with the nuclear and non-nuclear refurbishment scope, including development of concepts and costs to be compatible with the Air Force's new LRSO Cruise Missile. The study will also evaluate options for improving safety and use control features and ensures compatibility and integration with aircraft.	• **System Engineering & Integration**: Phase 6.2A will be completed, including the WDCR that develops an initial planning baseline for Phase 6.3 and beyond, covering scope, schedule, cost and risks for the life of the LEP. Phase 6.3 will begin with significant staffing ramp required to complete Baseline Design Review by FY 2021. Perform initial Independent Baseline Reviews (IBRs) at all sites to ensure an effective Earned Value Management System (EVMS). An updated Missile to Warhead Interface Control Document will be published and Stockpile-to-Target Sequence data continues to be measured for pre-flight environments. • **Component Development & Production**: Conceptual Design Reviews will be conducted for all components and the system design. Developmental lots with associated testing activities will focus on progressing Technology and Manufacturing Readiness Levels. • **System Testing & Qualification**: Warhead simulators/test units will be produced and delivered to conduct aircraft integration activities with the Air Force to understand the environments under which the warhead will have to perform. Conduct hydrodynamic physics tests within simulated missile bodies to support nuclear certification.	• The increase is due to significant ramp-up to begin Phase 6.3 of the warhead design. In Phase 6.3 all NNSA M&O contractors and Product Realization Teams are fully staffed and engaged in the design, development, material procurements, capital equipment purchases and installation. Phase 6.3, and 2019 in particular, will also require numerous test assets for both NNSA warhead development and AF Interface testing.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
IW1 $0	**IW1 $53,000,000**	**IW1 +$53,000,000**
• No Appropriated Funding	• Restart the Feasibility Study and Design Options work suspended in 2014 to replace the W78 warhead and investigate the feasibility of deploying the replacement warhead's NEP in a US Navy flight body. • Establish NNSA laboratory design agency and production agency program personnel, functions and processes required for Feasibility Study and Design Options work. • Establish Federal Program Office and required program personnel, documents, functions, and processes for Feasibility Study and Design Options work. • Evaluate proposed/assessed warhead technologies and progress maturity of select/key technologies.	• The increase represents establishment of the IW1 funding line.

Directed Stockpile Work
Stockpile Systems

Description

Stockpile Systems directly executes sustainment activities for the total (active and inactive) stockpile for the B61, W76, W78, W80, B83, W87, and W88 weapons. As required by 50 United States Code 2525, safety, security, and effectiveness assessments are performed to determine whether the systems can continue to be certified without the need for an underground nuclear test. Sustainment activities for each weapon system are identified by four major subprograms that support the enduring stockpile system, as well as LEPs and Alts:

Current U.S. nuclear weapons and associated delivery systems

Warheads—Strategic Ballistic Missile Platforms					
Type [a]	***Description***	***Carrier***	***Laboratorie***	***Mission***	***Military***
W78	Reentry vehicle warhead	Minuteman III Intercontinental	LANL/SNL	Surface to surface	Air Force
W87	Reentry vehicle warhead	Minuteman III Intercontinental	LLNL/SNL	Surface to surface	Air Force
W76-0/1	Reentry body warhead	Trident II D5 Strategic Weapon System (Submarine Launched	LANL/SNL	Underwater to surface	Navy
W88	Reentry body warhead	Trident II D5 Strategic Weapon System (Submarine Launched	LANL/SNL	Underwater to surface	Navy
Bombs—Aircraft Platforms					
Type [a]	***Description***	***Carrier***	***Laboratorie***	***Mission***	***Military***
B61-3/4/10	Non-strategic bomb	F-15, F-16, certified NATO aircraft	LANL/SNL	Air to surface	Air Force/ Select NATO forces
B61-7	Strategic bomb	B-2 bomber	LANL/SNL	Air to surface	Air Force
B61-11	Strategic bomb	B-2 bomber	LANL/SNL	Air to surface	Air Force
B83-1	Strategic bomb	B-2 bomber	LLNL/SNL	Air to surface	Air Force
Warheads—Cruise Missile Platforms					
Type [a]	***Description***	***Carrier***	***Laboratorie***	***Mission***	***Military***
W80-1	Air-launched cruise missile strategic	B-52 bomber	LLNL/SNL	Air to surface	Air Force

LANL = Los Alamos National Laboratory
LLNL = Lawrence Livermore National Laboratory
NATO = North Atlantic Treaty Organization
SNL = Sandia National Laboratories
[a]The suffix associated with each warhead or bomb type (*e.g.*, "-0/1" for the W76) represents the modification associated with the respective weapon.

Stockpile Systems Major Activity Levels:

(1) Weapon Maintenance: Includes production of LLCs that include GTSs, NGs, and other designated components as required in accordance with National Requirements Documents and/or Directive Schedules, day-to-day stockpile maintenance and repair activities, production and delivery of components for each weapon type, refurbishment and replacement of aging components to sustain stockpile life, and rebuilds.

(2) Weapon Surveillance: Includes new material laboratory and flight tests, retrofit evaluation system laboratory and flight tests, stockpile laboratory tests, stockpile flight tests, quality evaluations, special testing, and component and material evaluation to support assessment of the safety, security, and effectiveness of the nuclear weapons stockpile. Data from these tests contributes to the Annual Assessment and memorandum to the President.

(3) Weapon Assessment and Support: Includes activities associated with management of fielded weapon systems. Provides systems and component engineering support, support to planning, resolution, and documentation of SFIs to include assessment of root cause, extent of conditions, and impact to system effectiveness or safety. Also includes activities associated with planning, developing, and updating the technical basis for the materials, components, and weapons and performing the weapon assessments. Finally, activities associated with preparation, writing, and coordination of Annual Assessment Reports (AARs) and Weapon Reliability Reports and activities needed to assess/resolve system-specific weapon response issues and to provide support to the Nuclear Explosive Safety Study Groups (NESSG) and the Nuclear Weapon System Surety Groups (NWSSG) as required, are included.

(4) Development Studies/Capability Improvements: Includes activities associated with improvements in surveillance capabilities, technical basis improvements, technology maturation for insertion or replacement, and system/surety studies.

(5) Weapon Program Planning and Support: Includes activities associated with management of fielded weapon systems. Provides systems and component engineering support for planning, resolution, and documentation.

Stockpile Systems Description

B61 Stockpile Systems

The B61 gravity bombs are the oldest weapons in the enduring stockpile. The B61 is deployed by the Air Force on various aircraft. The B61 family includes five modifications with two distinct categories. The strategic category includes the B61 Modifications -7 and -11, with Modification-11 being the only active earth penetrating weapon. The non-strategic category includes the B61 Modifications -3, -4, and -10 supporting our extended nuclear commitment.

W76 Stockpile Systems

The W76-0 and W76-1 LEP are the warheads integrated into the Trident II D5 Strategic Weapon System. It is part of the SLBM force. The W76-0/Mk4 and W76-1/Mk4A is completed by NNSA as a Reentry Body Assembly and delivered to DOD.

W78 Stockpile Systems

The Mk12A/W78 re-entry vehicle is deployed on the Minuteman III ICBM.

W80 Stockpile Systems

The W80 warhead is used in the Air Launched Cruise Missile deployed by the Air Force.

B83 Stockpile Systems

The B83 is an aircraft delivered, strategic gravity bomb deployed by the Air Force.

W87 Stockpile Systems

The Mk21/W87 re-entry vehicle is deployed on the Minuteman III ICBM.

W88 Stockpile Systems

The W88 is integrated into the Trident II D5 Strategic Weapon System. It is part of the SLBM force. The W88/Mk5 is completed by NNSA as a Reentry Body Assembly and delivered to DOD.

FY 2020 - FY 2023 Key Milestones

- **Weapon Maintenance:** Conduct maintenance activities in accordance with directive documents (PCD) and execute repair and replacement of aging components as required.
- **Weapon Surveillance:** Continue to conduct surveillance activities in accordance with directive documents, to include: disassembly and inspections, system-level laboratory tests, joint flight testing, component and material evaluations, and assessment.
- **Weapon Assessment and Support:** Continue weapon assessment activities necessary to complete Weapon Reliability and Annual Assessment Reports, which include: laboratory testing and analysis, and significant finding investigations as required.
- **Weapon Program Planning and Support:** Continue activities associated with management of fielded weapon systems. Provides systems and component engineering support for planning, resolution, and documentation.

B61 Stockpile Systems

- **Weapon Surveillance:** Continue surveillance activities for the legacy stockpile systems and incorporate the additional requirements as the B61-12 transitions to stockpile systems.
- **Development Studies/Capability Improvements:** Continue feasibility studies as required and development and implementation of activities supporting the Integrated Surety Architecture (ISA).

W76 Stockpile Systems

- **Weapon Surveillance:** Conduct surveillance activities for the W76-0 and W76-1 in accordance with directive documents. Continue to conduct W76-0 and W76-1 stockpile surveillance to include: disassembly and inspection (D&I), system-level laboratory and joint flight testing, component and material evaluations (CME), and platform compatibility and testing activities.
- **Development Studies/Capability Improvements:** Provide laboratory and management expertise to Project Officers Group (POG) and DoD Safety Studies. Continue full scale development of the W76 JTA1 refresh.

W78 Stockpile Systems

- **Development Studies/Capability Improvements:** Conduct feasibility studies as required and in conjunction with the DOD as necessary. Begin surety enhancement development activities in FY 2022. Continue support for JTA6R fielding and support of Ground Based Strategic Deterrent (GBSD) development.

W80 Stockpile Systems

- **Development Studies/Capability Improvements:** Conduct feasibility studies as required and implementation of activities supporting the Integrated Surety Architecture.

B83 Stockpile Systems

- **Development Studies/Capability Improvements:** Begin development and implementation activities in support of Integrated Surety Architecture (ISA).

W87 Stockpile Systems

- **Weapon Maintenance:** Produce and deliver replacement Gas Transfer System (Alt 360) (FPU in FY 2019). Continue firing set production (FPU in FY19). Restart critical component production and PRT activities as required by strategic provisioning analysis.
- **Weapon Surveillance:** Restart surveillance related critical component production and PRT activities as required by strategic provisioning analysis.
- **Development Studies/Capability Improvements:** Continue Ground Based Strategic Deterrent (GBSD) integration activities in conjunction with the DOD.

W88 Stockpile Systems

- **Weapon Maintenance:** Continue production and fielding of Alt 940 surety solution.
- **Development Studies/Capability Improvements:** Continue critical development/integration and start system level qualification activities to replace legacy W88 System NG and GTS. Conduct appropriate feasibility studies in conjunction with the Department of Defense; provide laboratory and management expertise to the POG and Department of Defense Safety Studies. Conduct activities for surety enhancements, to include implementation of the surety technologies.

Stockpile Systems

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
B61 Stockpile Systems $57,313,000	**B61 Stockpile Systems $64,547,000**	**B61 Stockpile Systems +$7,234,000**
• **Weapon Maintenance:** Continue to produce LLCs. Continue ELNG development and qualification activities to achieve a first production unit for the B61-11 in FY 2019. • **Weapon Surveillance:** Continue surveillance activities, including, but not limited to: disassembly and inspections, system-level laboratory tests, joint flight tests, component and material evaluations, and assessment. • **Weapon Assessment and Support:** Continue weapon assessment activities necessary to complete Weapon Reliability and Annual Assessment Reports, which include: laboratory testing and analysis, and significant finding investigations as required. • **Development Studies/Capability Improvements:** Continue design activities for the Electronic NG. Continue feasibility studies as required and in conjunction with the DOD as necessar*y*. • **Weapon Program Planning and Support:** Continue activities associated with management of fielded weapon systems. Provides systems and component engineering support for planning, resolution, and documentation.	• **Weapon Maintenance:** Continue to produce LLCs. Complete qualification activities, achieve FPU, and continue production of the ELNG for the B61-11. • **Weapon Surveillance:** Continue surveillance activities, including D&I, system-level laboratory tests, joint flight tests, component and material evaluations, and assessment. • **Weapon Assessment and Support:** Continue weapon assessment activities necessary to provide data for WRRs and AARs, which include analyses from laboratory testing and SFIs, as required. • **Development Studies/Capability Improvements:** Perform development and qualification activities to support ISA requirements. Continue feasibility studies as required and in conjunction with DOD as necessar*y*. • **Weapon Program Planning and Support:** Continue activities associated with management of fielded weapon systems. Provides systems and component engineering support for planning, resolution, and documentation.	• The $7,234,000 increase represents a $5,815,319 increase in Weapon Maintenance associated with the production of the electronic neutron generator for the B61-11, a $6,042,000 increase in Development Studies/Capabilities Improvements in support of Integrated Surety Architecture work scope, a $3,012,325 decrease in Weapon Assessment, and a $1,610,994 decrease in Weapon Program Planning and Support.
W76 Stockpile System $38,604,000	**W76 Stockpile System $94,300,000**	**W76 Stockpile Systems +$55,696,000**
• **Weapon Maintenance:** Continue producing LLCs, which include an increase in NG/GTS production. • **Weapon Surveillance:** Conduct W76-0 and W76-1 core surveillance activities to include D&I, system-level laboratory, and joint flight testing; decrease in component testing, component and	• **Weapon Maintenance:** Continue producing LLCs, which include an increase in NG/GTS production to support W76-1 LEP requirements that are being assumed by the W76 Stockpile System. • **Weapon Surveillance:** Conduct W76-0 and W76-1 core surveillance activities to include D&I,	• The increase represents new JTA development, of $1,409,564, a $6,228,386 increase in Weapon Maintenance for limited life component exchanges (LLCE) NG and LLCE GTS, a $3,365,999 increase in Weapon Surveillance to conduct core surveillance to include W76-1, a $7,602,937

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
material evaluations (CME), and platform compatibility and testing activities. • **Weapon Assessment and Support:** Continue to conduct weapon assessment activities necessary to complete Weapon Reliability and AARs to include laboratory/site testing and analysis, trainer refurbishments, and SFIs. • **Development Studies/Capability Improvements:** Provide laboratory and management expertise to POG and DOD Safety Studies. Also limited development for Joint Test Assembly Refresh. • **Weapon Program Planning and Support:** Continue activities associated with management of fielded weapon systems. Provides systems and component engineering support for planning, resolution, and documentation.	system-level laboratory, and joint flight testing as more W76-1 LEP requirements are being assumed by stockpile systems • **Weapon Assessment and Support:** Continue to conduct weapon assessment activities necessary to complete Weapon Reliability and AARs to include laboratory/site testing and analysis, trainer refurbishments, and SFIs. The W76 Stockpile Systems will assume more W76-1 requirements. • **Development Studies/Capability Improvements:** Begin full program execution for development of JTA3 to ensure on time FPU prior to JTA1 end of life. • **Weapon Program Planning and Support:** Continue activities associated with management of fielded weapon systems. Provides systems and component engineering support for planning, resolution, and documentation.	increase in Weapon Assessment and Support to complete studies and assessment as the W76-1 transitions to the W76 Stockpile System, a $31,097,218 increase in Development Studies/Capability Improvements to develop the W76-1 JTAs, and a $5,991,896 increase in Weapon Program Planning & Support to support the above activities.
W78 Stockpile Systems $56,413,000	**W78 Stockpile Systems $81,329,000**	**W78 Stockpile Systems +$24,916,000**
• **Weapon Maintenance**: Conduct maintenance activities in accordance with directive documents (PCD) and execute repairs. Rebuild of stockpile surveillance samples. Production of LLC and replacement components as required. • **Weapon Surveillance:** Continue to conduct surveillance activities in accordance with directive documents, to include D&Is, system-level laboratory tests, joint flight testing, and material evaluations and assessment. • **Weapon Assessment and Support:** Continue weapon assessment activities necessary to complete Weapon Reliability and AARs to include laboratory testing and analysis, SFIs as required.	• **Weapon Maintenance**: Conduct maintenance activities in accordance with PCDs and execute repair and replacement of aging components as required. • **Weapon Surveillance:** Continue to conduct surveillance activities in accordance with directive documents, to include D&Is, system-level laboratory tests, joint flight testing, component and material evaluations and assessment. • **Weapon Assessment and Support:** Provide weapon assessment activities necessary to complete Weapon Reliability and AARs to include laboratory testing and analysis, SFIs as required.	• The $24,916,000 increase represents a $3,707,306 increase in Weapon Maintenance attributed to an increase in GTS production to support Hedge. A $1,566,826 increase in Weapon Surveillance for component and flight testing. A $1,612,000 decrease in Weapon Assessment and Support due to reinvestment in Development Studies for development of JTA6R technology. A $19,478,712 increase in Development Studies to continue development of JTA6R technology. A $1,775,156 increase in Weapon Program Planning/Support to provide systems and component engineering support for planning, resolution, and documentation to

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Development Studies/Capability Improvements: Conduct studies in conjunction with DOD as necessary. **Weapon Program Planning/Support:** Conduct activities associated with management of fielded weapon systems. Provides systems and component engineering support for planning, resolution, and documentation.	• **Development Studies/Capability Improvements:** Conduct studies in conjunction with DOD as necessary. Develop JTA6R technology to support flight test missions. • **Weapon Program Planning/Support:** Conduct activities associated with management of fielded weapon systems. Provide systems and component engineering support for planning, resolution, and documentation	include Ground Based Strategic Deterrent (GBSD) activities.
W80 Stockpile Systems $64,631,000	**W80 Stockpile Systems $80,204,000**	**W80 Stockpile Systems +$15,573,000**
• **Weapon Maintenance:** Continue to produce LLCs and complete Alt 369 activities to achieve FPU in 1Q FY 2018. • **Weapon Surveillance:** Continue surveillance activities, to include D&I, system-level laboratory and joint flight testing, component and material evaluations (CME), assessment, and platform compatibility and testing activities. • **Weapon Assessment and Support:** Continue weapon assessment activities necessary to complete WRRs and AARs, which include analyses of laboratory testing and SFIs, as required. • **Development Studies/Capability Improvements:** Conduct appropriate feasibility studies in conjunction with DOD and provide laboratory and management expertise to the POG and DOD Safety Studies. Perform development and qualification activities to support ISA requirement. • **Weapon Program Planning and Support:** Continue activities associated with management of fielded weapon systems. Provides systems and component engineering support for planning, resolution, and documentation.	• **Weapon Maintenance:** Continue to produce LLCs. Continue Alt 369 production. • **Weapon Surveillance:** Continue surveillance activities, to include D&I, system-level laboratory and joint flight testing, CME, assessment, and platform compatibility and testing activities. • **Weapon Assessment and Support:** Continue weapon assessment activities necessary to complete WRRs and AARs, which include analyses of laboratory testing and SFIs, as required. • **Development Studies/Capability Improvements:** Multi-System Transportation Attachment Device (MTAD) Conduct appropriate feasibility studies in conjunction with DOD and provide laboratory and management expertise to the POG and DOD Safety Studies. • **Weapon Program Planning and Support:** Continue activities associated with management of fielded weapon systems. Provides systems and component engineering support for planning, resolution, and documentation.	• The $15,573,000 increase represents a $4,466,000 increase in Weapon Maintenance to support Alt 369 production and associated LLC activities; an increase of $1,852,000 in Surveillance work scope, and an increase of $9,255,000 in Development Studies/Capability Improvements to support MTAD development and qualification activities.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
B83 Stockpile Systems $41,659,000	**B83 Stockpile Systems $35,082,000**	**B83 Stockpile Systems -$6,577,000**
• **Weapon Maintenance:** Continue to support LLCE operations • **Weapon Surveillance:** Continue surveillance activities, including D&Is, system-level laboratory tests, joint flight tests, CMEs, and assessment. • **Weapon Assessment and Support:** Continue weapon assessment activities necessary to complete WRRs and AARs, to include analyses of laboratory testing and SFIs, as required. • **Development Studies/Capability Improvements:** No activities planned. • **Weapon Program Planning and Support:** Continue activities associated with management of fielded weapon systems. Provides systems and component engineering support for planning, resolution, and documentation.	• **Weapon Maintenance:** Continue to support LLCE operations • **Weapon Surveillance:** Continue surveillance activities, including D&Is, system-level laboratory tests, joint flight tests, CMEs, and assessment. • **Weapon Assessment and Support:** Continue weapon assessment activities necessary to complete WRRs and AARs, to include analyses of laboratory testing and SFIs, as required. • **Development Studies/Capability Improvements:** No activities planned. • **Weapon Program Planning and Support:** Continue activities associated with management of fielded weapon systems. Provides systems and component engineering support for planning, resolution, and documentation.	• The $6,577,000 decrease represents a $419,186 decrease in Weapon Assessment and Support activities, and a decrease of $6,157,814 in Weapon Program Planning and Support.
W87 Stockpile Systems $81,982,000	**W87 Stockpile Systems $83,107,000**	**W87 Stockpile Systems +$1,125,000**
• **Weapon Maintenance:** Continue full-scale production of Small Ferroelectric NGs and NG exchanges. Continue activities for qualification of new GTS (Alt 360) with an FPU in FY 2019. Continue firing set development and qualification activities with a first production unit in FY 2019. Rebuild of stockpile surveillance samples. Production of LLC and replacement components as required. • **Weapon Surveillance:** Continue surveillance activities in accordance with directive documents, to include D&I, system-level laboratory and joint flight testing. In addition, Retrofit Evaluation System Tests for the W87 LLCE and Firing Set Rebuilds will continue.	• **Weapon Maintenance:** Continue NG production, firing set qualification and FPU activities. Reduced LLCE production and exchange related to inactive stockpile and execute repair, maintenance, and replacement of aging weapon components. Continue activities for qualification of GTS Alt 360 with an FPU in FY 2019. • **Weapon Surveillance:** Continue surveillance activities to include D&I, system-level laboratory and joint flight testing, component and material evaluations, and platform compatibility and testing activities. • **Weapon Assessment and Support:** Provide weapon assessment activities to include laboratory testing and analysis, Project Officer	• The $1,125,000 increase represents a $135,341 increase in Weapon Maintenance for increase in repair activities; increase in GTS production activities; decrease in NG production this FY. A $4,898,851 increase in Weapon Surveillance is attributed to component testing and fulfillment of flight testing requirements. A $2,628,799 increase in Weapon Assessment and Support is due to investment in design agency Tech Basis and Aging Studies. A $5,888,365 decrease in Development Studies is the result of transition for Alt 360 to full-scale production for LLCE. A $649,626 decrease in Weapon Program Planning/Support for reduced level of support.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
• **Weapon Assessment and Support:** Continue weapon assessment activities necessary to complete Weapon Reliability and AARs to include laboratory testing and analysis, SFIs as required. • **Development Studies/Capability Improvements:** Continue product realization activities for W87 Alt 360. • **Weapon Program Planning/Support:** Conduct activities associated with management of fielded weapon systems. Provide systems and component engineering support for planning, resolution, and documentation.	Group and DOD requested studies, and SFIs, necessary to complete WRR and AAR. • **Development Studies/Capability Improvements:** Continue product realization activities for the W87 Alt 360. Continue feasibility studies as required in conjunction with the DOD. Decrease firing set development activities that would impact out year production and stockpile rebuilds. • **Weapon Program Planning/Support:** Conduct activities associated with management of fielded weapon systems. Provide systems and component engineering support for planning, resolution, and documentation.	
W88 Stockpile Systems $103,074,000	**W88 Stockpile Systems $180,913,000**	**W88 Stockpile Systems +$77,839,000**
• **Weapon Maintenance:** Continue to execute production of weapon components required for repair, maintenance, and replacement. Continue design development and qualification activities to achieve full-scale NG production in FY 2019. Rebuild warheads only to maintain authorization basis due to W88 Alteration Program preparation, and begin Alt 940 production activities for start-up. Continue production qualification activities for the GTS supporting LLCE beginning in FY 2020. Rebuild stockpile surveillance samples. • **Weapon Surveillance:** Continue surveillance activities to include D&I, system-level laboratory and joint flight testing, CME, and platform compatibility and testing activities. Reduced component surveillance activities • **Weapon Assessment and Support:** Continue weapon assessment activities necessary to complete Weapon Reliability and AARs, to	• **Weapon Maintenance:** Continue to execute production of weapon components required for repair, maintenance, and replacement. Continue production and qualification activities to achieve full-scale NG production with increased technical scope in FY 2019. Continue production and qualification activities for the GTS LLCE cycle beginning in FY 2020. Rebuild warheads only to maintain authorization basis due to W88 Alteration Program preparation, and to fully execute Alt 940 production activities. • **Weapon Surveillance:** Continue surveillance activities to include D&I, system-level laboratory and joint flight testing, CME, and platform compatibility and testing activities. Continue component surveillance activities, to include Canned Subassembly non-destructive evaluations. • **Weapon Assessment and Support:** Continue weapon assessment activities necessary to	• The $50,115,142 increase in Weapon Maintenance continues execution of core maintenance, production and qualification for NG/GTS activities, and qualification/ production and fielding of Alt 940 to meet FPU at FY 2019 year-end; a $18,847,581 increase in Weapon Surveillance fully funds all core surveillance and D&Is, stockpile flight tests (SFT) and stockpile lab test (SLT), and continued component surveillance activities; a $6,891,460 increase in Weapon Assessment fully supports the baseline engineering, physics, and qualification of margins and uncertainties to conduct annual assessment, weapons reliability and other reports. A $9,146,256 decrease in Development Studies due to Alt 940 production activities moving to Weapon Maintenance, and an $11,131,073 increase in Weapon Program Planning/Support to fund technical and program management.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
include laboratory/site testing and analysis, trainer refurbishments, and SFIs. Continue the CASTLE transition program started in FY 2016 which includes a NES or Nuclear Explosive Safety Change Evaluation to authorize continued W88 operations in FY 2019. • **Development Studies/Capability Improvements:** Continue critical Development/Integration and start system level qualification activities for surety enhancements, including surety implementation, and replace legacy W88 System NG and remanufacture of GTS. Conduct appropriate studies in conjunction with DOD; provide laboratory and management expertise to the POG and DOD safety studies. Continue the surety implementation on the W88 system. Continue Alt 940 surety implementation and begin H1514 shipping container refurbishment. • **Weapon Program Planning & Support:** Continue activities associated with management of fielded weapon systems. Provides systems and component engineering support for planning, resolution, and documentation.	complete Weapon Reliability and AARs, to include laboratory/site testing and analysis, trainer refurbishments, and SFIs. Execute Alt 370 and Alt 940 SS21 authorization basis and fielding activities to support FPUs. • **Development Studies/Capability Improvements:** Continue critical Development/Integration and start system level qualification activities for surety enhancements, and replace legacy W88 System NG and remanufacture of GTS. Conduct appropriate studies in conjunction with DOD; provide laboratory and management expertise to the POG and DOD safety studies. Execute H1514 container production. Transfer of Alt 940 activities to Weapon Maintenance due to production ramp up. • **Weapon Program Planning & Support**: Continue and increase activities associated with management of fielded weapon systems. Provides systems and component engineering support for planning, resolution, and documentation.	

Directed Stockpile Work
Weapons Dismantlement and Disposition

Description

Weapons Dismantlement and Disposition (WDD) is a critical element of NNSA's integrated effort to transform the enterprise and the stockpile. Specific activities include weapons disassembly, harvesting of material and hardware for LEPs, disposition of retired warhead system components, and safety surveillance of selected components from retired warheads. Other supporting activities specific to retired warheads include conducting hazard assessments, issuing safety analysis reports, conducting laboratory and production plant safety studies, and declassification and sanitization of component parts. WDD relies on several enabling programs to complete its mission, such as Stockpile Services Production Support for shipping, receiving, and equipment maintenance; Infrastructure and Operations for infrastructure sustainment and containers; and the Office of Secure Transportation for movement of weapons and weapon components. The FY 2017 and FY 2018 National Defense Authorization Acts (NDAA) placed a spending cap of $56,000,000 on the Weapon Dismantlement and Disposition program through FY 2021.

WDD focuses on the safe and secure dismantlement of excess nuclear weapons and components. The WDD program has four focus areas:

Disassembly – WDD enables the dismantlement of weapons and canned subassemblies and is a significant supplier of material for future nuclear weapons production and Naval Reactors.

Component Disposition – WDD ensures waste streams are identified to allow the permanent disposition of weapon components.

Retired Systems Management – WDD enables safety studies that ensure weapons in the stockpile awaiting dismantlement remain safe while in DOD custody.

Component Characterization – WDD ensures that all potential hazards contained in weapon components are characterized to allow the weapons complex to safely work with individual weapon components.

FY 2020 - FY 2023 Key Milestones

- Execute the dismantlement of weapons and canned subassemblies and is a significant supplier of material for future nuclear weapons production and Naval Reactors.
- Execute annual activities as stated in the annual Dismantlement Program Plan.
- Provide material and hardware for the life extension programs.
- Material provided for external customers.

Weapons Dismantlement and Disposition

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Weapons Dismantlement and Disposition (WDD) $56,000,000	**Weapons Dismantlement and Disposition (WDD) $56,000,000**	**Weapons Dismantlement and Disposition (WDD) $0**
• Weapons dismantled to meet material and component requirements (e.g., W80-1 Alt 369 and W76-1 LEP). • Dismantlement helped benefit Production Technicians (PTs) in terms of technical training and clearances for future (LEPs) • CSAs received to provide feedstock to internal and external customers. • Provided technical expertise and safety plans for weapons undergoing dismantlement. • Enterprise sites continued legacy component disposition activities.	• Continue weapon dismantlements to ensure trained labor, material and component requirements are met (e.g., W80-1 Alt 369, B61-12 LEP, and W76-1 LEP). • Dismantlement to benefit Production Technicians (PTs) in terms of technical training and clearances for future (LEPs) • Will receive CSAs to provide feedstock to internal and external customers. • The laboratories will provide technical expertise and safety plans for weapons undergoing dismantlement. • Enterprise sites will continue legacy component disposition activities.	• No change.

Description

Stockpile Services provides the logistical, mechanical, and support foundation for all DSW operations that are applicable to multiple weapon systems in the nuclear weapons stockpile. This support for all weapon systems and continued sustainment for all DSW operations includes Production Support and R&D Support, essential for plant and laboratory critical skills, programmatic and infrastructure management, liaison support between the laboratories and production plants, material, quality controls, and surveillance and evaluation activities for the nuclear weapon stockpile; R&D Certification and Safety (RDCS), focusing on maintaining and modernizing the base hydrodynamic and subcritical experimental capabilities needed to support the stockpile, the early development of components to replace sunset technologies, new engineering models and algorithms, design studies with the objective of advancing technologies sufficiently to be adopted for future insertions, conducting scaled demonstrations of technologies anticipated for insertion into the stockpile, and processing and qualifying replacement components for the existing stockpile; and Management, Technology, and Production, which provides stockpile sustainment services including products, components, and/or services for multi-weapon surveillance, weapons reliability reporting to DOD, weapon logistics and accountability, and maintenance and/or replacement of weapons related equipment.

<u>Production Support</u>

Production Support is the backbone for the manufacturing capability of the stockpile and includes the workforce and equipment that form a multi-system manufacturing based program that provides the individual site capability and capacity to sustain NNSA's nuclear security enterprise's production mission. The production mission is defined as weapon assembly, weapon disassembly, component production, surveillance, and weapon safety and reliability testing. Production Support also enables the modernization of production capabilities to improve efficiency and ensure manufacturing operations meet future requirements. Production Support requires close coordination with the Component Manufacturing Development (CMD) activity under the Advanced Manufacturing Development program, which is charged with development and initial deployment of new manufacturing and production capabilities.

The Production Support mission scope includes:

(1) Engineering Operations – Internal plant-wide activities that establish product process flows and improvements, develop and maintain operating procedures, determine critical design parameter and manufacturing process capabilities, establish process controls, metrics and quality indices, and establish and maintain process safety controls/assessments;

(2) Manufacturing Operations – Activities that manage and provide oversight to manufacturing departments and all internal non-weapon-type specific manufacturing operations and processes, material controls, supervision, planning and scheduling, inventory control, packaging, shipping and procurement, internal production-related transportation, and internal production related safety activities. It also includes classified manufacturing operations that cannot be associated with a particular warhead;

(3) Quality, Supervision, and Control – Includes activities dealing with quality control, supervision of general in-line inspection and radiography, procedures development and execution, process control certification for War Reserve products, measurement standards and calibration techniques, calibration of equipment, tooling, gages and testers, and Quality Assurance (QA)-related equipment/processes for certification;

(4) Tool, Gage, and Equipment Services – Activities that include preparation of specifications and designs for non-weapon-type specific tooling including tools, gages, jigs and fixtures and test equipment, as well as design and development of tester software including tester control and product assurance. This category also includes work related to verification/qualification of hardware and software, procurement processes, and maintenance, both corrective and preventative, that directly support production-related equipment/process components;

(5) Purchasing, Shipping, and Materials Management – Planning, engineering, supplier management, and logistics activities associated with the materials supply chain; and

(6) Electronic Product Flow – Activities that include internal plant-wide purchase, design, development, installation, configuration, testing, training, and maintenance of classified and unclassified computer systems including hardware and software. These activities are directly linked to the performance of site-specific production functions, but are separate and distinct from general-use administrative and office-automated systems. Supported systems in both unclassified and classified environments enable manufacturing and quality assurance functions.

Research and Development (R&D) Support

The R&D Support Program is responsible for the programmatic and infrastructure management supporting multiple-system stockpile activities critical to DSW programs. Direct support to activities includes multiple-system flight tests, archiving of weapons data required to validate and verify computational and predictive methods without the use of underground tests, updating R&D and engineering tools to remain current with evolving technology, computer system support and cyber security compliance, quality assurance, securing databases for Joint Integrated Lifecycle Surety (JILS) activities, nuclear enterprise assurance, and liaison support between design laboratories and production plants. These endeavors support multiple systems in the existing stockpile and reduce multi-faceted risks that can affect operations and procedures for these systems.

The R&D Support mission scope includes:

(1) R&D Infrastructure Support – Addresses laboratory work that maintains the technical and scientific base including equipment, staff, and facilities. Specific activities include maintaining and upgrading computation/simulation systems and licenses, developing R&D staff with the technical skills and knowledge required to be proficient at core product testing and experimentation, and applying any tax that may be levied on an R&D program for building and capital use.

(2) Program Management and Integration for R&D Activities – Includes maintaining financial databases, milestone tracking, risk analyses, and R&D support for the POG and the NWSSG. Specific activities include overseeing aspects of DSW Program Management, assigning R&D laboratory personnel/assignees to external/offsite federal organizations, and managing and executing R&D support service contracts.

(3) Laboratory Research and Development Support to the Production Plants – Covers laboratory work required to support the production plants' R&D activities.

(4) Quality Control for Research and Development – Ensures that quality control procedures, methods, and processes are implemented in R&D activities.

(5) Joint Integrated Lifecycle Surety (JILS) – Provides support to assess weapon-venue specific challenges and recommends solutions to improve safety and security issues in conjunction with the weapon systems groups. JILS maintenance consists of database administration and the upkeep of the hardware and software required to maintain normal operations of the tool.

(6) Nuclear Testing Heritage (NTH) – Funds general and non-nuclear test readiness through advanced scientific and technology development. NTH supports legacy commitments such as the Nuclear Testing Archive. It also funds efforts to preserve and make accessible nuclear test data at the design laboratories.

(7) Nuclear Enterprise Assurance – Activities are related to site-specific policy development, program management, and implementation of the Nuclear Enterprise Assurance program within NNSA laboratories.

(8) Archiving Data and Management (ADAM) – Conserves historical records, knowledge, and data derived from the nuclear testing era and makes this data easily accessible to members of the stockpile stewardship community with requisite clearances and need-to-know.

Research and Development Certification and Safety (RDCS)

RDCS provides the engineering, applied research, development, and integration of capabilities for NNSA's stockpile stewardship efforts. This is accomplished through early development of components to replace sunset technologies, nuclear safety assessments and studies, systems engineering, new engineering models and algorithms, and design studies with the objective of advancing technologies sufficiently to be adopted for future insertions. The RDCS subprogram also conducts scaled demonstrations of technologies anticipated for insertion into the stockpile in order to validate performance against anticipated requirements and maintains NNSA's base hydrodynamic and subcritical experiment capabilities. The RDCS scope of responsibilities includes (1) Technology Development and Integration (formerly Weapon Component Development), (2) Technology Demonstrations, (3) Applied R&D Studies, including support for the annual assessment of the U.S. stockpile, and (4) Base Hydrodynamic and Subcritical Capabilities.

The RDCS mission scope includes:

(1) Technology Development & Integration (TDI) – Activities associated with the development, engineering, and integration of technologies that ensure the reliable performance, safety, and handling of all current and future stockpile systems. TDI oversees the early-stage development and testing of all weapon components targeted to replace sunset technologies and modernize subsystems, defined as components facing performance, aging, and/or security issues that can have negative impacts on the performance and safety of a weapon. TDI activities reduce stockpile risk, costs, and uncertainty in operations, maintenance, and safety. Moreover, TDI investments facilitate the expertise and knowledge necessary to sustain and enhance these capabilities. Weapon subsystems supported by RDCS include:

- **Gas Transfer Systems (GTS):** Activities associated with enhancing the design and capabilities of LLCs to offset weapon aging and uncertainty issues.
- **Neutron Generators (NGs):** Activities required for continual development and improvements associated with NG technologies to offset aging effects including components and materials, and development and qualification of improved radiation-hardened (rad-hard) ferro-electric and ELNG designs.
- **Arming, Fuzing & Firing (AF&F):** Required R&D activities needed to upgrade arming, fuzing, and firing subsystems that incorporate trusted microelectronics, control systems, and additional features, including new architectures that enhance agility, adaptability, and modularity.
- **Nuclear Explosives Package (NEP) and Related Components:** R&D activities in support of technologies required for next generation components and materials required to ensure safety, security, reliability, and performance of the aging NEPs of the enduring stockpile. Includes investigation and modeling of advanced initiation system dynamics, structural mounts, and replacement materials.
- **Material Science and Component Engineering:** Small research projects associated with applied material science and integration of technologies including, but not limited to: telemetry, initiation systems, detonators, sensors, testers, etc.
- **Energetics:** Mature advanced power source technologies to support future tactical and strategic weapon system LEP insertions including mature explosive materials, technologies, tools and processes to support future tactical and strategic weapon system LEP insertions.

(2) Technology Demonstrations (TD) – Work associated with research and development testing and evaluation activities including systems engineering and integration, test article purchase, development, build/modification, and installation, overhead (possible cost associated with platform and facility and associated infrastructure), data acquisition, analysis, and storage, and other activities and expenses associated developmental testing of one or more maturing technologies. This work includes two fundamental programmatic areas:

- **Joint Technology Demonstrator (JTD):** The JTD is a U.S. /UK strategic collaboration dedicated to the design and development of a series of joint integrated system demonstrations supporting new safety, security, and advanced manufacturing technologies. A goal of the JTD collaboration is to sustain core capabilities throughout the U.S. and UK nuclear weapons enterprise in the design, manufacture, ground testing, and assembly of flight-ready hardware. The collaboration exercises and matures capabilities in nuclear weapon science, component and subsystem technologies, cost- and time-efficient production methods, and systems integration, and seeks to reduce future programmatic risk, development and technology insertion time, and life cycle costs. These efforts target the highest risk capabilities and technologies required to minimize the risk to future weapon development activities, and has a nearer term focus than that of the Stockpile Responsiveness Program. It does not exercise all capabilities in all phases of the weapon lifecycle due to limited resources. JTD encompasses three distinct workstreams: 1) Workstream 1 is the NNSA, US Navy, and MOD collaboration developing a system architecture within the Mk5 aero shell, 2) Workstream 2 is the NNSA and USAF collaboration developing a system architecture with the Mk21 aero shell, and, 3) Workstream 3 is collaborative technology maturation between the MOD and NNSA.
- **Future Demonstrators:** Work associated with research and development test and evaluation activities using demonstrator platforms such as Superfuge, vibrafuge, sounding rockets, and ground test units (GTUs), excluding JTD-related activities, to gain confidence in technology enhancements (i.e., safety, security and performance). The work is recommended to increase the frequency of technology performance data collection to drive shorter development, transition, and implementation timelines.

(3) Applied Research and Development (R&D) Studies – Applied R&D includes establishing system-level context and associated requirements for fundamental technology development, weapon certification and safety processes, weapons effects assessments, and vulnerability studies. Specific applications include: Independent Nuclear Weapons Assessment (INWAP) and activities associated with planning, data exchange and conducting cross- laboratory assessments of weapons.

- Weapons Effects Studies: Weapons effects studies complementary to the Nuclear Survivability subprogram of the Engineering program.
- Weapon System Architecture Studies: Activities associated with defining system architectures to support future life extension and Alt programs, which improve surety and performance, reduce lifecycle costs, and provide the framework for fundamental technology development.

- Primary and Secondary Assessments: Activities associated with conducting annual assessment and certification of weapon primaries and secondaries.
- Assessment Methodologies Testing and Development: Activities associated with advancing the processes and data used for annual assessment of the stockpile.

(4) Base Hydrodynamic and Subcritical Capabilities: Includes activities required to ensure the base hydrodynamic capability is available to support experiments across multiple systems and system level experiments; activities associated with designing, preparing, and assembling diagnostic capabilities for multiple systems base hydrodynamic experiments and sub-critical tests experiments; activities associated with providing inputs and updates to the National Hydro Test Plan for multiple systems; activities associated with fielding and executing experiments, initial analyses of the experimental results through data reduction, and disposition of expended of hydrodynamic experiments and sub-critical tests; and activities associated with conducting and analyzing results of hydrodynamic experiments for certifying LEPs.

Management, Technology, and Production (MTP)

The MTP program is a multi-system production based program that enhances NNSA's nuclear security enterprise integration and efficiency. MTP funding is used to provide plant and laboratory personnel to sustain the stockpile, including activities relating to surveillance laboratory/flight test data collection and analysis; weapons reliability reporting to the DOD; weapon logistics and accountability; engineering authorizations; safety assessments; Use Control technologies used to keep weapons safe, secure, and available to the war fighter upon Presidential release authority; base spares used to sustain weapons in a safe reliable status; studies evaluating nuclear weapons operations safety; weapon components for use in multiple weapons systems; multi-weapon system transportation/handling gear/containers used to safely and securely store and transport weapons between DOD and DOE sites; and stockpile planning. MTP provides a coordinated enterprise wide product realization enterprise approach for weapon design and information systems used for weapon stockpile accountability reporting used to report quantities, values, and status to Congress.

The MTP mission scope includes:

(1) Product Realization Integrated Digital Enterprise (PRIDE): Operation and maintenance of 44 classified electronic information management systems that provide optimized and secure information management capabilities required to share information across the NNSA nuclear security enterprise on weapons design, manufacturing, surveillance, accountability, vendor material purchases, LLC exchanges, dismantlement, and refurbishment;

(2) Weapons Training and Military Liaison: Staffing the multi-weapon subject matter experts for Unsatisfactory Reports (URs) associated with DOD's field issues for testing and handling gear, Technical Publications, and coding issues that allows maintenance operations to return weapons to active status. Additionally, this activity sustains critical manufacturing skills required at enterprise sites;

(3) Studies and Initiatives: Activities that re-establish critical depleted uranium-related capabilities including skilled labor; casting, rolling, forming, and machining at Y-12 to manufacture cases and CSAs for the stockpile and LEPs; and upgrades the enterprise's weapons LAPS system;

(4) General Management Support: Non-programmatic costs for program management and oversight, shared taxes, assignees, and support services contracts;

(5) Assessments & Studies (Use Control): Includes in-depth vulnerability assessments of nuclear weapons in the stockpile; identifying or developing and deploying common technologies to address vulnerabilities, if found; and special studies to support the decision processes for optimizing LEP designs and for option down-select decisions by senior officials;

(6) Surveillance: Efforts that focus on multi-system, common use, or non-weapon specific activities (data capture, flight test planning) supporting stockpile evaluation, including activities and new capabilities for surveillance transformation;

(7) External Production Missions: Provides weapon response subject matter experts across all systems and all laboratories weapon response manning is critical to sustain safe operations (should an unexpected weapon condition or anomaly be observed during operations) to support weapons delivery schedules. Supports Nuclear Safety Research and Development activities associated with nuclear operations leading to development of safety technologies with strategic partners; and improvements in safe nuclear explosive operations;

(8) Base Spares (Production): Activities that produce new non-weapon specific base spares, containers, LLC forgings, detonators, mock HE, and other weapon components; and

(9) Base Spares (Maintenance): Activities associated with maintaining existing non-weapon specific base spares, handling gear/containers, GTSs, Use Control equipment, Code Management System equipment, test equipment, and other weapon components.

FY 2020-FY 2023 Key Milestones
Production Support (PS)

- Meet Neutron Generator (NG) Quarterly production build plan as defined in the approved Neutron Generator Enterprise Integrated Program Plan (NIPP) supporting weapon system ship/delivery schedules in accordance with Directive Documents.
- Meet Detonator production build plan as defined in the approved Detonator Production and Surveillance Program Execution Plan supporting weapon system ship/delivery schedules in accordance with directive documents.
- Execute Production Support activities to enable on-time completion of DSW deliverables by ensuring Process Equipment Availability.

Research and Development (R&D) Support

- Ensure that nuclear enterprise assurance is incorporated into all developed technologies so that the risk of insertion into the stockpile is reduced.
- Accelerate archiving, indexing, and storing of historic weapon data from the nuclear testing era.
- Continue supporting legacy testing heritage commitments at Nevada.
- Continue maintenance and upgrades of computer systems and licenses to maintain and develop R&D staff.

R&D Certification and Safety (RDCS)
Will continue to:

- JTD WS1: Complete physical, environmental, and functional ground test of MK5 design, execute two developmental hydrodynamic experiments, and meet exit criteria of Gate 3 for flight ready hardware.
- JTD WS2: Conduct flight ready hardware Final Design Review, ground qualification review, and system demonstrations for the Mk21 design.
- Develop architectures that enable modularity and ease of production (e.g., standard power and communications).
- Develop a state of health monitoring capability for future systems (e.g., embedded sensors).
- Replace obsolete fuzing technologies with more capable technologies including advanced radars, path length modules, inertial measurement units, and microelectronics.
- Leverage experimental platforms to demonstrate new technologies in relevant environments.
- Annually assess and report on the safety, security, and effectiveness of the nuclear deterrent and support dual validation teams and assessments.
- Maintain and modernize the base capabilities for hydrodynamic testing to ensure the capability is available to support multiple system and system level experiments.
- Design, prepare, and assemble diagnostic capabilities for multiple system base hydrodynamic experiments and subcritical test experiments.
- Field and execute experiments, provide initial analyses of the experimental results through data reduction, and dispose of expended hydrodynamic experiments and subcritical tests.
- Support R&D studies, assessments, and analyses supporting weapon certification and safety processes, nuclear and explosives operations, and weapon effects and vulnerabilities.

Management, Technology, and Production (MTP)

- Complete and Deliver Equipment in accordance with Equipment Requirements Schedule PCD.
- Provide all Enterprise Modeling and Analysis Consortium (EMAC) decision support tasks for the requesting stakeholder, build/refine enterprise models supporting the parent site and EMAC overall, and submit accurate monthly status reports on time.
- Operate the Weapons Evaluation Test Laboratory (WETL) surveillance activities in accordance with the baseline plans.
- Complete and Deliver the WRR to NNSA.

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Stockpile Services

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Production Support (PS) $447,527,000	**Production Support (PS) $512,916,000**	**Production Support (PS) +$65,389,000**
• Provide engineering and manufacturing operations for weapon operations (W76-1 LEP, B61-12 LEP, dismantlement, and detonator cable assembly production) to meet directive schedules including revised W76-1 LEP production rate. • Provide Labor to support Purchasing, Shipping, and Materials Management. • Provide Labor and supplies for preventative maintenance and equipment calibrations. • Perform Product Certification (independent evaluation of build records) for auditing purposes. • Provide Quality Assurance and Procedural/Engineering Safety. • Provide Classified Computer Network operations and maintenance. • Continue manufacturing modernization project; project formerly named Integrated-Work Execution and Production System Project (I-WEPS). • Provide maintenance and troubleshooting support for 300 plus active testers. • Continue to maintain equipment and processes for neutron generator and power supply production to meet revised schedules. • Perform Infrastructure Modernization. • Complete special projects (Environmental Conditioning, Function Test Station Laser replacement, digital radiography in glovebox, load line 6 upgrades)	• Provide engineering operations for weapon operations including LEP, surveillance, dismantlement, and component production to meet directive schedules and meet DOD delivery schedules including: • Equipment investments for detonator and DCA production to support increasing from one to five product lines and improving yield rate. • Perform production capability infrastructure upgrades, including upgrading the Unloading Laser. • Upgrade site specific shop-floor IT hardware and software, specifically • Continuing the MMP in support of digital product acceptance, including implementing upgrades to the pit product line and developing the upgrades for the detonator product lines. • Perform routine maintenance and upgrades to the Automated Reservoir Management System. • Conduct upgrades to Neutron Generator Enterprise shop-floor controls. • Upgrades to increase efficiency supporting the increased LEP workload. • Increase intra-site logistical support required to support weapon and component moves related to production. • Continue engineering and quality assurance preparation for B61-12 non-nuclear component production. • Provide engineering and quality assurance support for internal containers that support production.	• The increase represents continued growth of base capabilities, both workforce and equipment, required to support the increased LEP workload. Engineering operations increased by $36,875,000 to ensure procedures and requisite process equipment are in place to meet LEP FPUs. Manufacturing Operations increased by $10,214,000 to produce multi-weapon legacy material for the stockpile. An increase of $25,200,000 in Electronic Product Flow supports continuing the MMP and upgrading shop-floor IT hardware and software throughout the enterprise. Funding will also be applied to new initiatives Electronic Work Instructions $2,000,000, and NEA $3,400,000, including Purchasing, Shipping and Material Management increased due to increased intra-site transportation and supply chain management needs. An increase of $2,100,000 in Tool, Gage and Equipment Services supports increased maintenance and calibration services throughout the Enterprise to meet deliverables. Other Production Support activities increased by $3,600,000 to support workload for capacity for LEPs and ALTs. These increases are partially off-set by a decrease of $18,000,000 in manufacturing operations that transferred the Material Conversion Equipment Restart Project to the new Lithium Sustainment Budget and Reporting line.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
• Expand to five (from two) Neutron Generator production lines, requiring increased quality and calibration services. • Continue preparation (engineering and quality) for B61 LEP non-nuclear components. • Continue funding Nuclear Enterprise Assurance. • W76-1 LEP plant floor and glove boxes reach steady state production (increase in upkeep of aged facilities planned to retire but now must be maintained with delay in Uranium Production Facility completion). • Hiring and training personnel for Lithium Direct Material Manufacturing.	• Provide increased labor for purchasing, shipping and supply chain management. • Continue expansion of NG production up to five product lines, requiring increased maintenance and calibration services. • Continue funding Nuclear Enterprise Assurance at all production sites. • Provide labor and supplies for increased preventative and corrective maintenance, including equipment calibration throughout the enterprise supporting increased LEP and Major Alt workload. • Provide quality assurance and procedural/engineering safety. • Perform product certification (independent evaluation of build records) for auditing purposes.	
Research and Development (R&D) Support $34,187,000	**Research and Development (R&D) Support $38,129,000**	**Research and Development (R&D) Support +$3,942,000**
• Continue to develop and demonstrate quantification of margins and uncertainties (QMU) and apply QMU methodology toward assessment, certification, and qualification needs for the stockpile. • Continue providing scientific and technical support to the production plants to help achieve weapon production directives. • Electronically archive weapon data necessary to validate and verify predictive computational capabilities and simulations. • Support design and production agency experts serving detail assignments at NNSA HQ to provide technical advice and support.	• Continue supporting the operation and maintenance of the JILS database at the design laboratories. • Support design and production agency experts serving detail assignments at NNSA HQ to provide technical advice and support. • Continue implementing quality control procedures, methods, and processes in R&D activities. • Support limited infrastructure support activities at the laboratories. • Maintain financial databases, milestone tracking, risk analyses, and R&D support for the POG and Nuclear Weapons Safety Study Group, including overseeing aspects of DSW Program Management, assigning R&D laboratory	• The increase represents expanded investment in weapon data archiving activities, including preservation of testing data and computer platforms for making this data available to weapon scientists. The increase also supports implementation of nuclear enterprise assurance and supply chain risk management for R&D activities.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
• Continue supporting the operation and maintenance of the JILS database at the design laboratories. • Continue supporting legacy commitments by maintaining Nuclear Testing Heritage activities. • Continue supporting the early science development of new cross cutting technologies, focusing on efforts that support weapons LEPs, including development of radiation hardened transistors and advanced radiography technologies. Continue supporting legacy commitments from nuclear testing. This includes seismic monitoring, groundwater maintenance, protection, maintenance of certain test facilities and equipment, maintaining the Nuclear Testing Archive, and accelerated efforts to stabilize and digitize nuclear testing data.	personnel/assignees to external/offsite federal organizations, and managing and executing R&D support service contracts. • Perform the laboratory work required to ensure that the production plants have the ability to execute directed R&D work. • Implement nuclear enterprise assurance and supply chain risk management for R&D activities. • Continue to support staff integration into U.K. work flow in order to bolster collaboration JTD technology maturation activities. • Continue to build a digital archive of data from the nuclear testing era accessible to researchers to support stockpile stewardship activities. • Support design and production agency experts serving detail assignments at NNSA HQ to provide technical advice and support. • Continue supporting legacy commitments by maintaining Nuclear Testing Heritage activities.	
R&D Certification and Safety (RDCS) $156,481,000	**R&D Certification and Safety (RDCS) $216,582,000**	**R&D Certification and Safety (RDCS) +$60,101,000**
• Continue supporting the ISA project for enhanced surety and security during transportation of nuclear weapons between DOE and DOD sites. • Continue annually assessing the safety, security, and effectiveness of the enduring weapons systems in the stockpile, reporting weapon system status ultimately to the President, and determine if an underground test is required to solve a problem. • Address and resolve SFIs and emerging stockpile issues in accordance with the currently approved baseline closure plans.	• Continue development efforts for long-life GTS design options. • Increase technology development activities for the development of high energy, low sensitivity energetic components for future systems, as well as additively manufactured high explosives. • Continue executing the JTD project according to given schedule and objectives. • Continue development and testing of conformal thermal batteries, abnormal launch accelerometers, and replacement inertial sensor technologies.	• The increase represents investments in low cost alternative demonstrators for future systems (e.g. IW series) to demonstrate capability enhancements. This program also expands partnership with the US Air Force to conduct Work Stream 2 Phase 2 flight tests under the Program; an increase for the Dual-Axis Hydrodynamic Test Facility and Site 300 to support hydrodynamic experiments in early FY 2019; and an increase for development of base capabilities needed for the execution of 2 subcritical experiments a year with improved diagnostics.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
• Continue upgrade of the Code Management System for the legacy stockpile. • Continue limited design and development of LLCEs such as NGs, GTSs, energetics, and other replacement components. • Continue performing nuclear safety R&D studies and weapons effects studies. • Continue to sustain the infrastructure for conducting hydrodynamic tests in support of enduring stockpile systems and multiple system experiments. • Continue Safeguards technology development and development of hardware qualification; required computer modeling and simulation activities to sustain the stockpile. • Continue supporting stockpile primary, secondary, chemistry, and materials systems, analysis and annual assessments related to activities for the enduring stockpile. • Continue supporting subcritical integral weapons experiments. • Continue supporting independent Nuclear Weapon Assessment Teams activities within the National Laboratories to assess the state of the health and performance of the weapon systems in support of the Annual Assessment Process. • Continue development of thermal batteries, abnormal launch accelerometers, detonation monitoring assemblies and other safeguards components.	• Begin a focused effort on the development of a new warhead bus architecture and ELNG for future system insertion. • Continue development of IR rectenna, field programmable gate arrays, non-volatile memory, and radiation hardened microelectronics used to provide arming, firing, fuzing and other functions within nuclear weapons. • Evaluate options for positional aware fuzing. • Continue to evaluate the effectiveness of sounding rockets, Superfuge, and Vibrafuge for the qualification of weapon components. • Initiate integration of embedded sensors capability. • Continue development of the common high energy adaptable firing set. • Begin evaluating integrated data instrumentation capabilities for future telemetry systems. • Leverage and repurpose excess assets at the Kauai Test Facility to explore alternative options to demonstrate technology improvements for future systems. • Continue annually assessing the safety, security, and effectiveness of the enduring weapons systems in the stockpile, reporting weapon system status ultimately to the President, and determine if an underground nuclear test is required to solve a problem. • Address and resolve SFIs and emerging stockpile issues in accordance with the currently approved baseline closure plans. • Support base capabilities for hydrodynamic and subcritical integral weapons experimental programs increased cadence.	

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
	• Support multi-system R&D studies related to technology development, weapon certification, safety processes, weapons effects assessments, and vulnerability studies. • Support planned INWAP activities.	
Management, Technology, and Production (MTP) $251,978,000	**Management, Technology, and Production (MTP) $300,736,000**	**Management, Technology, and Production (MTP) +$48,758,000**
• Execute surveillance activities at a reduced level in accordance with FY 2017 Program Control Documents, and FY 2017 Integrated Weapon Evaluation Team Plans. Includes critical deferred and required multi-system surveillance activities to include testing requirements for the LEPs. • Add multi-system weapon response and external production resources to provide safety studies for un-interrupted assembly/disassembly operations at production plants. • Replace NNSA's nuclear security enterprise Image Management System (IMS) for authorized document production with the PRIME technology stack. • Study options to improve safety and use control technologies for future LEPs. • Perform Operations & Maintenance of the Integrated Digital Enterprise to collect, process, store, and transmit data among the NNSA nuclear security enterprise design and production agencies. • Respond to DOD Unsatisfactory Reports about issues with the stockpile. • Provide DOD training on weapons maintenance activities in the field. • Perform production and maintenance of test and handling gear, spare parts for DOD, and containers.	• Increase in Use Control studies and equipment procurements and equipment procurements supporting LEP FPUs, the enduring stockpile, and external deliverables. Increased Use Control training with DOD customers. • Execute surveillance activities in accordance with FY 2019 PCDs, and FY 2019 IWET Plans. Includes increased efforts at Tonopah Test Range and development of surveillance testers including stronglink, environmental, and centrifuges required to support LEP testing requirements. • Add multi-system weapon response and external production resources to provide weapon response services and conduct nuclear safety studies for un-interrupted manufacturing/ assembly/disassembly operations at production plants. • Continue the multi-year effort to upgrade and integrate the weapons LAPS system. • Sustainment of critical manufacturing skills in support of LEP production. • Perform operations and maintenance of the Integrated Digital Enterprise to collect, process, store, and transmit data among the NNSA nuclear security enterprise design laboratories and production plants. • Respond to DOD URs about issues with the stockpile.	• The increase represents growth in multi-weapon activities needed to support fielding the LEPs following FPU. Specifically, an increase of $2,944,000 in maintenance of base spares provides corrective maintenance required on DOD returned equipment required to support initial fielding of the upcoming LEPs, an increase of $3,900,000 in production of base spares ensures replacement test and handling equipment is provided with sufficient lead time to support the LEP FPUs, and an increase of $3,500,000 in weapons training and military liaison provides additional training courses supporting DOD fielding of the LEPs and increases the workforce responding to Unsatisfactory Reports from the field. An increase of $5,000,000 in Studies and Initiatives will fund the new Models-Based Environment. An $8,614,000 increase in Surveillance for increased efforts at Tonopah Test Range and development of surveillance testers including stronglink, environmental and centrifuges to support LEP testing requirements. Assessment and Studies is increasing $16,800,000 due to development costs. Additionally, there will be an increase of $3,000,000 per year over the FYNSP due to a special material cost spike. MTP also acquired

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
• Execute production of weapon components for use in multiple weapon systems (examples: Batteries, Stronglinks, switch tubes, polymers, and containers). • Conduct program management and oversight of weapon sustainment activities. • Maintain Uranium processing capability. • Conduct weapons Use Control Studies. • Replacement of the multi-port test valve for the GTS function testing for all systems. • Support efforts to attract and sustain an appropriately skilled workforce, including a Weapons Intern program; recruiting and retention programs to fill critical, skilled positions in science and manufacturing; and technical skills training to maintain proficiency in existing technologies and develop proficiency with new technologies.	• Provide DOD training on weapons maintenance activities in the field. • Perform production and maintenance of test and handling gear, spare parts for DOD, and containers. • Execute production of weapon components for use in multiple weapon systems, for example, batteries, stronglinks, switch tubes, polymers, and containers. • Conduct program management and oversight of weapon sustainment activities. • Continue re-establishing additional uranium processing capabilities.	$5,000,000 of scope under the nuclear safety research and development portfolio.

Directed Stockpile Work
Strategic Materials

Description
The Strategic Materials program consolidates management of nuclear material processing capabilities within the NNSA nuclear security enterprise. The program includes Uranium, Plutonium, Tritium, and Lithium Sustainment; Domestic Uranium Enrichment; and Strategic Materials Sustainment.

Uranium Sustainment
The NNSA Uranium Sustainment Program implements elements of the NNSA's Uranium Mission Strategy associated with phasing out mission dependency on Building 9212. This requires sustained resources across a multi-year period to systematically plan and execute all phases of the 9212 Exit Strategy. Uranium Sustainment specifically supports the transition of Building 9212 capabilities into existing and new-build facilities, as well as implementing a coordinated exit strategy to end production operations in Building 9212 and begin post operations clean out activities. The program sustains existing enriched uranium capabilities through enhanced equipment maintenance and the purchase of critical spare parts to improve the availability and reliability of production systems. Uranium Sustainment enables Area 5 de-inventory activities to reduce safety risks and establishes target working inventory levels for the production facilities, and optimizes the material composition of the inventory. Program funding supports investments to extend the operational life of building(s) 9215, 9204-2E and 9995. Additional investments critical to the overall Uranium Mission Strategy are funded under the Process Technology Development subprogram within Advanced Manufacturing Development.

Uranium Sustainment activities include the following:

(1) Phasing out mission dependency on Building 9212 by supporting the transition of enriched uranium capabilities into existing and new-build facilities.

(2) Developing plans and executing actions to implement the Building 9212 Exit Strategy.

(3) Continuing Area 5 de-inventory efforts to reduce safety and security risks, achieving and maintaining target working inventory levels, and optimizing the material composition of the uranium inventory.

(4) Developing, sustaining, and increasing the reliability of uranium scientific and manufacturing capabilities to reduce mission risks.

(5) Investment to extend the operational lifetime of existing enriched uranium facilities.

Additional work related to phasing out mission dependency on Building 9212 is described in the Process Technology Development line within the Advanced Manufacturing Development program.

Plutonium Sustainment
The NNSA Plutonium Sustainment Program provides a plutonium-based component manufacturing capability at reliable capacities to sustain a safe, secure, and effective nuclear deterrent. The program provides the equipment and personnel necessary to fabricate plutonium pits, qualify and certify produced pits for stockpile use, and manufacture precision plutonium devices for science-related evaluation. The program supports the requirements for pit production outlined in the FY 2015 National Defense Authorization Act (NDAA) which directs NNSA for the capacity to produce 10 war reserve pits in 2024, 20 war reserve pits in FY 2025 and 30 war reserve pits in FY 2026. Additionally, the program recovers ^{238}Pu for Defense Programs and invests in ^{238}Pu-related capabilities ($88,500,000) for the stockpile.

Plutonium Sustainment includes the following:

(1) Plutonium pit process engineering, process qualification, pit manufacturing, pit manufacturing equipment and personnel, pit fabrication tooling design and manufacturing, and non-nuclear pit component manufacturing.

(2) Design laboratory and production agency activities for plutonium stockpile product development.

(3) Engineering and physics-based evaluation and testing of development pits necessary for war reserve production.

(4) Fabrication of design definition development pits that explore new design features.

(5) Fabrication of plutonium devices for science and stockpile-related subcritical experiments.

(6) Recovery and reclamation of strategic quantities of ^{238}Pu for stockpile needs.

(7) Plutonium manufacturing support efforts such as radiological control program, facility and equipment maintenance, criticality safety program, shipping and receiving, authorization basis, work control documentation, training and qualification, and spare parts.

(8) A variety of critical support activities including waste management, storage capability, and nuclear operations infrastructure and facility configurations that are required to maintain plutonium capabilities.

(9) Other project costs associated with pre-conceptual design efforts supporting the selection of a single preferred alternative for plutonium pit production beyond 30 war reserve pits per year.

Tritium Sustainment
The Tritium Sustainment Program operates the national capability for producing tritium and is building the additional capacity required for national security requirements. Since FY 2003, NNSA has been producing tritium by irradiating Tritium-Producing Burnable Absorber Rods (TPBARs) in the Watts Bar Unit 1 (WBN1) nuclear power reactor operated by the Tennessee Valley Authority (TVA), during normal 18-month operating cycles. Annual extractions of tritium from TPBARs at the TEF began in FY 2007. The program maintains a contingency option to use reactors at TVA's Sequoyah site for backup. The tritium inventory is needed to support Limited Life Component Exchanges (LLCEs) for tritium reservoirs that are deployed in the stockpile. NNSA has coordinated with DOD to determine the tritium requirements needed for national security, and provides annual updates to DOD on tritium production and inventory status. Tritium is not consumed in the stockpile but radioactively decays at approximately 5.5% per year, requiring ongoing replenishment. Long-term tritium production schedules, based on detailed computational models and annual inventory reconciliations, are carefully calibrated to provide the required and reserve amounts, and production planning takes into consideration the material that is constantly being recovered and recycled from deployed reservoirs, including those from weapon dismantlements. Based on the updated tritium requirements, certified by the Nuclear Weapons Council, efforts are underway to obtain NRC approval for WBN2 as the second reactor for tritium production, to begin irradiation of TPBARs in early FY 2021.

The Tritium Sustainment mission scope includes:
(1) TPBAR Technology: Tritium production requires active design, surveillance, and research and development efforts to support irradiation of TPBARs by TVA. This includes post-irradiation examination of limited use assembly (LUA) TPBARs to evaluate the performance effects of component vendor changes and design refinements, as well as providing the technical evaluation, monitoring, and analysis required by the NRC. Each TPBAR irradiation cycle at TVA requires design analysis and certification of the TPBAR for each new fuel core design configuration. Test and evaluation efforts in Idaho National Laboratory's (INL) Advanced Test Reactor (ATR) are underway to understand the time-release performance of the lithium-aluminate pellets and to evaluate pellet configurations with less volume. Void volume in the TPBAR is a limiting factor on TPBAR failures in a reactor accident, and thinner pellets would increase internal void volume, reducing internal pressure, and possibly allowing for lower fuel enrichment and improved reactor operating conditions. Reducing TPBAR internal pressure could also reduce the permeation release of tritium from the TPBARs to the reactor coolant system, and to the environment. In addition, other tests are required to understand indications of an in-reactor TPBAR failure, a dropped TPBAR in the spent fuel pool, and the shelf-life limitation and storage requirements for TPBAR components. Technology also includes providing safety analysis to support licensing actions, and maintaining design and quality programs to support TPBAR fabrication.

(2) TPBAR Fabrication: TPBAR fabrication involves commercial contracts for maintaining the fabrication prime contractor and its subcontractor supply chain, who provide a dozen specialized components. These components are assembled into TPBARs required to meet each 18-month refueling cycle at TVA's reactors. This includes maintaining vendors that employ the processes for producing the plated zircaloy getters and the specially coated stainless steel cladding tubes that, respectively, enable the TPBAR to trap tritium within and minimize its permeation to the reactor coolant system. The TPBAR fabrication vendor has recently restarted production of zircaloy liners and lithium-aluminate pellets that were produced in large batches more than 10 years ago and have now been expended.

(3) **TPBAR Irradiation:** The production of tritium occurs in TVA's nuclear reactor when lithium-aluminate pellets in the TPBAR are bombarded by neutrons over a period of 18 months. DOE and TVA entered into an Interagency Agreement in 1999 under which TVA provides irradiation services in accordance with the national security provision in TVA's original charter. This Interagency Agreement is subject to the Economy Act that requires TVA to be reimbursed for all tritium related costs, but no profit. There are two main costs associated with providing reactor fuel for tritium production. TVA computes the cost of reactor fuel with and without TPBARs and invoices NNSA for the cost of the excess fuel required. Current national policy requires that TVA use only unobligated low enriched uranium (LEU) fuel for tritium production, that is, fuel not restricted to peaceful uses by foreign agreements or presidential declarations; NNSA must pay any difference in the price of unobligated enrichment compared to fuel TVA obtains for its Brown's Ferry reactors on the open market. At present, unobligated fuel purchased by TVA will come from Energy Northwest (ENW), who entered into a contract in May 2012 to enrich a quantity of DOE's high assay tails, or depleted uranium, at the Paducah Gas Diffusion Plant before it shut down in May 2013. At that time, the enrichment price to TVA was set at $150 per separative work unit in FY 2012 dollars, escalated at two percent a year. The subsequent softening of the uranium fuel market after the Fukushima event and due to recent worldwide energy surpluses has caused the enrichment price differential payments to increase significantly compared to original estimates; fuel deliveries from ENW will continue through FY 2022.

(4) **TPBAR Transportation:** After the TPBARs are irradiated for 18-months, the radioactive TPBARs are loaded into consolidation canisters, placed in specialized shipping casks, and trucked from TVA to the TEF at SRS. This transportation, which also provides for commercial security protection for the shipments, is handled by a commercial contractor under long-term contract to NNSA. In addition, radioactive-contaminated hardware fixtures used in tritium production are transported to the Nevada National Security Site (NNSS) for disposal after each irradiation cycle.

(5) **TPBAR Extraction**: TPBAR extraction takes place at the TEF at SRS. TPBARs are received in shipments from TVA in batches of 300 TPBARs per canister. Prior to extraction, TPBARs are prepared by cutting the head off each individual rod. After this process, a canister containing the TPBARs is moved into the extraction furnace where a special vacuum-thermal process is employed to extract the tritium. Once waste gases are separated from the product gas, the purified tritium is piped directly to the loading and unloading facility, next door at SRS, where it is loaded into gas transfer systems to meet the schedule for limited life component exchanges for deployed units under custody of the DOD. In FY 2017, the TEF conducted three extractions in succession; two a year are planned for FY 2018 and 2019. This is to provide vital production for the inventory and to exercise and evaluate the processes that will be required when the TEF will go up to as many as seven extraction a year. TEF control room operator recruiting and training have already begun to prepare for the full operations tempo in the near future. FY 2019 project work is for evaluation of zinc-65 abatement options and replacement of an obsolete security access system.

Lithium Sustainment

The Lithium Sustainment Program supports a LBS that includes maintaining the production of the nation's enriched lithium supply in support of Defense Programs, the DOE Office of Science, the Department of Homeland Security, and other customers. In addition, the program supports management of applied technologies that will aid in bridging the existing lithium capability to a new and safer Lithium Production Capability (LPC). The creation of this program in FY 2019 results in a net-zero funding and scope transfer from Stockpile Services (Production Support), Recapitalization (Capability Based Investments), and Strategic Materials Sustainment (Material Recycle and Recovery).

The Lithium Sustainment mission scope includes:

(1) **Produce and maintain the lithium material inventory to meet DP mission requirements and other customer deliverables:** Lithium material is currently supplied by both direct material manufacturing (DMM) and lithium conversion. DMM is a process that uses lithium recovered from retired weapons and recycles it for use in the current stockpile. NNSA's plan is to rely on DMM supplies to meet the demand as much as possible, since our purified lithium chloride supply is limited and our lithium purification capability is no longer available without extensive equipment set

reinvestments. It should be noted that lithium supply through DMM is dependent on weapon dismantlement funding resources and schedule. Supply may also be impacted by DOD's desire to retain certain weapons in the stockpile. Also, NNSA must continue to qualify additional retired systems for use in the DMM process and is a requirement of the supply chain.

In order to have sufficient quantities of material available for lithium production using the DMM process, the Dismantlement/Disassembly Plans and Retention List found in the NNSA Nuclear Weapons Production and Planning Directive (P&PD, current revision) is monitored and adjusted, as necessary, to incorporate dismantlements of retired weapons to provide lithium material feedstock.

(2) Reestablish a conversion capability of lithium chloride (LiCl) to lithium hydride and/or lithium deuteride (LiH/LiD): In addition to the DMM process, the current supply strategy also contains a plan to convert and use our on-hand purified LiCl. Lithium conversion involves chemically converting LiCl to Lithium metal and then reacting the metal with hydrogen or deuterium to produce LiH or LiD via wet chemistry processing. A significant inventory of production ready LiCl and Li metal is in storage at Y-12. This material was processed in the lithium purification area of Y-12 Building 9204-2 before it was shutdown. The Material Conversion Restart Project (formerly held by Production Support) is restarting the equipment and funding will also support the operations and maintenance of the electrolytic cell and hydriding reactors to convert the LiCl and Li metal to usable lithium hydride. NNSA is still evaluating options for reestablishing lithium purification including outsourcing the capability.

(3) Recapitalize process equipment to sustain process capabilities: Ongoing repairs and upgrades to process equipment are necessary to sustain safe operations and meet DP requirements. Lithium Sustainment supports projects to refurbish key equipment, address deferred maintenance, and restart the metal conversion operations. Recapitalization investments sustain our ability to conduct lithium operations while in Y-12 Building 9204-2 until a new LPC is established.

(4) Development, maturation, and deployment of lithium purification and production technologies in support of the LBS and LPC: NNSA is pursuing other risk mitigation actions such as development and deployment of safer and more efficient alternative lithium purification technologies. In order to minimize technical risk and successful insertion into a new LPC, the technologies should reach a TRL-7 or higher by Critical Decision 2 (CD-2) in accordance with DOE Policy. Successful material processing and manufacturing technology deployment will mitigate future material availability risks while providing the supply more efficiently and effectively.

Domestic Uranium Enrichment

The Domestic Uranium Enrichment (DUE) Program is responsible for establishing a reliable supply of enriched uranium to support U.S. national security and non-proliferation needs. Program requirements include providing unobligated uranium to support tritium production as well as varying uranium assays and forms to provide fuel for research reactors and naval reactors. The DUE program is implementing a three-prong strategy. First, the DUE program will down blend identified HEU from the uranium inventory to extend the need date for unobligated low enriched uranium fuel for tritium production. Down blending contracts are anticipated to be managed through Defense Programs beginning in FY 2019. Second, DUE will work to preserve and advance uranium enrichment expertise and technology to meet current and future U.S. government needs. Research and development activities will develop centrifuge technology, improve knowledge of uranium enrichment, and establish and maintain a core of personnel, laboratories, and equipment. Third, DUE will lead the acquisition process to reestablish a domestic uranium enrichment capability to support tritium production in the future.

The Domestic Uranium Enrichment mission scope includes:

- Activities to preserve and advance uranium enrichment expertise and technology to meet current and future U.S. government needs.
- Acquisition activities to re-establish a domestic uranium enrichment capability to support tritium production in accordance with the DOE O413.3B acquisition process.
- Manage down blending of HEU from the uranium inventory.

Strategic Materials Sustainment
The Strategic Materials Sustainment program is responsible for the planning of, prioritizing, and supplying required quantities of materials by recycling, recovering, and storing nuclear material and select non-nuclear program material. The program develops strategies to maintain the technical base for strategic materials. The program supports the nuclear security missions, which include nuclear weapons, non-proliferation, and naval reactors activities at the eight NNSA sites: three national security laboratories, four nuclear weapons production facilities, and the NNSS. The program is comprised of four subprograms, Material Recycle and Recovery, Storage, Nuclear Material Integration, and Strategic Planning Efforts.

The Strategic Materials Sustainment mission scope includes:

(1) Material Recycle and Recovery (MRR): responsible for the recovery and recycle of material streams necessary to maintain the nation's nuclear deterrent and provides recapitalization investment for the processes and human capital necessary to safely sustain the highest quality operations in an efficient manner.

The MRR subprogram provides a collaborative interface with Uranium, Plutonium, Tritium, Lithium Sustainment, and (Nuclear Material Integration) NMI to develop production milestones and program goals that reduces legacy material accumulation and supports reduction of Material at Risk (MAR), improves supply chain efficiency, dispositions process by-products, and delivers material products to the next program/process customer.

MRR activities support the implementation of new, as well as improved processes for fabrication and recovery operations, material stabilization, conversion, and interim storage. Other uranium related mission work supported by MRR funding includes maintaining a purified metal production capability needed for LEPs and Naval Reactors, in addition to processing and disposition of legacy materials to meet the goal of phasing out mission dependency on Building 9212. MRR also provides investment in supply chain capability for high purity depleted uranium feedstock to enable a sustained procurement of the material to meet mission requirements. Lithium related mission work scope and funding is now supported by the Lithium Sustainment Program.

MRR provides funding for the Chemistry and Metallurgy Research (CMR) de-inventory effort, the Confinement Vessel Disposition project, Weapons Engineering Tritium Facility (WETF) de-inventory and the processes to support PF-4 vault de-inventory in order to consolidate and disposition excess materials, provide required capability for Defense Program's needs, and reduce nuclear safety risk and personnel radiological exposure. Sustaining capabilities to effectively and efficiently process nuclear materials in PF-4 enables MAR reduction and improved inventory management posture in the facility. This scope also includes recapitalization efforts to efficiently and effectively sustain processing capabilities.

MRR provides funding for the operations associated with the recovery of tritium supporting Limited Life Components (LLCs). MRR capabilities provide the purified tritium supply for the entire inventory. This scope also includes recapitalization efforts to effectively and efficiently sustain processing capabilities.

(2) Storage: provides for storage and management of pits, plutonium, enriched and depleted uranium, lithium, weapons components and other materials. The Storage subprogram also includes long-term planning, forecasting and analysis of materials required for the manufacturing strategy in support of the nuclear weapons stockpile. Storage is an integral part of the de-inventory supply chain. Storage also includes recapitalization efforts to effectively and efficiently sustain these capabilities in support of the mission.

The Storage scope includes development and implementation of containers compliant with DOE Manual (M) 441.1-1. The program also supports operations within these storage facilities including measures to reduce operational risk through improved consumables inventory/supply chain management systems, optimized footprint utilization, and sustainability of processes. The program also supports deliverables to maintain DOE Order 410.2 compliance. All Storage programs at the sites are deploying recapitalization plans and comprehensive assessments of the storage process and feedstock system health.

(3) Nuclear Materials Integration (NMI): maintains and operates the Nuclear Materials Management and Safeguards System (NMMSS), which tracks and accounts for nuclear materials at DOE and Nuclear Regulatory Commission-licensed sites, and the Nuclear Materials Inventory Assessment (NMIA) that manages use and demand of accountable nuclear materials by DOE and NNSA laboratories and production plants. NMI also consolidates and disposes of excess NNSA nuclear materials and other unclaimed materials. This includes inactive actinides activities that ensure programmatic materials not in active use are properly characterized and safely packaged, and that unclaimed materials have an appropriate disposition path. NMI is also responsible for the funding and management of the DOE Lead Material Management Organization (LMMO) for Heavy Isotopes and the Nuclear Materials Archive LMMO in cooperation with the Offices of Intelligence and Counterterrorism.

(4) Strategic Planning Efforts (SPE): Initiates programmatic planning for the development of infrastructure strategies for high explosives (HE), lithium, micro-electronics, beryllium, tritium, and other capabilities. These strategies focus on ensuring NNSA maintains the technical base for certain materials of strategic significance, and has sufficient capabilities to support the enduring stockpile. Strategic planning facilitates early research into cost-effective solutions to technical, material, personnel, and logistics issues. It provides solutions to be undertaken before these issues begin to negatively impact the enduring stockpile. In addition, it also seeks to optimize resource utilization across the nuclear weapons complex and reduce uncertainty before committing major investments into solutions.

FY 2020 - FY 2023 Key Milestones
Uranium Program
- Execute the Building 9212 Exit Strategy including clean-out of chip cleaning and briquetting process areas and establishing a robust decontamination, sorting and segmenting capability.
- Achieve Area 5 Deinventory program goals and reach target working inventory levels in Building 9212:
- Complete upgrades to select uranium capabilities to enhance reliability and reduce mission risks. Implement the first planned maintenance outage as part of the Extended Life Program for Buildings 9215 and 9204-2E.

Plutonium Sustainment
- Continue investments in pit manufacturing personnel and equipment in support of Nuclear Weapons Council requirements for the capacity to produce 10 war reserve (WR) pits per year (PPY) in 2024, 20 WR ppy in 2025, and 30 WR ppy in 2026.
- Build and certify the W87 like pit design including production of development pits each year to sustain fabrication capability.
- Continue to fund other project costs associated with conceptual design of the selected alternative for pit production beyond 30 war reserve pits per year.

Tritium Sustainment
- Conduct successively increasing tritium producing burnable absorber rod (TPBAR) irradiation cycles at Tennessee Valley Authority (TVA), to begin producing 2,800 grams of tritium per reactor cycle by FY 2025; bring up a second reactor for tritium production by FY 2020; and use unobligated reactor fuel obtained by TVA from Energy Northwest under the Depleted Uranium Project.
- Provide technical production support and surveillance for tritium production operations at TVA by the TPBAR design authority, Pacific Northwest National Laboratory (PNNL), to ensure technical oversight in support of TVA and NRC requirements.
- Continue to improve understanding and modeling of in-reactor TPBAR performance to reduce program risks and improve the safety and reliability of the tritium production process.
- Obtain NRC approval for an improved reactor safety analysis to reduce on-going reactor fuel requirements.
- Conduct seven extractions per year at the TEF. The program is taking action to reach full extraction operations at the TEF during this time period. Perform infrastructure improvements projects for safety and control systems.
- Provide transportation for irradiated TPBARs from TVA to the TEF for extraction, and PNNL for post irradiation examination.
- Provide transportation for disposal of tritium program radioactive waste from base plates and thimble plugs from TVA.
- Maintain a risk management program including monitoring of emerging technologies for future tritium production options.
- Complete irradiation TPBARs at WBN1 and WBN2.

Domestic Uranium Enrichment Program

- Complete Analysis of Alternatives in FY2020, which will inform program strategy for continued technology development and determine path towards reestablishment of a domestic uranium enrichment capability.
- Continue down-blending identified HEU material to extend the need date for LEU fuel for tritium production.

Lithium Sustainment

- Continue to monitor, compute, and communicate dismantlement needs with WDD and other program managers to ensure an adequate lithium salt (LiH/LiD) supply.
- Continue processing LiCl material into additional lithium hydride supply.
- Continue to maintain base lithium processing capabilities and recapitalize lithium processing equipment (acquire, install, configure and authorize for operation).
- Continue maturation of lithium technologies that could be inserted in current base capabilities and utilized in the future LPC.
- Identify and pursue a replacement lithium salt purification source as necessary and execute purification of needed materials.

Strategic Materials Sustainment:

- Re-establish the high purity depleted uranium (DU) feedstock capability to enable the enduring procurement of DU in support of Defense Programs requirements.
- Continue to support DSW, Naval Reactors and Building 9212 de-inventory mission deliverables through the recycle of weapons-related materials.
- Optimize utilization of Building 9212 resources to support healthy transition of capabilities (e.g., Electrolytic Refining, Direct Chip Melt) into new (i.e., Uranium Production Facility) and enduring facilities.
  - Production Microwave use to improve overall quality of metal supply.
  - Aggressive purified metal production to improve overall quality of metal supply.
  - Processing of material forms not ideally suited for new or enduring facility operations.
  - Improve site posture regarding Material at Risk (MAR).
- Recycle and recovery of tritium supporting limited life component exchange requirements and executing a comprehensive recapitalization plan within the program to ensure effective, efficient mission critical capability sustainment.
- Accelerate PF-4 vault de-inventory project enabling footprint optimization that effectively and efficiently supports Pu Sustainment needs.
- Support healthy supply chain management of waste materials to support continued TRU waste shipments offsite, reduce MAR in PF-4, and complete final disposition of materials resulting from CMR de-inventory and the Confinement Vessel Disposition project.
- Complete process activities required in unique processing areas enabling the disposition of equipment and optimized utilization of the footprint in PF-4.
- Complete additional storage capacity projects and execute recapitalization plan to support effective and efficient surveillance of items and containers.
- Establish comprehensive Storage System Health assessments at sites with storage programs to improve process flows, reduce operational costs, and provide data to support investment in storage capability sustainment.
- Strengthen MRR process supply chains through development and implementation of improved life-cycle inventory management systems to ensure by-products and wastes are effectively managed.

Strategic Materials

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Uranium Sustainment $20,988,000	**Uranium Sustainment $87,182,000**	**Uranium Sustainment +$66,194,000**
• Continue Area 5 de-inventory efforts to reduce safety, security, and mission risks. • Operate at near just-in-time material inventories. • Continued support of efforts to develop, sustain, and increase the reliability of uranium scientific and manufacturing capabilities.	• Phase out mission dependency on Building 9212 by supporting the transition of enriched uranium capabilities into existing and new-build facilities. • Develop plans and execute actions to implement the Building 9212 Exit Strategy. • Continue Area 5 de-inventory efforts to reduce safety and security risks and maintain target working inventory levels. • Develop, sustain, and increase the reliability of uranium scientific and manufacturing capabilities to reduce mission risks. • Extend the operational lifetime of existing enriched uranium facilities.	The increase represents the following: • Reducing transition risk by accelerating planning and execution of the Building 9212 Exit Strategy. Includes support for the relocation of Building 9212 capabilities into new production environments, draining and isolating out-of-service systems, and establishing enabling capabilities for long term facility clean-out. • Reducing safety risk by continuing Area 5 de-inventory, achieving and maintaining target working inventory levels, and optimizing the material composition of the uranium inventory. • Reducing mission risk by increasing investments to sustain uranium science and manufacturing capabilities. • Reducing infrastructure risk by accelerating planning and investment to extend the operational lifetime of existing enriched uranium facilities.
Plutonium Sustainment $184,970,000	**Plutonium Sustainment $361,282,000**	**Plutonium Sustainment +$176,312,000**
• Continue to maintain base personnel while adding additional personnel to ramp up work and sustain pit-manufacturing capability. • Continue to upgrade end-of-life equipment vital to the pit manufacturing mission by significant equipment investments necessary for modernization in capability, capacity, and certification. • Invest in equipment and personnel needed to support increased pit production.	• Continue to maintain base personnel while adding additional personnel to ramp up work and sustain pit-manufacturing capability. • Continue to upgrade end-of-life equipment vital to the pit manufacturing mission by significant equipment investments necessary for modernization in capability, capacity and certification. • Invest in equipment and personnel needed to support increased pit production.	The increase represents the following: • Supports additional personnel, equipment, and certification activities needed to ramp pit production to meet mandated pit production requirements. • Supports additional infrastructure investments to meet requirements by the Nuclear Weapons Council to produce no fewer than 80 war reserve pits per year • Support engineering and alternative of analysis to inform a decision on a single preferred alternative

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
• Continue W87-like design developmental pit builds. • Continue engineering evaluation of development pits. • Continue recovery of ^{238}Pu. • Continue to fabricate plutonium experimental devices. • Contribute to the LANL Landlord Cost Recovery Program based on services for distributed, non-fixed operating costs in the plutonium facility; analytical chemistry distributed variable, non-fixed costs; and waste processing distributed, non-fixed costs.	• Continue W87-like design developmental pit builds. • Continue engineering evaluation of development pits (pit certification). • Continue recovery of ^{238}Pu. • Continue to fabricate plutonium experimental devices.	• Other project costs associated with pre-conceptual design efforts supporting the selection of a single preferred alternative for plutonium pit production beyond 30 war reserve pits per year.
Tritium Sustainment $109,787,000	**Tritium Sustainment $205,275,000**	**Tritium Sustainment +$95,488,000**
• Load and commence irradiation TPBARs in at WBN1; continue reactor core analysis for increased production and lower fuel enrichment; continue planning for a second tritium production reactor; provide fuel enrichment premiums for unobligated fuel from Energy Northwest; consolidate TPBARs for shipment to TEF; and maintain unobligated fuel inventories. • Conduct three extractions at the TEF in preparation for going to full operations mode in the future; conduct preventative maintenance to maintain TEF readiness, provide remote camera replacement and install wireless air monitor. • Maintain the TPBAR designer of record and address technical issues for increasing TPBAR production and NRC licensing actions; conduct post irradiation examination limited use assembly rods at PNNL for potential design refinements; complete irradiation of pellet performance testing at INL's ATR and ship test samples to PNNL to commence PIE; conduct tritium experiments,	• Load and commence irradiation TPBARs at WBN1; reimburse TVA for uranium fuel price differential and for obligation preservation and fuel storage; continue preparations for tritium production startup in WBN2 and submit LAR to the NRC for safety analysis to improve reactor operating margins and reduce fuel costs in the future. • Conduct two extractions at the TEF, and continue preparations to staff full operations mode with cleared and trained control room operators and associated staff; evaluate options for zinc-65 abatement and replace an obsolete security access system. • Maintain the TPBAR designer of record and address technical issues for increasing TPBAR production and NRC licensing actions; conduct post irradiation examination of pellet performance test samples from INL's ATR; support WBN2 core design and WBN1 improved safety analysis efforts; conduct tritium	The increase represents the following: • Funding for increased fuel cost, enrichment price differential and TPBAR irradiation fees at TVA. • Support staffing, training, and operations at the TEF. • Increase for TPBAR component procurements and small parts risk reduction inventory. • Increase for engineering and R&D support for startup of WBN2, pellet performance testing in INL's Advanced Test Reactor, and support of an improved reactor safety analysis.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
analysis, and modeling to reduce tritium production risks; monitor of emerging technologies with potential for tritium production to reduce long-term mission risks. • Continue procurements of new pellets, liners, full-length getters and other TPBAR components. • Complete TPBAR transport with two shipments to the TEF, and prepare a request for proposals for next TPBAR transportation contract.	experiments, analysis, and modeling to reduce tritium production risks; monitor industry developments of future technologies with potential for tritium production to reduce long-term mission risks. • Conduct four TPBAR shipments to the TEF; ship low-level hardware waste to NNSS; evaluate the conceptual design for the high capacity shipping cask, and prepare a competitive procurement for future transportation services.	
Lithium Sustainment $0	**Lithium Sustainment $29,135,000**	**Lithium Sustainment +$29,135,000**
• No Appropriated Funding.	• Continue to process LiC to LiH to support the supply. • Continue to process LiH and LiD in support of DSW deliverables. • Continue the recapitalization of process equipment to sustain process capabilities. • Continue the maturation of technologies for near term use and for inclusion into the LPC. • Support the capital acquisition of the LPC. • Continue to pursue options to reestablish conversion and purification capabilities.	• The increase represents establishment of the Lithium Sustainment line and consolidation of lithium activities held in various DSW programs in prior years.
Domestic Uranium Enrichment $50,000,000	**Domestic Uranium Enrichment $100,704,000**	**Domestic Uranium Enrichment +$50,704,000**
• Preserve and advance uranium enrichment expertise and technology to meet current and future U.S. government needs. • Continue the acquisition process to approve the alternative selection and cost range (CD-1) for a domestic uranium enrichment capability to support tritium production.	• Preserve and advance uranium enrichment expertise and technology to meet current and future U.S. government needs. • Continue the acquisition process to approve the alternative selection and cost range (CD-1) for a domestic uranium enrichment capability to support tritium production. • Initiate down blending campaign	• The increase represents initiating a down blending campaign.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Strategic Materials Sustainment $212,092,000	**Strategic Materials Sustainment $218,794,000**	**Strategic Materials Sustainment +$6,702,000**

• Continue to provide for recycling and recovery of plutonium, enriched uranium, lithium, tritium, and other materials from fabrication and assembly operations, LLCs, dismantlement of weapons, and nuclear components
  o Characterize and procuring existing supplies of high purity depleted uranium, maintain a purified metal production capability needed for LEPs and Naval Reactors, and process and dispose of legacy materials to meet the 2025 goal of ceasing programmatic operations in Building 9212.
  o Continue the CMR de-inventory effort, the Confinement Vessel Disposition project, WETF de-inventory and the PF-4 vault de-inventory.
  o Continue the operations associated with the recovery of tritium supporting LLCs. Continue recapitalization efforts to reduce operational risk incurred by utilizing equipment beyond its intended design life.
• Provide for effective storage and management of pits, HEU, and other weapon nuclear and non-nuclear materials. Includes: receipt, storage, and inventory of nuclear materials, non-nuclear materials, HEU, depleted uranium and lithium.
  o Develop and implementation of containers compliant with DOE Manual (M) 441.1-1.
  o Continue pit surveillance operations for safe storage, long-term storage of special nuclear materials, and national security inventory thermal monitoring and characterizations.
• Provide long-term forecasting, planning and analysis of materials.
• Continues to support the emphasis on nuclear material consolidation and de-inventory activities across the NNSA nuclear security enterprise.
	• Continue to provide for recycling and recovery of plutonium, enriched uranium, tritium, and other materials from fabrication and assembly operations, LLCs, dismantlement of weapons, and nuclear components.
	• Maintain a purified metal production capability needed for LEPs and Naval Reactors, and process and dispose of legacy materials to meet the goal reducing mission dependency on Building 9212.
	• Continue the CMR de-inventory effort, and the Confinement Vessel Disposition project.
	• Continue the operations associated with the recovery of tritium supporting LLCs. Improve system health by advancing recapitalization efforts to reduce operational risk incurred by utilizing equipment beyond its intended design life. Further supports improved system health through initiatives to better manage by-product generation and subsequent supply chain.
	• Provide for effective storage and management of pits, HEU, and other weapon nuclear and non-nuclear materials. Includes: receipt, storage, and inventory of nuclear materials, non-nuclear materials, HEU, depleted uranium and lithium. Develop and implementation of containers compliant with DOE Manual (M) 441.1-1. To include system health improvements through inventory management setpoint investment and footprint optimization efforts in PF-4 vault.
	• Continue pit surveillance operations for safe storage, long-term storage of special nuclear materials, and national security inventory thermal monitoring and characterizations. Reduces operational risk and improves system health, fully supporting footprint optimization efforts and
		The increase in MRR and Storage represents:
		• Funding to initiate re-establishment of a purified depleted uranium feedstock capability.
		• Decrease of $2,600,000 due to lithium scope and funding transfer to newly established Lithium Sustainment line.
		• In NMI, no significant changes.
		• In SPE, no significant changes.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
• In partnership with the NRC, operate and maintain NMMSS. • Continue activities to remove plutonium-bearing mixed oxide fuel. • Continue to treat, consolidate, and dispose of NNSA inactive actinides that are no longer required. • Continue the process and disposition of NNSA materials currently stored at non-NNSA sites, including the sodium bonded fuel experiment assemblies. • Maintain Heavy Isotopes and NNMA LMMOs, including recovery of spent Californium sources. • Continue activities to recover Pu-244 and other national asset isotopes from Mk-18a targets in storage. • Perform planning studies, research, and analyses relating to the life-cycle management of nuclear materials. • Pilot Test Recovery of University Fuels. • In SPE, complete a validation of material staging requirements, an assessment of beryllium oxide capability development, and a baselining of beryllium machining equipment. Continue long range planning to support B231 NEP Engineering and Materials Capabilities Transformation, and development of other infrastructure strategies.	reducing competition for resources in performance of surveillance requirements. • Provide long-term forecasting, planning and analysis of materials. • Continue to support the emphasis on nuclear material consolidation and de-inventory activities across the NNSA nuclear security enterprise. • Continue partnership with the NRC to operate and maintain NMMSS. • Continue activities to remove plutonium-bearing mixed oxide fuel. • Continue to treat, consolidate, and dispose of NNSA inactive actinides that are no longer required. • Continue the process and disposition of NNSA materials currently stored at non-NNSA sites, including the sodium bonded fuel experiment assemblies. • Continue support of Heavy Isotopes and NNMA LMMOs, including recovery of spent Californium sources. • Consolidation and storage of aliquots for the National Nuclear Material Archive. • Continue activities to recover Pu-244 and other national asset isotopes from Mk-18a targets in storage. • Continue performing planning studies, research, and analyses relating to the life-cycle management of nuclear materials. • In SPE, continue planning studies, analyses of alternatives, and other activities to support the development of infrastructure strategies for high explosives (HE), lithium, micro-electronics, beryllium, tritium, and other material streams and capabilities.	

Directed Stockpile Work
Performance Measures

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Annual Warheads Assessment- Annual percentage of warheads in the stockpile that are assessed to determine whether they are safe, secure, reliable, and effective.							
Target	100 % of stockpile certified	100 % of stockpile certified	100 % of stockpile certified	100 % of stockpile certified	100 % of stockpile certified	100 % of stockpile certified	100 % of stockpile certified
Result	**Met** - 100						
Endpoint Target	Annually, conduct 100% of the assessment activities to determine whether warheads in the stockpile are safe, secure, reliable, and effective available to the President for deployment						
Retired Weapons Systems Dismantlement – Complete the dismantlement of all weapon systems in excess to stockpile requirements per approved annual schedule published in the Production and Planning Directive (P&PD).							
Target	100 % of annual planned dismantlements	100 % of annual planned dismantlements	100 % of annual planned dismantlements	100 % of annual planned dismantlements	100 % of annual planned dismantlements	100 % of annual planned dismantlements	N/A
Result	**Met** - 100						
Endpoint Target	Complete between FY 2009 and FY 2022 the dismantlement of the quantity of weapons in retired status at the end of FY 2008.						
Steady State W76-1 LEP Production – The percentage of planned builds equal to the percentage of allocated funding as represented in the annual Selected Acquisition Report (SAR).							
Target	100 % of scheduled unit builds	100 % of scheduled unit builds	100 % of scheduled unit builds	100 % of scheduled unit builds	100 % of scheduled unit builds	100 % of scheduled unit builds	100 % of scheduled unit builds
Result	**Not Met** - 95						
Endpoint Target	Complete production of the NWC-approved W76-1 LEP production schedule by FY 2019.						
Tritium Production - Cumulative number of Tritium-Producing Burnable Absorber Rods irradiated in Tennessee Valley Authority reactors to provide the capability of producing new tritium to support national security requirements.							
Target	3,824 TPBARs	4,928 TPBARs	4,928 TPBARs	6,336 TPBARs	6,336 TPBARs	8,288 TPBARs	8,288 TPBARs
Result	**Met** - 3,824						

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Endpoint Target	By the end of FY 2020, complete irradiation of 6,768 Tritium-Producing Burnable Rods (TPBARs) to provide tritium for nuclear weapons. Note: The Tennessee Valley Authority (TVA) Watts Bar Nuclear Power Plant Unit 1 completes irradiation of TPBARs is completed every 18 months, or 1.5 years, in approximately October or March. For FY 2013, the irradiation cycle started in October of 2012. Thus, there is no increase to the number of TPBARs irradiated in FY 2013 and, for the same reason, no increase in FY 2016 or FY 2019. The pattern will continue through the life of the program.						

Directed Stockpile Work
Capital Summary[a]

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2017 Current	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted	Outyears to Completion
Capital Operating Expenses Summary (including Major Items of Equipment (MIE))								
Capital Equipment >$500K (including MIE)	N/A	331,571	94,590	86,790	114,047	157,404	+62,814	N/A
Plant Projects (GPP and IGPP)	N/A	41,524	20,367	20,367	34,077	33,417	+33,062	N/A
Total, Capital Operating Expenses	**N/A**	**373,095**	**114,957**	**107,157**	**148,124**	**190,821**	**+95,876**	N/A
Capital Equipment > $500K (including MIE)								
Total Non-MIE Capital Equipment	N/A	274,043	58,152	58,152	59,431	60,738	+2,586	N/A
Coordinate Measurement Machine #1, LANL	28,683	12,559	6,474	6,474	7,150	2,500	-3,974	0
Coordinate Measurement Machine #2, LANL	23,301	5,645	3,798	3,798	11,250	2,608	-1,190	0
Replacement of Electronic Beam Welder #1, LANL	12,889	6,233	3,745	3,745	2,911	0	-3,745	0
Precision Machining, LANL	9,286	6,044	2,038	2,038	1,204	0	-2,038	0
CNC Waist Banding Lathe #1, LANL	5,600	2,824	1,134	1,134	1,642	0	-1,134	0
Molecular Beam Epitaxy Tool, SNL	10,743	0	7,599	7,599	2,042	1,102	-6,497	0
CoLOSSIS II, PTX	13,292	9,618	3,074	3,074	600		-3,074	0
Glove Box Refurbishment Project I, Y-12	7,000	0	0	0	0	2,500	+2,500	4,500
Glove Box Refurbishment Project II, Y-12	7,000	0	0	0	0	0	0	7,000
5-Axis Grinder, Y-12	5,000	0	0	0	2,500	2,500	+2,500	0
High Energy Digital Radiography System, Y-12	5,000	0	0	0	2,500	2,500	+2,500	0
Multi-Mass Leak Detector, Y-12	8,200	0	0	0	2,000	2,000	+2,000	4,200
Life Extension Program Project 1, Y12	5,600	0	0	0	0	2,800	+2,800	2,800
Life Extension Program Project 2, Y12	30,000	0	0	0	0	10,000	+10,000	20,000
Life Extension Program Project 3, Y12	8,800	0	0	0	0	4,400	+4,400	4,400
Life Extension Program Project 4, Y12	20,500	0	0	0	0	5,120	+5,120	15,380
Life Extension Program Project 5, Y12	7,600	0	0	0	3,800	3,800	+3,800	0
Life Extension Program Project 6, Y12	23,400	0	0	0	0	11,700	+11,700	11,700
Parts Cleaning for Direct Lithium Material Mfg, Y-12[a]	10,300	2,000	8,300	500	0	0	-8,300	0
Lithium Salt Crusher/Grinder, Y-12[b]	8,860	0	0	0	400	8,460	+8,460	0
GEN III MPDV, LANL	6,500	0	0	0	6,500	0	0	0
Density Measurement , LANL	5,038	0	0	0	600	638	+638	3,800
New Pressure Test Glovebox, LANL	5,001	0	0	0	0	0	0	5,001

[a] FY 2016 funding is $2,000 under CBI, FY 2017 actual will be $8,300 ($7,800 WDD and $500 CBI)

[b] In FY 2018, $400K will be funded from Capability Based Investments. Remaining will be funded through Lithium Sustainment.

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2017 Current	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted	Outyears to Completion
New Trunkline for Downdraft, LANL	5,000	0	0	0	517	683	+683	3,800
New Surface Preparation glovebox, LANL	5,001	0	0	0	0	563	+563	4,438
New Entry/Exit Hood, LANL	5,000	0	0	0	0	1,500	+1,500	3,500
Dimensional Inspection Box, LANL	5,000	0	0	0	0	103	+103	4,897
Oxide Roast Glovebox, LANL	6,000	0	0	0	0	750	+750	5,250
New Cleaning Glovebox, LANL	6,501	0	0	0	0	813	+813	5,688
New Disassembly Lathe,LANL	6,501	0	0	0	0	813	+813	5,688
Foundry In-line Staging Glovebox, LANL	6,501	0	0	0	0	813	+813	5,688
Size Reduction Press, LANL	5,000	0	0	0	0	2,500	+2,500	2,500
Machining Staging Glovebox, LANL	6,500	0	0	0	0	0	0	6,500
Warm Isostatic Press, LANL	5,500	0	0	0	0	5,500	+5,500	0
Vacuum induction melter, LANL	7,500	0	0	0	0	7,500	+7,500	0
500 Ton Press, LANL	5,500	0	0	0	0	5,500	+5,500	0
Remote Sensor System (RSS), SNL	12,881	12,605	277	277	0	0	-277	0
Solvent Sprayer, SNL	5,500	0	0	0	4,500	1,000	+1,000	0
Silicon-Germanium (SiGe) Epitaxial Growth Reactor , SNL	5,000	0	0	0	0	5,000	+5,000	0
Microfab Photolithography Tool, SNL	5,500	0	0	0	4,500	1,000	+1,000	0
Total, Capital Equipment (including MIE)	N/A	**331,571**	**94,590**	**86,790**	**114,047**	**157,404**	**+62,814**	**126,730**
Plant Projects (GPP and IGPP)								
Total Plant Projects (GPP/IGPP)	N/A	41,524	19,562	19,562	19,992	20,432	+20,882	0
9212 Decon/ Sort & Seg Facility, Y-12	9,600	0	0	0	600	3,000	+3,000	6000
HEUMF Rack Reconfiguration Rows B/C, Y12	6,500	0	0	0	2,500	4,050	+4,050	0
12-64 Bays 6, 11, 12 & 15 Replacement Facilities, PTX	5,283				708	2,351	+2,351	2224
Bldg. 92042E Dry Room Control Upgrades, Y-12	8,147		805	805	3,758	3,584	+2,779	0
Total, Plant Projects (GPP/IGPP)	**N/A**	**41,524**	**20,367**	**20,367**	**27,558**	**33,417**	**+33,062**	**8,224**
Total, Capital Summary	**N/A**	**373,095**	**114,957**	**107,157**	**141,605**	**190,821**	**+95,876**	**134,954**

Outyears for Directed Stockpile Work

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Capital Operating Expenses Summary (including MIE)				
Capital Equipment >$500K (including MIE)	112,555	97,792	88,082	77,588
Plant Projects (GPP)	25,353	25,094	21,811	22,291
Total, Capital Operating Expenses	**137,908**	**122,886**	**109,893**	**99,879**

Overview

The Science program provides the knowledge and expertise needed to maintain confidence in the nuclear stockpile without nuclear testing. Capabilities developed and maintained in the Science program provide: (1) the basis for annual assessments of weapon performance and certification of life extension programs (LEPs), (2) understanding of the impacts of surveillance findings to assure that the nuclear stockpile continues to meet military requirements, and (3) the core technical expertise required to be responsive to global nuclear security policy questions. Science deliverables facilitate assessing current weapon and weapon component lifetimes. They also facilitate development and qualification of modern materials and manufacturing processes, concepts for reuse of certain components, and modern safety concepts for the sustainment programs.

Science performs strategic experiments to obtain the materials and nuclear data required to understand the physics of and validate nuclear weapons performance simulations. This data is acquired using unique, small- and large-scale experimental facilities associated with increasingly higher levels of complexity. They include hydrodynamic and subcritical experiments used to obtain data on the dynamic behavior of plutonium and surrogate materials in integrated geometries. These experiments and data analyses facilitate safety, security, and effectiveness evaluations of sustainment concepts without the need for underground testing. These activities also develop, exercise, and maintain the expertise and competence of the nuclear weapon design, engineering, and assessment community that resides at the National Nuclear Security Administration (NNSA) laboratories.

The Science program links directly to the Advanced Simulation and Computing (ASC), Inertial Confinement Fusion Ignition and High Yield (ICF), Engineering, and Directed Stockpile Work (DSW) programs. Science relies on advanced experimental facilities located at the national laboratories and security sites. The operational funds for these facilities are included in other program budgets such as ICF and Infrastructure and Operations.

Highlights of the FY 2019 Budget Request

The FY 2019 Request provides a significant increase in the Dynamic Materials Properties (DMP) subprogram. This increase supports an acceleration of the pace of subcritical experiment execution at the Nevada National Security Site underground laboratory complex (NNSS U1a). This will facilitate the increased pace, as well as greater flexibility and relevance of subcritical experiments using plutonium (Pu).

In accordance with congressional direction in the FY 2017 Omnibus Explanatory Statement, NNSA consolidated multiple investments under the new Enhanced Capabilities for Subcritical Experiments (ECSE) subprogram in the FY 2018 Request. The ECSE subprogram acquires and installs programmatic diagnostic equipment in support of the subcritical experiments in relevant weapon geometries. Major investments include Advanced Sources and Detectors (ASD) Major Item of Equipment (MIE) that designs and implements a large radiographic system managed under DOE O 413.3B, research and development on neutron source and diagnostic platforms, and readiness activities. The construction project 17-D-640, U1a Complex Enhancements Project, NNSS continues to be funded under Infrastructure and Operations.

Focus areas for each of the subprograms are:

- **Advanced Certification** - This subprogram provides the ability to qualify and certify designs, components and manufacturing processes for the stockpile. Activities include : (1) advancement of weapon system assessment and certification methodologies including quantification of margin and uncertainties, (2) determining whether concepts proposed for future stockpile systems can be certified, (3) advanced safety and security designs, (4) survivability concepts, and (5) certification of structural components using additive manufacturing (AM) or other advanced-manufactured materials.
- **Primary Assessment Technologies** – Activities include: (1) design and analysis of hydrodynamic experiments, (2) experiments supporting burn studies for boost science, (3) plutonium aging experiments supporting sustainment programs, and (4) work on manufacturing technologies to engineer and fabricate plutonium parts for Sub Critical Experiments (SCE).
- **Dynamic Materials Properties** – Activities include: (1) perform focused experiments acquiring data on behavior of key stockpile materials, including Pu, in dynamic conditions, (2) partnering with other programs on the design, development, and execution of subcritical experiments, (3) execute two SCEs in support of upcoming sustainment

programs, (4) conduct work focused on current and new high explosive formulas, and (5) development of detectors and experimental platforms for the study of stockpile related materials.

- **Advanced Radiography** - develop next-generation accelerator components, diagnostics, and imaging systems in support of fundamental, focused, and integrated weapons experiments using both surrogate and plutonium. Advanced Radiography evolves pulsed power capabilities in support of NNSA radiographic systems, hostile testing environments and material pressure platforms; and sustains modeling, simulation, and analysis techniques and software that aids in analysis in the collected experimental data. Supported efforts are conducted across the NNSA complex.
- **Secondary Assessment Technologies** - provide the experimental and science predictive capability used to quantify full system performance margins and associated uncertainties, using codes, underground testing (UGT) data, and a variety of above ground experiments at relevant conditions to develop new data and physical models needed to improve and increase confidence in predictive capability. Key elements include primary output, radiation flow, complex hydrodynamics and burn, material properties, and weapons outputs and effects.
- **Academic Alliances and Partnerships** - support basic science research in subject areas relevant to the Stockpile Stewardship mission, develop a pipeline of graduates with expertise in disciplines of interest to NNSA and DOE national laboratories, and develop peer-to-peer interactions among the Academic Alliances and Partnerships programs.
- **Enhanced Capabilities for Subcritical Experiments** - develop advanced enabling diagnostics for subcritical plutonium hydrodynamic experiments (SCE) in integrated weapon geometries. NNSA plans the ECSE effort to be complete in the mid-2020s timeframe to obtain experimental results from untested stockpile configurations involving plutonium reuse, insensitive high-explosive (IHE), and other modern configuration changes to support the sustainment program schedule. Additionally, NNSA agrees with the JASON study that ECSE "…may significantly reduce uncertainties that may arise in the future due to aging, or in certification of weapons through future life extension programs (LEPs) or alterations (ALTs), or through remanufacture or reuse of weapon components."

FY 2017 Accomplishments

- Conducted two hydrotests as part of the Certification Readiness Exercises for pit reuse and the use of IHE for primary options for the future stockpile and as part of the Joint Technology Demonstrator (JTD) collaboration with the Atomic Weapons Establishment (AWE).
- Conducted hubcap experiments with advanced manufactured (AM) components in support of the JTD. This work leads directly to JTD Ground Test activities in FY2020.
- Conducted the Eurydice surrogate experiments in the Lyra subcritical experiments (SCEs) series. The data will inform material models used in annual assessments.
- Measured the neutron reactivity of a static, highly enriched uranium object as a proof-of-principle for the Neutron Diagnosed Subcritical Experiment (NDSE) diagnostic for the upcoming Excalibur series of SCEs.
- Completed the Level 1 Advanced Safety Concepts milestone and complementary Predictive Capability Framework (PCF) pegpost.
- Executed plutonium material strength experiments at the National Ignition Facility (NIF) and obtained scientifically significant plutonium strength data at pressures relevant to the stockpile.
- Delivered plutonium data from NIF, JASPER, Z, and small-scale experiments at TA-55 to validate the plutonium equation-of-state (EOS) and plutonium aging models directly relevant to stockpile assessments, stockpile certification, and future stockpile options including the B61-12 LEP.
- Concluded a high energy density (HED) Shear campaign at NIF that provided an essential dataset to understand shear forces in the HED regime of the stockpile.
- Used the Advanced Radiographic Capability (ARC) at NIF to obtain data on an HED platform.
- Completed the first set of physics experiments on the Thor intermediate-scale, pulsed power facility.
- Invented a new, laser-triggered gas switch that may reduce the cost and complexity of underground, pulsed-power drivers for advanced radiography and may eliminate the need for the use of SF6 in those drivers.
- Delivered high explosives' data from experiments at the Dynamic Compression Sector (DCS) that support the development of more advanced models of the detonation and performance of IHE.
- Measured the dynamic response and jetting behavior of stockpile-relevant, advanced composite materials at the DCS.
- Produced samples with excess levels of an impurity of a relevant material to characterize microstructure property changes, and obtained first iron line opacity measurements on NIF.
- Demonstrated the efficacy of the surrogate cross section measurement technique to constrain cross section uncertainties, which can be a dominant uncertainty for diagnostics from underground tests.

- Matured >15 keV x-ray source on the Z facility for studies in radiation effects on non-nuclear components and extended opacity data on Z to include additional materials and plasma conditions

Major Outyear Priorities and Assumptions

- Supporting sustainment program schedules through FY 2030 (as approved by the Nuclear Weapons Council and documented in the Fiscal Year 2018 Stockpile Stewardship and Management Plan).
- Continuing the ECSE diagnostics effort.
- Developing the next-generation science and engineering workforce required to achieve future nuclear security objectives as described in the *Nuclear Posture Review*.
- Supporting partnerships, collaborations and consortiums that provide resources and enhance research and education of minority students to develop the needed technical workforce for NNSA's laboratories and production plants.
- Underpinning capabilities for annual assessment of the stockpile.
- Developing capabilities needed for resolution of significant findings discovered through stockpile surveillance.
- Advancing a sustainable dynamic plutonium experimental capability at the Nevada National Nuclear Security Site (NNSS), including advanced diagnostics through the ECSE effort to address potential reuse options and to qualify remanufacturing processes.
- Executing hydrodynamic experiments to support advanced certification objectives in safety and security, enhancing the metallurgical understanding of the effects of aging and options for modern manufacturing processes, executing simulations and experiments and supporting simulations to inform the development of design options and facilitating capabilities for weapon secondaries.
- Conducting experiments to assess manufacturing options for other nuclear explosive package components.
- Developing predictive capabilities to assess U.S. weapon performance in hostile environments.
- Developing capabilities to support assessments of foreign state nuclear weapon activities.
- Developing certification methodologies to support a responsive stockpile.

Science Funding

(Dollars in Thousands)	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Research, Development, Test and Evaluation (RDT&E)				
Science				
Advanced Certification	60,000	59,593	57,710	-2,290
Primary Assessment Technologies	99,000	98,328	95,057	-3,943
Dynamic Materials Properties	106,000	105,280	131,000	+25,000
Advanced Radiography	45,700	45,390	32,544	-13,156
Secondary Assessment Technologies	76,000	75,484	77,553	+1,553
Academic Alliances and Partnerships	49,800	49,462	53,364	+3,564
Enhanced Capabilities for Subcritical Experiments	0	0	117,632	+117,632
Total, Science	**436,500**	**433,537**	**564,860**	**+128,360**

Outyears for Science Funding

(Dollars in Thousands)	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Research, Development, Test and Evaluation (RDT&E)				
Science				
Advanced Certification	57,710	62,658	64,068	66,062
Primary Assessment Technologies	95,169	125,661	128,951	127,409
Dynamic Materials Properties	136,000	159,767	162,914	134,428
Advanced Radiography	32,544	55,989	67,375	68,789
Secondary Assessment Technologies	77,553	82,104	83,952	85,841
Academic Alliances and Partnerships	53,364	55,052	55,993	56,726
Enhanced Capabilities for Subcritical Experiments	119,952	96,548	41,478	32,411
Total, Science	**572,292**	**637,779**	**604,731**	**571,666**

Science
Explanation of Major Changes
(Dollars in Thousands)

	FY 2019 Request vs FY 2017 Enacted
Science	
Advanced Certification: Decrease reflects deferral of certification work on advanced surety methods.	-2,290
Primary Assessment Technologies: Decrease reflects prioritization to support of material aging assessments and studies to support boost science; including a Level-1 milestone.	-3,943
Dynamic Materials Properties: Increase supports pace of two SCEs per year with improved diagnostics, plutonium characterization including Pu aging science, advanced-manufacturing and new high explosive formulation for future stockpile options with continued matching of funds for the NNSA/DoD Joint Munitions Program. The increase also supports the rise in cost to maintain and develop experimental platforms for materials of interests to the NNSA and DOD	+25,000
Advanced Radiography: Decrease reflects the Advanced Sources and Detectors (ASD) Major Item of Equipment (MIE) funds moving to the ECSE line.	-13,156
Secondary Assessment Technologies: Increase supports theoretical effort and experimental program at HED facilities for off-nominal performance, opacity, radiation flow, and outputs and effects including performance in hostile environments.	+1,553
Academic Alliances and Partnerships: Increase supports partial inflation for grants and cooperative agreements for basic science research relevant to the stockpile stewardship mission.	+3,564
Enhanced Capabilities for Subcritical Experiments: Increase reflects funding moves from FY 2017 Science lines, which will support advanced diagnostics for subcritical hydrodynamic integrated weapons experiments, producing key data to support stockpile aging assessments, reuse/remanufacture decisions, and LEP certifications.	+117,632
Total, Science	**+128,360**

Science
Advanced Certification

Description

Advanced Certification develops tools and methods to certify future stockpile systems and components in the absence of nuclear testing. The program assesses whether designs and technologies for LEPs and for a stockpile responsive to future threats can be certified. Advanced Certification will integrate computing, science, technology, and engineering advancements to facilitate certification of future life extensions and other warhead developments. More specifically, Advanced Certification: (1) addresses impacts of materials behavior and design options on weapon performance, (2) refines computational tools and methods for certifying weapons without nuclear testing, (3) evaluates failure modes, and (4) assesses the performance impacts of new manufacturing processes.

FY 2020-FY 2023 Key Milestones

- Develop certification approaches for systems and components responsive to emerging threats.
- Perform hydrodynamic tests to validate the Scaling and Surrogacy methodology, and study characteristics of historical primary anomalies.
- Conduct assessments of comparable nuclear tests, studies of failure modes, and other advanced methods to facilitate their use in certification of upcoming sustainment programs.
- Continue studies supporting understanding of scaling and surrogacy to support the experimental basis for weapon assessments.
- Conduct experiments in support of product-based certification methods in particular of components made with advanced manufacturing.
- Conduct exercises on the certifiability of reuse designs, surety designs, hardening concepts, and designs incorporating new manufacturing technologies.
- Develop, characterize, and test prototype nuclear explosive package components made using advanced manufacturing methods, including structural components, primary polymeric components, canned subassembly components, and radiation case components.

Advanced Certification

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Advanced Certification $60,000,000	**Advanced Certification $57,710,000**	**Advanced Certification -$2,290,000**
• Continue to execute the mandate to improve and strengthen certification path and assessment tools with new experimental data. • Improve predictive capability with common model development and resolution of failure modes. • Analyze hydrotest data to assess the feasibility of the design under investigation. • Continue to mature the development of AM structural component and execute small-scale hydrotest to assess the feasibility of such design. • Continue to mature other safety options with small-scale experiments and refine design concepts for possible use in future stockpile options. • Continue to develop method for assessing certification challenges for secondary design options and outline path forward. • Explore nuclear package design concepts to support responsive stockpile effort.	• Prioritize the understanding of critical certification paths and assessment tools for a responsive stockpile • Prioritize the Analysis of hydrotest and subcrit data and other experimental data that inform our ability to certify proposed stockpile systems and components. • Continue predictive capability improvements with common model development and resolution of failure modes. • Delay maturing safety and surety options.	• Decrease reflects reduction in effort to mature advanced surety options.

Science
Primary Assessment Technologies

Description

Primary Assessment Technologies provides capabilities needed for annual assessment of stockpile primaries, design and certification of future sustainment programs, improvements in primary safety and security, and for resolving significant finding investigations (SFI). A key focus involves the rigorous acquisition of fundamental nuclear science data, such as fission cross sections and prompt fission neutron spectra (PFNS). These data address removal of compensating errors in simulations, resulting in improved margins and uncertainties supporting the stockpile annual assessment. Further, these data enable improved understanding of initial conditions for boost, outputs, and effects. A principal focus of Primary Assessment Technologies in the outyears will be to continue developing predictive capabilities for modeling boost, a process key to proper functioning of the weapon. Another principal focus is improving capabilities to assess impacts of material aging processes (including corrosion processes), and changes associated with stockpile sustainment programs, such as reuse of components and the incorporation of safety changes (e.g., use of IHEs). The aging program includes theory, modeling, and simulations along with fundamental measurements of aged-plutonium alloys to incorporate and evaluate aging effects. Primary Assessment Technologies also provides science capabilities needed for intelligence community assessments of foreign-state nuclear weapon activities that also results in providing critical weapon skills, training, and experimental opportunities for designers and engineers not provided in typical Directed Stockpile Work (e.g., LEPs).

There are two major Predictive Capability Framework (PCF) pegposts that complement Primary Assessment Technologies work scope planned between 2019 and 2024: 1) off-nominal conditions, and 2) microstructure. These assessments support the need to ensure predictive capabilities build upon established capabilities by developing common models to quantify uncertainties in predictions, as well as models to assess the impact of variabilities caused by engineering, aging, or manufacturing features.

FY 2020 - FY 2023 Key Milestones

- Provide tools and methods for predicting primary lifetimes that account for initial production defects.
- Re-institute the capability for examining plutonium at the proton Radiography facility at LANSCE.
- Develop ability to fabricate plutonium thin (10 nm) films supporting target fab, surface studies, and nuclear forensics.
- Conduct HED experiments to measure properties of burning plasmas relevant for weapon operation.
- Continue to provide the ability to resolve SFIs associated with observations made by modern surveillance tools.
- Provide the science base that facilitates maturation and certification of future sustainment options associated with primaries.
- Develop updated assessment of aging based on new, experimental data.
- Conduct experiments and analyses to resolve principal remaining uncertainties associated with boost. This will facilitate assessments of weapon performance in regimes that differ from those tested either because of aging, changes in manufacturing processes, or changes in design.
- Complete predictive capability framework (PCF) milestone on boost to resolve key uncertainties in stockpile assessment.
- Conduct experiments and analyses to address nuclear physics parameter uncertainties.
- Expand weapon science capabilities to strengthen intelligence community assessments of specific foreign state nuclear weapon activities. Develop modern capabilities for the science-based Stockpile Stewardship Program (SSP) appropriate and suitable for use by the counter terrorism and counter proliferation program mission.
- Develop a comprehensive understanding (e.g., kinetics, surface morphology) of the corrosion process on actinide materials.

Primary Assessment Technologies

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Primary Assessment Technologies $99,000,000	**Primary Assessment Technologies $95,057,000**	**Primary Assessment Technologies -$3,943,000**
• Support the Enhanced Capabilities for Subcritical Experiments (ECSE) effort to achieve a diagnostic suite to obtain plutonium data from SCEs that will inform models of the performance of the modern stockpile. • Conduct experiments in support of boost science to answer outstanding questions with respect to primary performance. • Deliver the design and diagnostic requirements for focused experiments supporting burn studies. • Issue the design release for the first dynamic Neutron Diagnosed Subcritical Experiment (NDSE) and carry out required engineering development. • Assess the capability for a combined mix and strength model to improve modern codes of the performance of weapon primaries. • Conduct plutonium aging experiments supporting the B61, the annual assessment review, and pit reuse options. • Characterize the initial conditions of several device configurations and assess the impacts of the initial conditions to primary performance. • Perform IHE component qualification and characterization associated with weapon safety. • In collaboration with Plutonium Sustainment, begin the engineering and fabrication of plutonium parts for upcoming SCEs.	• Re-institute ability to conduct plutonium experiments at the LANL proton Radiography (pRad) facility for material and component characterization under dynamic conditions. • Complete installation of x-ray diffraction (XRD) capabilities on Sandia National Laboratories' (SNL) Z Facility, enabling time-resolved, XRD on dynamically compressed, polycrystalline matter. • Conduct surface-science theoretical studies and measurements on plutonium specimens to address critical scientific issues. • Advance capability for a combined mix and strength model to improve modern codes that predict the performance of weapon primaries. • Conduct experiments in support of boost science to improve the current understanding of primary performance. • Engineer and fabricate plutonium parts for upcoming SCEs in collaboration with Plutonium Sustainment. • Conduct material aging experiments in support of the B61 LEP, annual assessments, and to support pit reuse options for sustainment programs.	• Decrease reflects prioritization to support of material aging assessments and studies to support boost science; including a Level-1 milestone.

Science
Dynamic Materials Properties

Description

Dynamic Materials Properties subprogram develops and maintains the experimental capabilities needed to inform modern, physics-based models that describe and predict the behaviors of weapon materials in environments of extreme conditions of pressure, temperature, stress, strain, and strain rates to understand how the behavior impacts nuclear weapon performance. This program provides the experimental data and essential materials knowledge required for annual assessment and certification of the stockpile as well as to inform future sustainment options. The materials of interest include plutonium, uranium, high explosives, and other materials used in nuclear weapons. Surrogate materials aid understanding and develop data without the use of special nuclear materials. They also used aid in the development and qualification of advanced diagnostics prior to fielding more complex and costly experiments on nuclear materials. It is essential to continue to invest in understanding the properties and performance of special nuclear materials, insensitive high-explosives (HE), polymers, and foams to address future design options and manufacturing processes for sustainment programs. The program develops new experimental capabilities as required to provide the needed data and to support the interpretation of the data. This subprogram is coordinated closely with the other Science subprograms and the ASC, DSW, Major Modernization program, and the Department of Defense (DOD)-DOE Joint Munitions Program.

Required experiments are conducted at laboratory facilities, including PF-4 at TA-55, the Z Facility, U1a, the Advanced Photon Source (APS), Los Alamos Neutron Science Center (LANSCE), Joint Actinide Shock Physics Experimental Research (JASPER) facility, other gas and powder gun facilities, as well as small-scale laboratories for testing and characterization. Assessing the use of IHE in weapons systems that were originally designed to use conventional high explosives and for understanding the effects of processing on production consistency and performance. The consideration of pit and secondary component reuse and replacement also requires materials study prior to qualification and certification. Key materials data on polymers, foams, and other similar materials will be generated, analyzed, and incorporated into models. These materials often demonstrate aging degradation and, therefore, could result in potential performance changes. Dynamic Materials Properties also provides critical materials data to monitor plutonium aging and to address impacts to weapon performance due to new manufacturing processes. Environmental regulations and replacement material availability drive the requirement to evaluate and baseline potential new materials for critical nuclear weapons applications.

Research pursued in the Dynamic Materials Properties subprogram supports: (1) the annual assessment process, (2) baselining materials properties for the future determination of aging effects, and (3) considering materials replacement and future options for sustainment programs. The characterization of new materials and processes for stockpile applications, referred to as “production science,” is an emerging concern for modernization. Dynamic Materials Properties is one of the two substantial funding sources (along with Research and Development Certification and Safety within DSW) for subcritical and other plutonium experiments. This subprogram includes the major experimental capabilities devoted specifically to obtaining data on plutonium and other weapons materials under extreme conditions in an integrated assembly. New experimental capabilities are developed as needed to provide the required data for annual assessment and potential future sustainment options. In particular, the following may be required to facilitate certification of pit reuse with IHE for upcoming sustainment programs: (1) subcritical experiments using radiography, radiometry, holography, and/or Photon Doppler Velocimetry (PDV) diagnostic, (2) heating and cooling capabilities on dynamic testing platforms, (3) high-pressure Z experiments on plutonium and other relevant materials, and (4) the development of the Phoenix platform, JASPER, and other experimental platforms such as ECSE. Additionally, desirability for certification purposes in the long run may be afforded by the Matter Radiation Interactions in Extremes (MaRIE) capability.

FY 2020-FY 2023 Key Milestones

- Deliver high-pressure plutonium data using the JASPER capability at NNSS.
- Develop advanced platforms for high-pressure materials measurements on the Z-machine.
- Support subcritical experiments at NNSS in support of upcoming sustainment programs, pit-reuse options, evaluating the effects of aging on performance, and annual assessment.
- Develop and field advanced diagnostics for equation-of-state, strength and damage, and hydrodynamic and subcritical experiments, in particular, Multiplexed PDV advances and pyrometry.

- In support of sustainment options, execute experiments providing key data at NNSA experimental facilities: JASPER, TA-55, LANSCE, the Z machine, HE firing sites, and other laboratory-scale science facilities.
- Support the testing and qualification of uranium, surrogates, high explosives, and other non-nuclear materials for remanufacturing options.
- Evaluate the dynamic response of materials produced by AM for potential stockpile applications.

Dynamic Materials Properties

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Dynamic Materials Properties $106,000,000	**Dynamic Materials Properties $131,000,000**	**Dynamic Materials Properties +$25,000,000**
• Execute the Vega SCE (Lyra series) at U1a. • Execute Eurydice confirmatory experiment (Lyra series) at U1a. • Resolve the dominant physics and chemistry mechanisms involved with high-explosive initiation to inform next generation burn models. • Obtain data on key characteristics of plutonium by performing experiments at JASPER, Z, and TA-55. • Execute a high-Z experimental series at NIF to obtain key data on high-Z materials of interest. • Assess AM versus conventionally manufactured metals and alloys to inform strength models and to assess how accurately the current strength models are accounting for AM materials. • Evaluate new IHE formulas to assess initiation characteristics, detonation, and to inform next generation burn models. • Complete the final design review for the Generation II 6-ft. containment vessel needed for future SCEs supporting upcoming sustainment options. • Develop and field advanced diagnostics to probe detonation velocity of HE (microwave interferometry), temperature (pyrometry), and phase change of metals for use under dynamic and shock loading conditions.	• Conduct the Sierra Nevada SCE (Lamarck series) at U1a. • Implement temperature measurement diagnostics for plutonium experiments to provide data relevant phase transitions, kinetics, and aging. • Development of time-resolved measurements of phase transition dynamics and high fidelity EOS in plutonium and plutonium alloys at low pressure and moderate temperature. • Develop temperature measurement diagnostics to apply to shock-ramp experiments on Z. • Develop x-ray diffraction as a standard diagnostic on Z for measuring material structure and phase. • Utilize all SNL facilities (Z, Thor, gas guns) to provide material data in support of PCF peg posts, qualifying high explosives PBX9502 and LX21 for the B61-12, W80-4, and maturing materials candidates. • Improve throughput/efficiency of JASPER facility. • Develop next generation containment system for higher pressure hazardous material experiments on Z. • Continue development and authorization of next-generation containment (NGC) system for the Z facility. • Continue development of and field advanced diagnostics for temperature (pyrometry) and phase change of metals for use under static and dynamic conditions.	• Increase supports pace of two SCEs per year with improved diagnostics, plutonium characterization including Pu aging science, advanced-manufacturing and new high explosive formulation for future stockpile options with continued matching of funds for the NNSA/DoD Joint Munitions Program. • The increase also supports the rise in cost to maintain and develop experimental platforms for materials of interests to the NNSA.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
	• Conduct experiments at the APS DCS to elucidate the formation of high explosive condensates during initiation to inform reactive burn models. • Conduct qualifications of IHE in support of on-going sustainment programs. • Develop and characterize additively manufactured explosives.	

Science
Advanced Radiography

Description

Developing predictive capabilities for stockpile stewardship in the absence of nuclear testing relies on the development of advanced platforms and diagnostics to facilitate and improve the reliable and repeatable measurement of experiments. These capabilities address SFIs and technology assessment system certification for LEPs in the execution of sustainment programs. Advanced Radiography develops technologies and diagnostics that support experimental activities that NNSA funds primarily within Primary Assessment Technologies, Dynamic Material Properties, Advanced Certification, and DSW. This includes sources, targets, and imaging systems used to diagnose hydrodynamic and subcritical experiments, and the development of platforms and diagnostics for other dynamic material properties experiments, including those that study plutonium properties. These transformational technologies improve the quality and reliability of scientific results at many NNSA experimental facilities at the national security laboratories and NNSS. These include the Dual-Axis Radiographic Hydrodynamic Test (DARHT) facility, Contained Firing Facility using Flash X-Ray (FXR) technology, Z pulsed power facility, Cygnus radiography system at the U1a Complex, and Proton Radiography (pRad) at the Los Alamos Neutron Science Center (LANSCE).

FY 2020-FY 2023 Key Milestones

- Complete the Thor pulsed power research and development activities.
- Research and develop the next generation Z facility.
- Procure and install the next generation DARHT and FXR cameras.
- Procure and install the next generation proton radiography cameras.
- Modernize radiographic analysis techniques and models.
- Advance and field hydrodynamic diagnostics for both surrogate and plutonium experiments.

Advanced Radiography

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Advanced Radiography $45,700,000	**Advanced Radiography $32,544,000**	**Advanced Radiography -$13,156,000**
• Through use of simulation, modeling tools, and prototypes develop next-generation prime power energy storage, pulsed power, and current adder technology. • Advance hydrodynamic diagnostics for both surrogate and plutonium experiments. • Design the next-generation x-ray and proton imaging systems. • Modernize radiographic analysis techniques and models based on experimental results.	• Design, procure, and assemble a multi-stage coaxial impedance matched Marx Generator. • Develop advanced power flow simulations for current coupling efficiency on the Z facility. • Deploy power flow and plasma diagnostics on the Z facility to provide validation data for power flow simulations.	• Maintain scheduled technology and diagnostic development. • Decrease reflects NNSA prioritization of near term activities in other Science sub-programs.

Science
Secondary Assessment Technologies

Description

The Secondary Assessment Technologies subprogram provides capabilities that increase confidence in the assessment of stockpile secondaries, enabling a broad range of sustainment options and resolution of SFIs. A principal focus of Secondary Assessment Technologies is to provide the experimental and science predictive capability used to quantify full system performance margins and associated uncertainties. The subprogram uses past underground test (UGT) data and conducts and utilizes a variety of above ground experiments to obtain new data and to develop and validate physical models needed to improve and to increase confidence in predictive capability. Key elements include primary output, radiation flow, complex hydrodynamics and burn, material properties, and weapons outputs and effects. For stockpile systems, this assessment facilitates: (1) the reacceptance of existing secondaries and other nuclear explosive package components for future sustainment options, and (2) the development of the qualification methodology science basis for physics performance of remanufactured canned sub-assembly (CSA) components. Understanding the impact of manufacturing processes for the production and restoration of CSA components requires both experimental measurements and modeling techniques to address performance impacts and is a growing area of the subprogram. A major deliverable for Secondary Assessment Technologies is the improved predictive capability for secondary performance for nominal and off-nominal conditions. This will be delivered as a level-1 pegpost in FY 2019. A focus of the subprogram that will increase in the outyears is weapon outputs, effects, and performance in hostile environments. Understanding survivability in a hostile environment requires understanding weapon outputs, propagation of outputs, and the subsequent effects coupling into the weapon intended for survival and how the performance of the weapon is impacted. This research includes obtaining experimental data supporting weapon design code validation for more accurate weapon output calculations, improving laboratory radiation sources and diagnostics to support code validation and hardware qualification experiments, and developing platforms for evaluating candidate and evolving stockpile technologies for radiation hardness.

Secondary Assessment Technologies has strong programmatic coupling with other subprograms within Science and the high energy density (HED) facilities supported by both the Science and ICF programs, including NIF, the Omega Laser Facility at the University of Rochester, and the Z facility at SNL, and has significant coupling to advanced computing platforms supported by the ASC Program and with the Nuclear Survivability subprogram in the Engineering program.

FY 2020-FY 2023 Key Milestones

- Develop physics-based models for key secondary-relevant issues that include SFI's, sustainment program and the Annual Assessment Report; and validate through HED and other experimental efforts and platform developments to obtain necessary experimental data.
- Execute program plans associated with secondary capabilities and design options consistent with the sustainment program schedule. Deliver data on radiation transport to validate models, in support of design assessments and Annual Assessments.
- Execute the program plan to deliver full system weapon outputs modeling capabilities.
- Develop warm x-ray, neutron sources, and system-generated electromagnetic pulse (SGEMP) platforms and common models for outputs and effects studies.
- Develop diagnostic and platform capabilities for HED experiments that study complex hydrodynamics and burn, material phase structure, and opacity.
- Deliver opacity data on multiple materials from Z and NIF to improve and validate first-principles opacity models.
- Continue to recruit, develop, and retain stockpile stewards, maintaining the technical superiority in the nation's nuclear security interest.

Secondary Assessment Technologies

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Secondary Assessment Technologies $76,000,000	**Secondary Assessment Technologies $77,553,000**	**Secondary Assessment Technologies +$1,553,000**
• Mature efforts to understand weapon outputs, effects, and performance in a hostile environment. • Execute NIF opacity experiments with iron and continue the Z opacity experimental series. • Assess initial conditions of weapon secondaries and compare with performance models. • Add alternate code, full-system simulation results to the secondary validation suite. • Collect experimental data and infer the cross section of neutron-induced reactions important to radiochemical analysis. • Assess impact of body of work on radiation flow. • Conduct radiation effects sciences measurements using a >15 keV x-ray source on Z. • Complete beam line transition activities at SSRL. • Develop new calibration methods, sources, and diagnostics to support HED experiments at NIF, Omega, and Z. • Continue to recruit, develop, and retain stockpile stewards, maintaining the technical superiority in the nation's nuclear security interest. • Mature and execute plans for the 2019 Secondary Performance pegpost, delivering an advanced predictive capability for secondary performance in nominal and off-nominal conditions. • Further development of warm x-ray sources.	• Complete the Predictive Capability Framework (PCF) pegpost for FY 2019, delivering advances in understanding of secondary performance in nominal and off-nominal conditions. • Deliver dataset from HED platform for use in informing simulation methodology and in support of the FY 2019 PCF pegpost. • Demonstrate full system UGT weapon outputs modeling capabilities in preparation for 2022 Secondary Performance pegpost. • Deliver advanced imaging of >15 keV X-ray sources on Z. • Assess methods for increasing warm x-ray source output on Z for radiation effects. • Complete a systematic study of L-shell opacities and obtain time-gated absorption spectra from opacity experiments on Z. • Operate the soft X-ray beamline in support of national diagnostic calibration needs, and test and begin commissioning of the hard X-ray beamline at SSRL. • Complete experiments on a material for two manufacturing methods and variations in impurities. • Acquire data from ORION opacity experiments to contribute to resolution of Model-data discrepancies.	• Increase supports theoretical effort and experimental program at HED facilities for off-nominal performance, opacity, radiation flow, and outputs and effects including performance in hostile environments.

Science
Academic Alliances and Partnerships

Description
The Academic Alliances and Partnerships subprogram funds academic programs to develop NNSA's next-generation technical workforce. Congress established this subprogram in the Consolidated Appropriations Act, 2016, consolidating the Site Stewardship Minority Serving Institutions Partnership Program (MSIPP) and the Stewardship Science Academic Alliance (SSAA) program within a new subprogram in Science.

(dollars in thousands)

Budget Category	FY 2017 Enacted	FY 2018 Request	FY 2019 Request
Science			
Academic Alliances and Partnerships	**49,800**	**52,963**	**53,364**
Minority Serving Institution Partnership Program	18,959	18,832	18,832
Stewardship Science Academic Alliance (SSAA) Grants and Cooperative Agreements	30,841	34,131	34,532

NNSA funds scientific academic programs to develop the next generation of highly trained technical workers able to support its core mission and to ensure there is a strong community of technical peers, external to the NNSA national laboratories, capable of providing peer review and scientific competition to strengthen the basic fields of research relevant to the NNSA. Within Science, the Academic Alliances and Partnerships subprogram supports the following academic programs: (1) Stewardship Science Academic Alliance (SSAA) and (2) Minority Serving Institutions Partnership Program (MSIPP).

The SSAA Program funds research projects at universities to conduct fundamental science and technology research of relevance to stockpile stewardship (materials under extreme conditions, low-energy nuclear science, high energy density physics, and radiochemistry). Launched in 2002, the SSAA Program enables advanced experimental activities through program-supported Centers of Excellence and research grants at over 40 universities. The program supports students in the aforementioned fields critical to stewardship science including opportunities to conduct research at NNSA's laboratories, building a field of talented and committed doctoral students sharing a common desire to advance science while impacting national security. The SSAA Program funds the Stewardship Science Graduate Fellowship (SSGF) and the Laboratory Residency Graduate Fellowship (LRGF) to train scientists to meet U.S workforce needs by providing financial support and professional development opportunities to students pursuing a Ph.D. in fields of study that solve complex science and engineering problems critical to stewardship science.

NNSA MSIPP's goal is to increase participation of women and minorities in NNSA's nuclear security enterprise and across the nation in STEM disciplines, developing individuals, building core competencies for NNSA, and improving institutional capacity in Minority Serving Institutions (MSI). MSIPP supports MSI efforts including Historically Black Colleges and Universities (HBCUs), Hispanic Serving Institutions (HSIs), and Tribal Colleges and Universities (TCUs).

MSIPP aligns investments in university capacity and workforce development with the NNSA mission to develop the needed skills and talent for NNSA's enduring technical workforce at the laboratories and production plants, and to enhance research and education at under-represented colleges and universities. This alignment is defined by the following goals: 1) strengthen and expand MSI capacity and research experience in NNSA/DOE mission areas of interest, 2) increase visible participation of MSI faculty in NNSA/DOE technical engagements and activities, such as collaborative research, technical workshops, expert panel reviews and studies, and competitive processes, 3) target collaborations between MSIs and NNSA/DOE laboratories and plants that increase scientist-to-scientist interactions, applied research and engineering application collaborations and/or implementation of research results, and provide MSI access to NNSA/DOE facilities, 4) increase the number of MSI students who graduate with Science, Technology, Engineering, and Mathematics (STEM) degrees relevant to DOE mission areas and who have had exposure to career opportunities at DOE, and 5) increase the number of minority graduates and post-doctoral students hired into NNSA/DOE's technical and scientific workforce.

FY 2020-FY 2023 Key Milestones

- Provide advanced experimental measurement techniques in areas of Condensed Matter Physics and Materials Science, Hydrodynamics, Fluid Dynamics, Low-Energy Nuclear Science, and Radiochemistry via the SSAA program.
- Provide opportunities for intellectual challenge and collaboration by promoting scientific interactions between the academic community and scientists at the NNSA laboratories, via the SSAA program.
- Increase availability of unique experimental facilities sited at NNSA laboratories to the broader academic community, particularly for collaborations in areas of relevance to Stockpile Stewardship.
- Develop and maintain a long-term, recruiting pipeline to NNSA laboratories by increasing visibility of NNSA scientific activities to U.S. faculty and student communities.
- Pursue consortium based STEM grants that specifically target TCU's that provide TCU's the opportunity to build their STEM capacity and academic infrastructure in STEM. As a result TCUs will be in a sound position to become an intricate part of a STEM pipeline that addresses the STEM needs of the Tribal community.
- Confirm the hiring of various students into the NNSA/DOE and Federal workforce that have matriculated through various STEM consortium pipelines.
- Partner with other Federal agencies specifically NASA to broaden the reach of our MSIPP and to co-fund various minority STEM projects that are of mutual interest to the partnering agencies.
- Continue to strengthen and expand the MSI program through the five-year cybersecurity consortium investment between the HBCUs, Charleston County School District and the NNSA/DOE laboratories.

Academic Alliances and Partnerships

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Academic Alliances and Partnerships $49,800,000	**Academic Alliances and Partnerships $53,364,000**	**Academic Alliances and Partnerships +$3,564,000**
• Supports for the MSI Program formerly known as the Massie Chairs Program. New and continued support to HBCU, HSI, TCU, and community based grants. MSIPP consortium based model focused on research and internships in STEM. Building educational/institutional infrastructure, and enhancing the pipeline of diverse, high quality talent in STEM academic disciplines and careers. • Support the SSAA Grants and Cooperative Agreements program. • Increase emphasis in advanced experimental measurement techniques supportive of NNSA's core mission areas.	• Supports the MSIPP with new and continued support to the HBCU, HSI, TCU and community-based grants. Supports the MSIPP consortium based model focused on research and internships in STEM. Supports building educational/institutional infrastructure and enhancing the pipeline of diverse, high-quality talent in STEM academic disciplines and careers. • Supports the SSAA Program to develop the next generation of highly-trained technical workers able to support the NNSA core mission and to ensure there is a strong community of technical peers.	• Increase supports partial inflation for grants and cooperative agreements for basic science research relevant to the stockpile stewardship mission.

Science
Enhanced Capabilities for Subcritical Experiments

Description

In 2014, the national security laboratories LANL, LLNL, SNL, and the NNSS jointly identified a significant gap in the capabilities available to meet the responsibilities of the science-based Stockpile Stewardship Program; NNSA lacks the ability to diagnose the final stages of a subcritical primary implosion using plutonium. In 2016, the JASONs Defense Advisory Group identified the same gap in current U.S. capability to carry out and diagnose such experiments. Science efforts have advanced the understanding of plutonium in the early evolution of an imploding system and identified the need to similarly improve understanding of plutonium performance during the extreme physical conditions reached later in an implosion. This improved understanding will inform certification and evaluation of various components of stockpile transformation, but is not possible given the limitations of existing facilities and diagnostic methods. In addition to the physics gap, the national laboratories have identified a gap in experimental capabilities needed to develop the next generation of weapon designers in the absence of underground nuclear testing. To fill these gaps and to support the program plan documented in the 2017 Stockpile Stewardship and Management Plan (SSMP), NNSA places a high priority on developing enhanced capabilities for subcritical experiments (ECSE) at NNSS's underground laboratory, the U1a Complex. This enhanced capability will be operational in the mid-2020s timeframe for use by the laboratory weapon design community.

The ECSE subprogram consolidates a portfolio of work that includes (1) the Major Item of Equipment titled Advanced Sources and Detectors (ASD) that was funded in FY 2017 under the subprogram Advanced Radiography, (2) a developing technology named Neutron-diagnosed Subcritical Experiments (NDSE) that was funded in FY 2017 under the subprogram Primary Assessment Technologies, and (3) readiness activities to prepare the new capability for operation in the mid 2020s. Though managed by the ECSE subprogram, the construction project 17-D-640, U1a Complex Enhancements Project, NNSS is funded under Infrastructure and Operations.

ASD, managed under DOE O 413.3B, designs and installs a large radiographic system that will be generating the x-ray energies and multi-pulse capability necessary to diagnose late-time dynamics in plutonium experiments. ASD is scheduled to achieve CD-1 in FY 2018 when the cost range will be determined independently according to DOE Order 413.3B requirements. NDSE is a measurement concept that NNSA will apply to dynamic plutonium experiments that will measure the negative reactivity of a subcritical assembly. Since neutron multiplication is very sensitive to the material properties of fissile material, the data will provide a new constraint on the codes and models used to simulate the performance of nuclear weapon primaries, improving our stockpile assessment capability.

As outlined in the NNSA 2017 SSMP, NNSA plans long-term investments supporting plutonium science at the NNSS. NNSS is the only site in the United States with the capability to perform experiments combining high explosives and plutonium, a core capability for NNSA's Stockpile Stewardship Program, as per 50 U.S. Code§ 2521.

FY 2020-FY 2023 Key Milestones

- Begin long lead procurements
- Submit Critical Decision-2 (Approve Performance Baseline) for the accelerator
- Submit Critical Decision-3 (Approve Start of Construction) for the accelerator
- Begin accelerator module procurement
- Start injector test at the Integrated Test Stand
- Begin detector procurement
- Begin installation of Special Equipment in UCEP

Enhanced Capabilities for Subcritical Experiments

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Enhanced Capabilities for Subcritical Experiments $0[a]	**Enhanced Capabilities for Subcritical Experiments $117,632,000**	**Enhanced Capabilities for Subcritical Experiments +$117,632,000**
• Achieve CD-1 for the Major Item of Equipment, ASD. • Complete the proof-of-principle static experiments for the Dense Plasma Focus (DPF) diagnostic in support of NDSE. • Execute NDSE simulations and assess constraints. • Execute additional static experiments to assess modeling and response capability. • Improve DPF performance and reliability. • Evaluate photo-fission as an alternative (neutron source) to DPF. • Develop a U1a time-of-flight gamma ray detector.	• Submit an ASD CD-2/3 package. • Continue to develop injector needed for the ASD project. • Continue to execute NDSE simulations and assess constraints. • Perform additional static experiments to assess modeling and response capability. • Continue to improve DPF performance and reliability. • Continue to evaluate photo-fission as an alternative (neutron source) to DPF.	• Increase reflects funding moves from FY 2017 Science lines, which will support advanced diagnostics for subcritical hydrodynamic integrated weapons experiments, producing key data to support stockpile aging assessments, reuse/remanufacture decisions, and LEP certifications.

[a] Advanced Radiography funded the FY 2017 ECSE work scope described. ECSE became a new Congressional control level in the FY 2018 request.

Science
Performance Measures

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Science-Based Capabilities - Provide the science-based capabilities necessary to support stockpile certification on an annual basis.							
Target	100 % of progress	100 % of progress	100 % of progress	100 % of progress	100 % of progress	100 % of progress	100 % of progress
Result	**Met** - 100						
Endpoint Target	Each year provide the science-based capabilities (e.g., experimental infrastructure, assessment and certification methodologies, experiments, data, and analyses) required to enable the annual assessment and certification of the stockpile including certification of LEPs and weapon modifications.						

Science
Capital Summary

	Total	Prior Years	FY 2017 Enacted	FY 2017 Current	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted	Outyears to Completion
	(Dollars in Thousands)							
Capital Operating Expenses Summary (including Major Items of Equipment (MIE))								
Capital Equipment >$500K (including MIE)	N/A	10,231	30,524	30,524	41,387	91,643	+61,119	N/A
Plant Projects (GPP and IGPP)	N/A	0	0	0	0	0	0	N/A
Total, Capital Operating Expenses	**N/A**	**10,231**	**30,524**	**30,524**	**41,387**	**91,643**	**+61,119**	N/A
Capital Equipment > $500K (including MIE)								
Total Non-MIE Capital Equipment	N/A	10,021	6,934	6,934	7,087	7,243	+309	N/A
Advanced Sources Detectors, LANL	591,600	210	23,590	23,590	34,300	84,400	+60,810	449,100
Total, Capital Equipment (including MIE)	N/A	**10,231**	**30,524**	**30,524**	**41,387**	**91,643**	**+61,119**	**449,100**
Plant Projects (GPP and IGPP)								
Total Plant Projects (GPP/IGPP)	N/A	0	0	0	0	0	0	0
Total, Plant Projects (GPP/IGPP)	**N/A**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total, Capital Summary	**N/A**	**10,231**	**30,524**	**30,524**	**41,387**	**91,643**	**+61,119**	**449,100**

Outyears for Science

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
	(Dollars in Thousands)			
Capital Operating Expenses Summary (including MIE)				
Capital Equipment >$500K (including MIE)	146,302	169,465	124,231	39,701
Total, Capital Operating Expenses	**146,302**	**169,465**	**124,231**	**39,701**

Engineering

Overview

The Engineering Program is responsible for creating and maturing advanced toolsets and capabilities necessary to maintain a safe, secure, and effective nuclear weapons stockpile and enhance nuclear weapon safety, security, and use-control. This program supports four key mission areas: (1) strengthening the science, technology, and engineering base by maturing advanced technologies to improve weapon surety, (2) providing tools for qualifying weapon components and certifying weapons without underground testing, (3) supporting annual stockpile assessments through improved weapons surveillance technologies and warhead component aging assessments, and (4) providing capabilities that accelerate the nuclear weapons lifecycle and strengthen the ability of the United States to respond to unexpected developments that could threaten nuclear security. Primary responsibilities of this program include:

- Assessing nuclear and non-nuclear components without underground testing;
- Providing fundamental, sustained engineering research and development for stockpile assessment and certification throughout the lifecycle of each weapon;
- Providing the ability to predict the response of weapon components and subsystems to aging and normal, abnormal and hostile environments;
- Advancing components and materials testing processes to minimize destructive effects while ensuring high-level weapon reliability and certification;
- Developing enhanced technologies that both minimize probability of unauthorized use and maximize reliability for authorized use;
- Demonstrating and strengthening the spectrum of capabilities required for a responsive, safe, and effective U.S. nuclear deterrent; and
- Maintaining the capabilities to assess and evaluate new materials for insertion opportunities into life extension programs (LEPs) and major alterations (ALTs).
- Develop and demonstrate capabilities to shorten design, certification, and manufacturing cycles to minimize time and costs leading to engineering prototype and production.

The Engineering Program is comprised of five subprograms:

1. **Enhanced Surety:** Provides advanced safety, use-control, and security solutions for insertion into stockpile weapon systems and venues.

2. **Weapons Systems Engineering Assessment Technology (WSEAT):** Provides experimental capabilities, diagnostics, and data needed for assessing that weapons will not be damaged by delivery environments and will be robust to possible accidents.

3. **Nuclear Survivability:** Provides the tools and technologies necessary for ensuring that U.S. weapons meet Department of Defense (DOD) requirements related to survivability.

4. **Enhanced Surveillance:** Provides diagnostics and the science needed to ensure that aging will not harm the stockpile.

5. **Stockpile Responsiveness:** Provides, in collaboration with the DOD, efforts that sustain, enhance, and exercise capabilities required to conceptualize, study, design, develop, engineer, certify, produce, and deploy nuclear weapons to ensure the U.S. nuclear deterrent remains safe, secure, reliable, credible, and responsive.

Highlights of the FY 2019 Budget Request

- Maintain emphasis on the immediate needs of the Directed Stockpile Work (DSW) program.
- Test and evaluate technologies for multi-security for Air Force systems.
- Provide early confidence testing for multi-point safety (MPS) subsystem for future weapons.
- Develop experimental test facilities for future delivery systems. NNSA's efforts focus on the relationship between the delivery environment and the response of the nuclear explosive package.

- Address environmental testing, engineering tools, and technical capabilities based on DOD requirements associated with evolving delivery system design, qualification, and production.
- Release validation data on required weapon systems internal and external intrinsic radiation environments.
- Investigate non-nuclear survivability options and capabilities with the DOD and the United Kingdom.
- Develop advanced imaging systems for detecting the precursors of harmful weapon aging.
- Provide predictive capabilities for extrapolating the effects of corrosion and other aging phenomena.
- Develop laboratory weapon qualification platforms that reproduce the extreme environments characteristics of hostile nuclear encounters.
- Provide experimental tools and advances in simulation capabilities to qualify the behavior of new electronics in radiation environments.
- Conducts a robust Stockpile Responsiveness Program in coordination with DOD.

FY 2017 Accomplishments
Enhanced Surety:
- Completed the design and advanced prototype build of an electro-mechanical surety device to support future weapon systems. (LANL)
- Used the results from a series of multiple small-scale experiments to develop the error-bars on a computer-generated prediction model of the aging and compatibility effects of MPS. (LLNL)
- Successfully launched a full-scale six to eight year MPS experiment to study the long term maturity compatibility and aging effects. (LLNL)
- Redesigned a crucial component, including modeling, fabrication, and assembly, that increased the life of the component by ten-fold and reduced the size by 75% for use in future Reentry Body/Reentry Vehicle (RB/RV) required systems. (SNL)
- Completed initial environmental testing of weapon storage vaults for use in the evaluation of surety performance in a representative environment. (SNL)
- Designed and integrated MPS into a mock system in order to conduct a near-term system test in a relevant environment. (SNL)
- Completed the FY 2015 Surety Technology Initiative and reached Technology Readiness Level 3 (form factor demonstrator) that resulted in the identification of vulnerabilities, solution study, and design improvements of a detonator safing device for use in future systems. (LLNL, SNL)
- Finalized NextGen surety component design that reduces the initial cost estimates by one-third and reduces the weight by 40%. (SNL)
- Completed and delivered NextGen surety hardware builds integrated with advanced architectures to the joint technology demonstrator (JTD) team. (SNL, LLNL)
- Integrated detonator-safing design options of two laboratories into one system demonstrator (LANL, LLNL)
- U.S. national laboratories developed advanced technologies that the United Kingdom leveraged into designing a security prototype container. (SNL, LLNL, LANL)

Weapons System Engineering Assessment Technology:
- Successfully completed a demonstration test that combined acceleration, spin, and vibration on mock hardware provided by the W87 ALT Fuze program. (SNL)
- Provided a comprehensive dataset of loads and responses from fluid-structure interaction measurements which will enable the validation of uncertainty quantification of models and capabilities for predicting surface loads of component vibration responses under re-entry conditions. (SNL)
- Constructed boundary conditions for uncertainty quantification using a two-camera configuration and performed proof-of-concept in the hypersonic wind tunnel. (SNL)
- Exercised a micro-digital-image-correlation diagnostic for observing and quantifying the damage and failure of high explosives at the crystal-binder length scale which supports the development of high-fidelity mock high explosives. (LANL). Mock high explosives simulate the density, thermal, and mechanical properties of conventional and insensitive high explosives. They are used to reduce risk and address the safety challenges associated with environmental testing.

- Exercised existing contact thermal conductivity models to compare with previously collected validation data, and performed pre- and post-test surface roughness measurements to inform the contact thermal conductivity model selection. (LANL)
- Executed intermediate strain rate tensile tests on steel, aluminum, and Teflon specimens to provide calibration and validation data for current and future weapon simulation. (LANL)
- Improved the Livermore Insensitive High Explosives damage model to investigate the effects of tensile-shear damage coupling. (LLNL)
- Obtained mechanical properties data for legacy cushions and additively manufactured cushions. (LLNL)
- Measured Coefficient of Thermal Expansion (CTE) data of two enduring systems' case parts. (LLNL)

Nuclear Survivability:

- Completed relevant program dependencies for the W88 ALT 370 program, including uncertainty quantification threat assessment of III-V electronics, device and component photocurrent and photoconductivity tests, and cable and terminal protection device evidence. (SNL)
- Obtained cold x-ray impulse and shock data to examine effects of accelerated aging in composites. (SNL)
- Completed five Z shots to simulate hostile environment response of materials sensitive to atmospheric storage condition. (SNL)
- Calculated initial threat response for the latest builds of four III-V heterojunction bipolar transistors-based discrete and small-scaled integrated circuits in the W88 ALT 370 fireset. (SNL)
- Conducted first 14 MeV neutron experiments at the National Ignition Facility (NIF) at ~10cm standoff distance to deliver record neutron fluence on the experimental package. Data is used to assess fidelity of the source. (SNL, LLNL)
- Completed collaboration on Hostile Impulse Multi-Physics post-shot data reduction and documentation for cassette configuration/performance, composite sample environmental histories, water diffusion analysis, and calorimeter survivability using gas puff x-ray source at Z. (SNL, Atomic Weapons Establishment)
- Began research effort to understand System-Generated Electro-magnetic Pulse (SGEMP) and Source Region Electro-magnetic Pulse (SREMP) effects in detonator cable assemblies, including design of the Detonator Electromagnetic Response Chamber. (LANL)
- Demonstrated approach to using modern, supported codes for x-ray impulse modeling. (LANL)
- Performed a neutron environment survivability analysis for an advanced concept study. (LANL)
- Conducted an Annular Core Research Reactor (ACRR) experiment on uranium test objects with AWE. (LANL)
- Increased fidelity in legacy ACRR experiment modeling (included radiation and detector response. (LLNL)
- Performed experimental campaigns on the National Ignition Facility and Omega for the hot uranium experiment for Output Uncertainty Quantification effort. (LLNL)
- Began development of Ebooks 2.0 and published a new version that included new models, bug fixes, improved documentation, and additional features. (LLNL)

Enhanced Surveillance:

- Developed new acoustic/vibration diagnostic technique that non-destructively provides detailed information on timing, aging trends, and performance of stronglinks and launch accelerometers in both lab and flight tests. (SNL)
- Completed destructive and non-destructive thermal battery component and materials aging tests and accelerated aging studies of Li/FeS2-chemistry batteries, using the B61 main and pulsed batteries as representative examples. (SNL)
- Quantified aging effects of different moisture levels on the degradation of energetic materials in detonators to provide guidance for design specifications on new energetic components. (SNL)
- Developed a new code, DRACO, for simulation of integrated aging effects in LANL life extension program components. (LANL)
- Performed neutron imaging experiments at the Los Alamos Neutron Science Center (LANSCE) to test performance of various scintillators. (LANL)
- Performed a significant number of material aging studies to identify aging signatures in weapons materials with the development of material aging models. (LANL)
- Received an R&D 100 award for the advanced x-ray scintillator (GLO). (LLNL)
- Qualified new production stream for M97 silicone polymers. (LLNL)

- Completed installation of key components of the neutron imaging infrastructure and completed calculations of neutron dose rates within the facility. (LLNL)
- Completed aging study comparing legacy cellular silicone materials against new direct link write silicone materials. (KCNSC)
- Advanced the mass leak detector prototype to technology readiness level 6, enabling the deployment of the system to DSW/Production Support. (CNS)
- Extended the database of aging properties of current tritium reservoir structural materials after tritium charging and aging to build in helium in the microstructure. (SRNL)

Stockpile Responsiveness Program:
This program was a new start in FY 2017 with a small increment of $2 million appropriated in the advanced certification subprogram. With this funding NNSA accomplished the following baseline organizational activities:

- Established a partnership with the Office of the Deputy Assistant Secretary of Defense for Nuclear Matters and identified a stockpile responsiveness working group with points of contact assigned by relevant DOD organizations.
- Identified laboratory technical leads for the program
- Held preliminary working level meetings to explore candidate design exercises and approaches towards accelerating the nuclear weapons life-cycle
- Conducted a preliminary concept study on a classified topic demonstrating a path forward to executing the design competition directed in the FY2016 NDAA.

Major Outyear Priorities and Assumptions
Outyear funding levels for the Engineering Program total $964.0 million for FY 2020 through FY 2023. This includes the specific experiments, tests, and component maturation that support the enduring stockpile, Alterations, Modifications, LEPs and other insertion opportunities. The Engineering Program priorities reflect continued efforts to assess and sustain the safety, security, reliability, and performance of the nuclear weapons stockpile. Engineering Program priorities include the following:

- Developing and maturing improved use control, safety and security technologies for both near- and long-term insertion opportunities in accordance with Presidential Policy Directive – 35, the Nuclear Weapons Council, NNSA requirements and numerous surety assessments.
- Provide experimental capabilities, diagnostics, and data needed to ensure weapons will not be damaged by delivery environments or accidents.
- Provide tools and technologies necessary for ensuring U.S. nuclear weapons will penetrate enemy defenses and survive hostile environments.
- Provide scientific understanding and diagnostics needed to ensure that aging does not adversely impact the stockpile.
- Provide capabilities that accelerate the development cycle for nuclear weapons and strengthen the ability of the United States to respond to unforeseen events that might threaten the deterrent.

Engineering Funding

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Research, Development, Test and Evaluation				
Engineering				
Enhanced Surety	37,196	36,943	43,226	+6,030
Weapon Systems Engineering Assessment Technology	16,958	16,843	27,536	+10,578
Nuclear Survivability	36,100	35,855	48,230	+12,130
Enhanced Surveillance	42,228	41,941	58,375	+16,147
Stockpile Responsiveness	0	0	34,000	+34,000
Total, Engineering	**132,482**	**131,582**	**211,367**	**+78,885**

Outyears for Engineering Funding

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Research, Development, Test and Evaluation				
Engineering				
Enhanced Surety	46,500	49,626	51,710	56,785
Weapon Systems Engineering Assessment Technology	35,945	36,735	37,485	38,252
Nuclear Survivability	48,932	51,000	53,000	55,000
Enhanced Surveillance	60,279	62,260	63,546	64,860
Stockpile Responsiveness	34,830	36,327	40,143	40,814
Total, Engineering	**226,486**	**235,948**	**245,884**	**255,711**

Engineering
Explanation of Major Changes
(Dollars in Thousands)

	FY 2019 Request vs FY 2017 Enacted
Engineering	
Enhanced Surety: The increase provides early confidence testing of MPS subsystems for future weapons, and further development of weapon security technologies for several Air Force venues.	+6,030
Weapon Systems Engineering Assessment Technology: The increase supports development of experimental test facilities for future delivery systems, investments in ground test capabilities for coupled environments, development of new diagnostics to collect adequate data from testing; and development of advanced methodologies for measuring engineering performance of materials, components, and systems for future qualification.	+10,578
Nuclear Survivability: The increase supports experimental laboratory platforms and modeling capabilities to quantify margins and uncertainties for key failure modes; and studies of evolving threats and mitigating technologies for survivability.	+12,130
Enhanced Surveillance: The increase supports advanced imaging development and testing (neutron imaging and x-ray graded collimation); scintillator development and diagnostics, identification, and quantification of aging processes in high-risk materials; and the development and validation of accelerated aging techniques for materials used in non-nuclear components.	+16,147
Stockpile Responsiveness: Increase supports design competition teams to study responsiveness concepts, prototypes, and the development of approaches for accelerating the qualification and production cycle.	+34,000
Total, Engineering	**+78,885**

Engineering
Enhanced Surety

Description

The Enhanced Surety subprogram is dedicated to simultaneously minimizing the probability of unauthorized use and maximizing the reliability of authorized use of a U.S. nuclear weapon while maintaining the highest levels of safety. Enhanced Surety creates, develops, and matures advanced safety, security, and use-control or denial technologies to minimize the probability of an accidental nuclear explosion and, in the unlikely event that security fails and unauthorized access is gained, reduce the risk of an unauthorized nuclear yield to the lowest possible level.

Enhanced Surety seeks advances in leading-edge technologies in two timeframes:

- Maturing near-term surety concepts and technologies to offer the most effective surety solutions for the enduring stockpile and future insertion opportunities achievable within the time-lines of known LEPs or other improvements in weapon functionality; and
- Continuously creating and evolving highly advanced surety technologies, independent of specific weapon types or insertion opportunities that can result in major surety improvements.

Enhanced Surety incorporates national security guidance as outlined in the Presidential Policy Directive (PPD) – 35; DOE Order 452.1D, Nuclear Explosive and Weapon Surety Program; the NNSA Defense Programs surety strategy; and the 2010 JASON Surety Study findings and recommendations; in conjunction with the Joint Integrated Lifecycle Surety (JILS) risk assessment capability to identify the most cost-effective surety technologies. This enables program and weapon system managers to make better-informed implementation decisions on stockpile surety improvement options.

Enhanced Surety activities include:

(1) Advanced Safety – Minimizes the probability of accidental nuclear yield or dispersion of fissile material. Develops improved control over warhead initiation including improved stronglinks, weaklinks, firing systems, and high explosive initiation systems, in order to provide nuclear weapon safety.

(2) Advanced Use Control/Denial – Creates and matures options, internal and/or external to the warhead, to minimize the potential for deliberate unauthorized use of a U.S. nuclear weapon.

(3) Advanced Security Systems – Develops and demonstrates system concepts and associated enabling technologies that could integrate weapon capabilities with physical security.

FY 2020 - FY 2023 Key Milestones

- Ensure advanced surety options are available for the Interoperable Warhead series by FY 2020 to meet objective and threshold surety requirements.
- Develop advanced security solutions for Air Force ICBM Launch Facilities by FY 2020.
- Develop integrated use control and physical security subsystems for Air Force weapon storage by FY 2022.
- Develop enhanced capability shipping configurations for all legacy stockpile systems by FY 2023.

Enhanced Surety

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Enhanced Surety $37,196,000	**Enhanced Surety $43,226,000**	**Enhanced Surety +$6,030,000**
• Performed material compatibility and parametric studies on MPS options. • Focused on advanced use control technology development to address only highest priority needs. • Matured test and evaluate the next generation highest priority device. • Tested and evaluated technologies for multi-venue ISS implementation for Air Force systems.	• Perform accelerated aging and reaction investigation of test coupons, and continue second year of the MPS full-scale compatibility experiment in order to validate aging of test coupons to full-scale experiment. • Accelerate development of the Highest Priority Next Gen components for future weapon systems. • Further develop multi-venue system architectures for Air Force applications.	• Increase support early confidence testing of MPS subsystems for future weapons. • Further development of weapon security technologies for several Air Force venues.

Engineering
Weapon Systems Engineering Assessment Technology

Description

Weapon Systems Engineering Assessment Technology (WSEAT) provides experimental capabilities, diagnostics, and data needed for assessing that weapons will not be damaged by delivery environments and that weapons will also be robust to possible accidents. It is motivated by the evolving needs of stockpile stewardship for cutting-edge testing and data to increase efficiency and model predictive capability, as well as for qualification of weapons hardware and quantification of weapons margins and assessment uncertainties. WSEAT includes all relevant stockpile-to-target sequence (STS) and manufacturing support service environments excluding nuclear and hostile electromagnetic environments.

Qualification of warheads for future delivery systems will place unique demands on the capabilities provided by WSEAT. Future delivery systems will likely be characterized by STSs different than those for the present stockpile. WSEAT will be relied on to provide laboratory testing facilities that reproduce the environments experienced by the warhead and fundamental data to validate simulations of the engineering performance of the warhead.

Weapon Systems Engineering Assessment Technology activities include:

(1) Storage and Transportation - Delivers capabilities that ensure weapon systems are not damaged by transportation or conditions of prolonged storage.

(2) Reentry Body/Reentry Vehicle (RB/RV) Flight – Supports design and qualification of systems to perform correctly during environments unique to RB/RV flight. This includes weather conditions and effects, as well as a broad range of atmospheric conditions. RB/RV flight environments are distinct due to the environments imparted by the initial missile launch and flight as well as the exo-atmosphere trajectories and shocks imparted during final deployment.

(3) Bombs and Cruise Missile Flight - Supports design and qualification of systems to perform correctly during environments unique to bomb and cruise missile flight. This includes weather conditions and effects, as well as a broad range of atmospheric conditions. Bombs and cruise missiles have unique environments such as the initial launch from an aircraft, powered flight for cruise missiles, and laydown for bombs.

(4) Accidents – Ensures weapon systems remain safe in accidents, including drops during handling, bunker fires, aircraft crashes, and fuel fires. This effort requires engineers to simulate extreme temperatures, impacts, or other conditions to test the stockpile.

FY 2020 - FY 2023 Key Milestones

- Develop and apply experimental modeling capabilities, diagnostics, and data needed to assess impacts of delivery environments and accidents.
- Provide new understandings of critical physics of weapon environments and validation data needed to support the development of predictive models.
- Invest in ground test capabilities for coupled environments, new diagnostics, and advanced methodologies for measuring engineering performance of materials, components, and systems needed for future qualification.
- Invest in capabilities for ground testing and model validation for reentry environments and flight test diagnostics.
- Form key links between engineering sciences, computational simulation, and system evaluation in normal and abnormal environments.

Weapon Systems Engineering Assessment Technology

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Weapon Systems Engineering Assessment Technology $16,958,000	**Weapon Systems Engineering Assessment Technology $27,536,000**	**Weapon Systems Engineering Assessment Technology +$10,578,000**
• Validated test capability instrumentation to quantify weather effects on RB/RV flight bodies using ground test facilities. • Developed RB/RV system-scale multi-axis hybrid shaker test capability for shock and vibration testing of RB/RV and for contact fuze performance qualification margins. • Characterized LAC response to lightning for LAC qualification and predictive performance. • Validated capability for stress state characterization of high explosive systems for all STS environments. • Incorporated insensitive high explosive failure into material models. • Developed polymer material models that incorporate failure mechanisms. • Quantified uncertainties and assess margins for a reentry system primary in normal and abnormal environments. • Characterized electromagnetic test facilities (EMSE, MSC and GTEM). • Characterized dynamic brazing processes.	• Develop experimental test facilities to support normal and abnormal environments. • Invest in ground test abilities for coupled environments. • Combine thermal, fluid, electromagnetic, and structural dynamic environments for qualification across all mission STS. • Develop predictive integrated delivery environments in ground base capabilities with comparable analytic capabilities for design and qualification. • Develop predictive performance models in delivery environments for all nuclear weapon material. • Develop predictive performance models in delivery environments for components selected via a risk informed approach (e.g., thermal batteries, glass-to-metal seals, and mechanisms). • Validate capability for stress state characterization of high explosive systems for all STS environments. • Incorporate insensitive high explosive failure into material models. • Develop polymer material models that incorporate failure mechanisms. • Quantify uncertainties and assess margins for a reentry system primary in normal and abnormal environments. • Characterization of electromagnetic test facilities (EMSE, MSC and GTEM). • Combined environments for future delivery.	• The increase supports development of experimental test facilities for future delivery systems, investments in ground test capabilities for coupled environments, development of new diagnostics to collect adequate data from testing; and development of advanced methodologies for measuring engineering performance of materials, components, and systems for future qualification.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
	• Engineering modeling of NEP initial conditions impacting yield. • Instrumentation for developing environmental specifications. • Develop new methodology for integrated qualification. • Impact of abnormal environments on safety themes.	

Engineering
Nuclear Survivability

Description
Nuclear Survivability provides the tools and technologies necessary for ensuring that U.S. weapons will penetrate enemy defenses. Since weapons entering the stockpile are expected to be fielded for decades, Nuclear Survivability includes projections for the evolution of defensive technologies.

Nuclear Survivability scope includes: (1) developing scientific and engineering models for understanding radiation effects, (2) improving laboratory radiation sources and diagnostics to support code validation and hardware qualification experiments, (3) generating experimental data to validate scientific and engineering models, (4) understanding radiation-hardened design strategies, and (5) evaluating candidate and evolving stockpile technologies for radiation hardness capabilities in a generalized, weapon-relevant configuration.

Nuclear Survivability activities include:

(1) Electromagnetic System-Generated Electro-Magnetic Pulse (SGEMP) and Electro-Magnetic Pulse (EMP) effects – Develops experimental capabilities and obtains validation data for modeling that enable qualification of components to x-ray driven electromagnetic effects as well as provide fundamental understanding to the physics phenomena to aid in the development of modeling and simulation capability based on modern codes.

(2) Effects of X-Rays and Air Blast on Materials – Supports activities related to material and structural effects in response to x-rays and air blast. This includes direct testing of materials and components at high-energy density (HED) radiation generating facilities; development of diagnostics and platforms to increase the usefulness of these facilities; development of surrogate testing capabilities; and development and validation of modeling and simulation capabilities based on modern codes.

(3) Neutron Effects – Provides direct testing of materials and components and develops validated modeling and simulation tools for all neutron-related survivability activities. Some specific activities include modeling and experiments to investigate fission heating, modeling to quantify the initiation response to external neutron fields, experiments and modeling to investigate displacement damage in semiconductors and other electronic effects, facility and diagnostic development, material aging effects on neutron environment survivability, and radiation transport modeling capability development.

(4) Weapon Outputs – Provides validation of new tools, in combination with underground test data and above ground experiments, to better understand and improve the calculated uncertainties associated with weapon output modeling. This includes developing a comprehensive understanding of required modeling fidelity, developing more transparent and functional databases, and improving visualization software for weapon output modeling that will enhance the development of new computational tools.

(5) Integrated Assessments – Performs computational analyses for combined environments against hostile environments. In addition, data generated with integrated survivability assessments can be utilized downstream to better understand terminal flight dynamics of U.S. warheads after a hostile engagement.

FY 2020 - FY 2023 Key Milestones
- Maintain and extend test capabilities at the Z machine, Hermes, Saturn, ACRR and NIF.
- Provide tools and technologies necessary to design and qualify components and subsystems to meet requirements to withstand radiation environments associated with hostile encounters.
- Evaluate performance damage to non-nuclear components and evaluate damage modes to the nuclear explosive package yield.
- Enable QMU-based assessments for key survivability failure modes.

Nuclear Survivability

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Nuclear Survivability $36,100,000	**Nuclear Survivability $48,230,000**	**Nuclear Survivability +$12,130,000**
• Delivered validation data for the W88 ALT 370 qualification-level device and circuit models for compound semiconductor HBTs and circuits with Uncertainty Quantification. • Modeled and validated silicon transistor devices. • Incorporated InRad environments into the B61-12 environmental specification. • Investigated non-nuclear survivability topics for future sustainment program incorporation. • Planned ACRR test with special nuclear materials to support the W80-4. • Delivered operational capability in SREMP/SGEMP to U.S. Strategic Command in Cooperation through the Weapons Effects Strategic Collaboration. • Developed experimentally validated models for thermal, blast, and dust. • Acquired SGEMP experimental data for model validation. • Developed experimentally validated impulse and blowoff models. • Continued eRedbook updates with added suite of threat models relevant to future sustainment program studies, including all stockpile weapon outputs in the eBluebook. • Incorporated ultraviolet/infrared spectrum into codes.	• Provide capabilities to determine margin-to-failure for key components in hostile environments. • In cooperation with DTRA, deliver operational capability in SREMP/SGEMP to U.S. Strategic Command in Cooperation through the Weapons Effects Strategic Collaboration. • Develop experimentally validated models for thermal and blast phenomena. • Acquire SGEMP experimental data for model validation. • Continue development of experimentally validated impulse and blowoff models. • Continue eRedbook updates with added suite of threat models relevant to future sustainment program studies. Include all stockpile weapon outputs in the eBluebook. • Incorporate ultraviolet/infrared spectrum into codes. • Develop an analysis and testing process for qualifying detonators and detonator cable assemblies to hostile environments. • Develop techniques and experimental platforms for in-situ characterization process monitoring for materials subject to radiation environments. • Continued development of reproducible warm x-ray sources. • Additional diagnostics necessary for generating validation data for x-rays. • Platform development at ACCR and other neutron facilities to generate validation data for a neutron damage assessment capability.	• The increase supports experimental laboratory platforms and modeling capabilities to quantify margins and uncertainties for key failure modes; and studies of evolving threats and mitigating technologies for survivability.

Engineering
Enhanced Surveillance

Description

Enhanced Surveillance (ES) provides diagnostics and the aging science needed to ensure that aging will not harm the nuclear weapons stockpile. ES contributes to weapon safety, performance, and reliability by providing the tools needed to predict material, component, and subsystem lifetimes, and detect the precursors of potential age-induced defects. These efforts are dedicated to understanding aging phenomena and how they affect weapon lifetime assessments.

The ES program provides insight on the chemical compatibility of reused legacy materials and components with new materials introduced to weapons undergoing LEPs. In addition to lifetime predictions, new diagnostic tools are being developed and deployed to support conventional surveillance efforts and to provide additional data needed to validate predictive aging models. ES enables a more robust stockpile surveillance program with the overarching goal of identifying problems as early as possible in order to minimize their impact on the effectiveness of the deterrent.

Enhanced Surveillance activities include:

The ES program contributes to weapon safety, performance, and reliability by providing the tools needed to predict material, component, and subsystem lifetimes, and detect the precursors of potential age-induced defects. ES efforts are dedicated to understanding aging phenomena and how they affect weapon lifetime assessments. Six functional areas are supported by Major Technical Elements:

(1) **Non-Nuclear Components and Materials** – Addresses potential aging problems of components and materials and identifies highest risk aging concerns that cross-cut multiple weapon systems.

(2) **High Explosives in the Nuclear Explosives Package (NEP)** – Determines when main charges and boosters need to be replaced based on new predictive methods and non-destructive evaluation tools and examines early detection of potential changes in behavior related to safety, performance, and reliability.

(3) **Plutonium for Pits** – Develops and delivers new analytical methods, tools, modeling, and diagnostics, including non-destructive evaluation techniques, to achieve timely, less invasive, and more cost-effective core surveillance.

(4) **Canned Subassemblies (CSAs) and Cases** – Provides material aging models and integrated materials chemistry simulations needed to determine when, or if, CSAs or cases will need to be refurbished or replaced.

(5) **Polymers and Adhesives in the NEP** – Assesses aging of polymeric materials used throughout the stockpile (i.e., potting materials, cushions, pads, adhesives, structural supports, containment vessels for explosives, and detonator cable assemblies).

(6) **Systems** – Provides improved confidence in future weapons reliability, safety, and performance by augmenting the existing surveillance program with system-level evaluation diagnostics that include new capabilities to measure component-level parameters during system testing.

FY 2020 - FY 2023 Key Milestones

- Develop and refine understanding of stockpile aging and age aware models for weapon materials, components, and subsystems. Provide assessments of aging model status for highest-risk materials identified under Laboratory stewardship.
- Complete an Enhanced Surveillance stockpile aging and lifetime assessment report to support the annual assessment process.
- Provide timely warning of aging phenomenon that threaten the effectiveness of the nuclear deterrent.
- Develop and plan capabilities needed to enable certification of new materials for incorporation into LEPs, MODs, and ALTs.
- Publish lifetime estimates for all current weapon systems.

- Develop and test neutron imaging and x-ray graded collimation technologies as well as supporting scintillator advancement and associated future diagnostics.

Enhanced Surveillance

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Enhanced Surveillance $42,228,000	**Enhanced Surveillance $58,375,000**	**Enhanced Surveillance +$16,147,000**
• Completed an Enhanced Surveillance stockpile aging and lifetime assessment report to support the annual assessment process. • Demonstrated a broad science-based component and material evaluation (CME) program for predictive assessment and uncertainty quantification for selected components. • Developed, validated, and deployed improved predictive capabilities and diagnostics to assess performance and lifetime for nuclear and non-nuclear materials. • Characterized aging behavior of legacy and potential replacement materials and components in coordination with decision making on sustainment programs, ALTs, and SFIs. • Conducted CME activities on a prescribed set of component families. • Refined lifetime estimates across the nuclear explosives package materials and components for sustainment program use. • Documented advances in predictive aging models for second tier polymeric materials in LLNL systems.	• Develop and test neutron imaging and x-ray graded collimation technologies. • Support scintillator development and diagnostics. • Develop and validate accelerated aging techniques for non-nuclear components. • Complete an Enhanced Surveillance stockpile aging and lifetime assessment report to support the annual assessment process. • Develop and refine understanding of stockpile aging and age aware models for weapon materials, components, and subsystems. Provide assessments of aging model status for highest-risk materials identified under laboratory stewardship. • Provide timely warning of aging phenomenon that threaten the effectiveness of the nuclear deterrent. • Develop new diagnostics to fill surveillance and data needs for improved aging models. • Develop and plan capabilities needed to enable certification of new materials for incorporation into LEPs, MODs, and ALTs. • Publish lifetime estimates for all current weapon systems. • Procure x-ray computed tomography system. • Validate corrosion resistant coating options for replacement in modernization program applications. • Quantify the rate and extent of degradation of lubricants due to oxygen and moisture.	• The increase supports advanced imaging development and testing (neutron imaging and x-ray graded collimation); scintillator development and diagnostics, identification, and quantification of aging processes in high-risk materials; and the development and validation of accelerated aging techniques for materials used in non-nuclear components.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
	• Determine failure mechanisms for aging of glass to metal seals. • Determine mechanisms governing epoxy and adhesive off-gassing, curing and degradation with age. • Quantify extent of corrosion in energetic components in sealed environments. • Deliver spectrally encoded imaging as a next-generation tool for the interrogation of high explosive performance. • Complete study to simulate and measure irradiation effects from x-ray computed tomography • Complete phenomenological models of compression set and load retention in high-risk polymers. • Demonstrate weapon gas analysis capabilities to enable identification of aging environments.	

Engineering
Stockpile Responsiveness

Description

The FY 2016 National Defense Authorization Act (NDAA), Section 3112 established the need for NNSA to develop a Stockpile Responsiveness Program. NNSA will execute this program in consultation with DOD. The Stockpile Responsiveness Program will focus on developing scenarios to respond to representative future threats, challenges, and opportunities, and to explore concepts jointly with the DOD including prototyping, flight testing, non-nuclear component qualification, and methods for Nuclear Explosive Package (NEP) certification. This program will exercise the capabilities required to support all phases of the joint nuclear weapons life cycle process, transfer knowledge and skills to the newer generation of nuclear weapon designers and engineers, and strengthen integration between DOD and NNSA. The budget was specified in the FY 2017 NDAA, and it has not previously been appropriated.

Stockpile Responsiveness activities include:

The Stockpile Responsiveness Program will develop and demonstrate capabilities to shorten design, certification, and manufacturing cycles to minimize time and costs leading to engineering prototype and production. These efforts will include both non-material (procedures) and material improvements (manufacturing, improved design, new testing capabilities). Stockpile Responsiveness activities will be conducted in coordination with DOD. The Stockpile Responsiveness Program will also execute the weapon “pathfinder” process that will enhance, and exercise the spectrum of capabilities required to develop and manufacture nuclear weapons to ensure the nuclear deterrent of the United States remains safe, secure, reliable, credible, and responsive.

FY 2020 - FY 2023 Key Milestones

- Explore new technology concepts.
- Examine ways to accelerate the research cycle to enhance the country’s ability to respond to uncertainty.
- Identify future geopolitical or technical challenges and execute plans to conceptualize, study, develop, and engineer system and/or operational concepts to offset these challenges.
- Identify shortfalls in the design, test, and production processes necessary to bring systems into production.
- Develop scenarios to respond to future threats, challenges, and opportunities.
- Exercise the ability to execute options that may have significantly different characteristics and requirements than current stockpile systems.

Stockpile Responsiveness

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Stockpile Responsiveness $0	**Stockpile Responsiveness $34,000,000**	**Stockpile Responsiveness +$34,000,000**
• Established plan for stockpile responsiveness exercises. • Held inter-agency meeting to identify challenge scenarios.	• Execute joint DOE/DOD working group that will oversee Stockpile Responsiveness. • In coordination with DOD and the intelligence community, study evolving threats to the deterrent. • Conduct competitive studies and execute challenge scenario that includes qualification, engineering, hydrodynamic tests, flight testing, and prototyping. • Develop and test small-scale hardware to validate concepts. • Provide engineering to enable agile qualification with hydrodynamic tests and sounding rocket tests.	• The Stockpile Responsiveness Program budget line was not funded in FY 2017, although Congress provided an additional $2M in the Advanced Certification subprogram of the Science Program which supported initial organizational and planning activities for the Stockpile Responsiveness Program.

Engineering
Performance Measures

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Performance Goal (Measure)	**Technology Maturation Capabilities** - The annual progress towards the maturation of technologies and stockpile assessment capabilities as measured by the number of deliverables in the implementation plans completed.						
Target	13 deliverables	14 deliverables	N/A	N/A	N/A	N/A	N/A
Result	**Met** - 13						
Endpoint Target	Until the last nuclear weapon system in the stockpile is dismantled, NNSA will continue to mature technologies and stockpile assessment capabilities to support Directed Stockpile Work (DSW) nuclear weapons refurbishment and assessment activities.						
FY 2019 Note:	This Performance Measure is being replaced with the new Engineering and Surveillance Capabilities Performance Measure.						
Performance Goal (Measure)	**Engineering and Surveillance Capabilities** - Percentage progress toward providing planned/scheduled capabilities for survivability and surveillance required for annual assessment of the stockpile, Life Extension Program decisions, and early identification of aging problems that could degrade stockpile performance.						
Target	N/A	N/A	100 % completion of specified activities/ deliverables identified in the annual update of the Engineering Program implementation plan	100 % completion of specified activities/ deliverables identified in the annual update of the Engineering Program implementation plan	100 % completion of specified activities/ deliverables identified in the annual update of the Engineering Program implementation plan	100 % completion of specified activities/ deliverables identified in the annual update of the Engineering Program implementation plan	100 % completion of specified activities/ deliverables identified in the annual update of the Engineering Program implementation plan
Result	N/A						
Endpoint Target	100 % completion of specified activities/deliverables identified in the annual update of the Engineering Program implementation plan (Annual)						

Engineering
Capital Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2017 Current	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted	Outyears to Completion
Capital Operating Expenses Summary (including Major Items of Equipment (MIE))								
Capital Equipment >$500K (including MIE)	N/A	6,509	+2,909	+2,909	+2,973	+3,038	+129	N/A
Plant Projects (GPP and IGPP)	N/A	0	0	0	0	0	0	N/A
Total, Capital Operating Expenses	**N/A**	**6,509**	**2,909**	**2,909**	**2,973**	**3,038**	**+129**	N/A
Capital Equipment > $500K (including MIE)								
Total Non-MIE Capital Equipment	N/A	6,509	2,909	2,909	2,973	3,038	+129	N/A
Total, Capital Equipment (including MIE)	N/A	**6,509**	**2,909**	**2,909**	**2,973**	**3,038**	**+129**	**0**
Plant Projects (GPP and IGPP)								
Total Plant Projects (GPP/IGPP)	N/A	0	0	0	0	0	0	0
Total, Plant Projects (GPP/IGPP)	**N/A**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total, Capital Summary	**N/A**	**6,509**	**2,909**	**2,909**	**2,973**	**3,038**	**+129**	**0**

Outyears for Engineering

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Capital Operating Expenses Summary (including MIE)				
Capital Equipment >$500K (including MIE)	3,153	3,173	3,243	3,314
Plant Projects (GPP)	0	0	0	0
Total, Capital Operating Expenses	**3,153**	**3,173**	**3,243**	**3,314**

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Inertial Confinement Fusion Ignition and High Yield

Overview

The Inertial Confinement Fusion Ignition and High Yield (ICF) Program provides essential data and supporting expertise required for the ongoing assessment and certification of the nuclear weapon stockpile, making it an important program for the U.S. Department of Energy's (DOE) national security mission of maintaining a safe, secure, and effective nuclear deterrent. As the DOE National Nuclear Security Administration (NNSA) extends the life of the nuclear arsenal, it exercises the nation's design and manufacturing capabilities and maintains the scientific and technical proficiency of our workforce and effectiveness of our infrastructure. As our warheads proceed through the life extension program (LEP) process, new materials and components must be certified. The ICF Program plays a key role in the assessment and certification of the stockpile by providing experimental and computational scientific capabilities that deliver a credible knowledge basis on the behavior of new materials and components for life-extended systems.

The ICF Program plays a critical role in sustaining the nation's expertise and capabilities in high energy density (HED) science, a core technical competency of the NNSA Stockpile Stewardship Program (SSP). ICF does this through the development and operation of experimental facilities and measurement instruments to provide unique access to extreme temperature, pressure, and density regimes relevant to nuclear weapons performance. As the majority of the energy released from a nuclear weapon is generated by matter in the HED state, understanding the behavior of matter in the HED regime is critical to predicting the performance of nuclear weapons and understanding both primary and secondary nuclear weapon physics. The ICF Program provides important access to critical data necessary to validate the physics models upon which our integrated simulation capability is built. This includes the study of dynamic material behavior in extreme conditions, radiation transport, radiation-hydrodynamics, and thermonuclear burn. The experimental science basis provided by the program, combined with archived legacy data from the underground test program, gives confidence in the codes and models used to support the annual assessments and certifications, execute LEPs, and resolve Significant Finding Investigations (SFIs).

The capabilities provided by the ICF Program for Stockpile Stewardship include national HED facilities, experimental platforms, computational models, experimental diagnostics, and target engineering and production. Achieving the requisite conditions for HED experiments is only possible at facilities specifically designed to create such environments. The three national HED facilities are the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory (LLNL), the Z pulsed power facility at Sandia National Laboratories (SNL), and the Omega Laser Facility (Omega) at the University of Rochester's Laboratory for Laser Energetics (LLE). Outside of underground nuclear explosive testing, these facilities provide the only platforms that can be used to experimentally validate the simulation codes that couple transport processes with hydrodynamics models. These HED platforms also provide a vital capability for the study of radiation effects sciences, used to determine weapon survivability in hostile environments.

Additionally, the ICF Program supports long-term research and development (R&D) efforts in ignition science, with the goal of developing a self-sustained, thermonuclear, burning plasma (i.e., ignition) platform, as well as ignition-generated fusion yields, for SSP applications. Such a platform represents the next-generation of scientific capability to provide direct access to weapon-relevant regimes and nuclear environments for the study of high-yield, weapon-relevant conditions. The achievement of laboratory-scale thermonuclear ignition is an important objective of the SSP and is a scientific 'grand challenge' problem that tests our codes, our people, our facilities, and our integrated capabilities. To this end, the scientific pursuit of laboratory ignition and subsequent generation of high fusion yields places the program at the leading edge of science and technology in the field of HED science.

To accomplish these missions, the ICF Program coordinates closely with several other NNSA program elements within the Office of Research, Development, Test, and Evaluation (RDT&E), and facilitates experiments for external partners in the interest of national security. Priorities and requirements for these programs are documented in the Stockpile Stewardship and Management Plan (SSMP).

Activities conducted by the ICF Program to advance our understanding of HED stockpile science include:

- Investigating material behaviors in HED regimes presently inaccessible via other experimental techniques; and
- Improving the predictive capability of our science and engineering models in high-pressure, high-energy, high-density regimes.

Activities in support of ignition science, a subset of HED stockpile science, include:

- Developing high-fidelity diagnostics, advanced experimental platforms, and predictive capabilities and simulations;
- Characterizing and understanding perturbations prevalent in plasmas and thermonuclear environments;
- Maintaining the scientific leadership necessary to recruit, train, and retain the highest caliber scientists and engineers to engage in stockpile stewardship; and
- Making progress towards the achievement and application of multi-megajoule fusion yields.

Highlights of the FY 2019 Budget Request

The FY 2019 ICF Program builds upon the FY 2017 accomplishments listed below, supporting the DOE mission to maintain a safe, secure, and effective nuclear deterrent. Planned activities for 2019 include:

- Providing key data that reduces uncertainty in calculations of nuclear weapons performance;
- Obtaining data on the properties of high-atomic-weight materials, such as uranium and plutonium, under HED conditions that have previously not been achieved in laboratory environments, using the Z Facility at SNL and the NIF at LLNL;
- Fielding platforms at NIF to measure the complex hydrodynamic behavior of materials;
- Understanding physics issues currently limiting ICF ignition target performance at the NIF;
- Building on successes demonstrated by pulsed power fusion concepts;
- Progressing with the implementation of the National Diagnostic Plan to develop new transformative diagnostics and to optimize the cost-effective development of diagnostics for NNSA's HED facilities; and
- Continuing safe and efficient operation of NNSA's national HED facilities in accordance with their Governance Plans.

The FY 2019 Request supports continued research and operations at NNSA's preeminent HED facilities, with research efforts focusing on HED stockpile science supporting the broader RDT&E portfolio. Emphasis on improving operational efficiencies at both the NIF and the Z facilities will continue. Pulsed-power-based HED research and operations are supported at levels necessary to maintain base SSP capabilities and advance new fusion concepts. Research efforts toward the development of an ignition platform are slowed to meet higher priority NNSA mission needs. Program planning will continue to ensure priorities are aligned with SSP requirements.

In summary, the FY 2019 Budget provides approximately $118,121,000 to SNL for the operation and utilization of the Z facility. This includes $63,089,000 from the ICF Program budget and approximately $55,032,000 under the Science Program. The ICF budget provides approximately $258,777,000 to LLNL to fund operation of the NIF for all users, and $28,154,000 for ICF Program research activities. Additionally, this budget provides $40,383,000 to the University of Rochester for the operations of the Omega Laser Facility for all users, and $5,000,000 for ICF Program research activities. As part of rebalancing the ICF Program to strengthen long-term support for SSP efforts, as well as responding to higher NNSA priorities, the FY 2019 Request initiates a three-year ramp-down in financial commitment to the University of Rochester's Laboratory for Laser Energetics, including the Omega Laser Facility, resulting in the cessation of the financial assistance agreement.

Facility/Subprogram	LLNL (NIF)	LLE (OMEGA)	SNL (Z Facility)
	(Dollars in Thousands)		
Research	28,154	5,000	8,169
Ignition	22,053	0	0
Support of Other Stockpile Programs	6,101	5,000	0
Pulsed Power ICF	0	0	8,169
Operations	258,777	40,383	54,920
Diagnostics, Cryogenics, and Experimental Support	27,936	7,700	7,942
Facility Operations and Target Production	230,841	32,683	46,978
Total Operation and Utilization	**286,931**	**45,383**	**63,089**

Major Outyear Priorities and Assumptions

Outyear funding levels for the ICF Program total $1,769,705,000 for FY 2020 through FY 2023. ICF Program priorities include the following:

- Increase development of HED experimental capabilities, particularly intense sources of neutrons and x-rays, to simulate nuclear weapons outputs and effects to meet evolving nuclear survivability requirements for stockpile modernization as described in the 2018 SSMP.
- Maintain the necessary HED experimental capabilities (1) to support LEPs through validation of nuclear weapons models used to evaluate LEP materials and design options and (2) to conduct long-term research to aid in resolution of future SFIs.
- Develop HED experimental capabilities to study the impacts of aging on the behavior of nuclear weapons materials in the HED regime and the behavior of new materials developed through new production science efforts.
- Continue development of HED experimental capabilities to study primary boost, including the behavior of materials under relevant conditions and the application of burn platforms, as part of a broader primary boost science effort coordinated across RDT&E.
- Pursue laboratory ignition and the eventual achievement of high yield, which provides direct access to weapons-performance-relevant regimes. Significant advances in ignition research have been made in the last five years and requirements for thermonuclear-yield-producing platforms have evolved since first established at the outset of the SSP. A priority of the ICF Program is to update the strategy and plan regarding the demonstration of ignition, and an eventual high yield capability, which will inform future national strategy and investments.
- Improve NNSA uncertainty quantification (UQ), the quantitative evaluation of uncertainties in numerical predictions. The ignition effort will be increasingly used as the test bed to advance our UQ methodology for the weapons program particularly into regimes where little-to-no experimental data exist.

At present, the demand for facility use for HED stockpile science at each HED facility typically exceeds the available experimental time by a factor of two. While reductions in the FY 2019 facility operations budget will result in fewer total experiments, proportionally more experimental time will be allocated for critical HED SSP experiments at each facility.

FY 2017 Accomplishments

- **High-impact stockpile stewardship experiments:**
    - Measured shockless compression of a uranium alloy on the Z facility, relevant to future subcritical experiments.
    - Completed STAR and Z experiments for cross-platform comparisons with NIF and other facilities as part of national tantalum strength milestone.
    - Conducted two Pu strength experiments on NIF to compare with weapons performance assessment models.
- **Experiments executed on the NNSA's HED facilities:**
    - NIF Experiments: 408; Z Facility Experiments: 142; Omega Experiments: 2138.
- **New or improved capabilities developed on HED facilities this fiscal year:**
    - NIF demonstrated multiple shots at 2.5-MJ full-NIF-equivalent performance on one quad of laser beams, paving the path to full NIF operation at 2.5 MJ with modest optical system changes (a nearly 40% increase in total energy).
    - NIF, Z, and Omega brought online the first transformational diagnostics to provide dramatic improvements in HED measurement capability and met the *Getting the Job Done* NA-10 milestone: 4-frame Ultrafast X-ray Imager, high-

resolution x-ray spectrometer in collaboration with PPPL, 2nd neutron imager line-of-sight on the NIF, and Wolter x-ray optic for Z.

- **Lab Accomplishments:**
  - **LLNL** delivered the highest fusion yield to date achieved in any laboratory (1.7×10^{16} DT neutrons; 47 kJ fusion yield) on the NIF as a result of improvements in controlling hohlraum drive symmetry and the minimization of fill-tube degradation effects.
  - **SNL** set new Z facility records for >20 keV x-ray output (increase of >50%) and peak current to a radiation source.
  - **LANL** completed a multi-year NIF campaign of 63 experiments exploring hydrodynamic material mixing in the presence of shear flow, providing data to validate an important Advanced Simulation and Computing (ASC) mix model.

Inertial Confinement Fusion Ignition and High Yield
Funding

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Research, Development, Test and Evaluation				
Inertial Confinement Fusion Ignition and High Yield				
Ignition	77,932	77,403	22,434	-55,498
Support of Other Stockpile Programs	23,363	23,204	17,397	-5,966
Diagnostics, Cryogenics and Experimental Support	64,196	63,760	51,453	-12,743
Pulsed Power Inertial Confinement Fusion	5,616	5,578	8,310	+2,694
Joint Program in High Energy Density Laboratory Plasmas	9,492	9,428	0	-9,492
Facility Operations and Target Production	342,360	340,035	319,333	-23,027
Total, Inertial Confinement Fusion Ignition and High Yield	**522,959**	**519,408**	**418,927**	**-104,032**

Outyears for Inertial Confinement Fusion Ignition and High Yield
Funding

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Research, Development, Test and Evaluation				
Inertial Confinement Fusion Ignition and High Yield				
Ignition	29,942	36,578	37,386	38,213
Support of Other Stockpile Programs	17,397	16,759	17,130	17,508
Diagnostics, Cryogenics and Experimental Support	47,128	62,859	64,248	65,668
Pulsed Power Inertial Confinement Fusion	9,476	8,748	8,942	9,139
Joint Program in High Energy Density Laboratory Plasmas	10,000	0	0	0
Facility Operations and Target Production	314,084	312,542	319,449	326,509
Total, Inertial Confinement Fusion Ignition and High Yield	**428,027**	**437,486**	**447,155**	**457,037**

Inertial Confinement Fusion Ignition and High Yield
Explanation of Major Changes
(Dollars in Thousands)

	FY 2019 Request vs FY 2017 Enacted
Inertial Confinement Fusion Ignition and High Yield	
Ignition: Decrease reflects the shift to higher priority NNSA efforts. Reduces the number of ignition platform designs being studied, suspending research on the laser direct-drive design concept. All ignition research will slow, with the emphasis of ignition R&D placed on laser indirect-drive concept development and magnetic direct-drive platforms.	-55,498
Support of Other Stockpile Programs: Decrease reflects the shift to higher priority NNSA efforts.	-5,966
Diagnostics, Cryogenics, and Experimental Support: Decrease reflects the shift to higher priority NNSA efforts. Execution of the National Diagnostics Plan will slow, and the development of some transformational diagnostics will be paused.	-12,743
Pulsed Power Inertial Confinement Fusion: Increase capitalizes on recent advances in pulsed-power fusion concept development.	+2,694
Joint Program in High Energy Density Laboratory Plasmas: Decrease suspends NNSA's direct support of stockpile science workforce development in the HED subject area to support higher priority program efforts.	-9,492
Facility Operations and Target Production: Decrease in funding to support higher NNSA priorities. Operations at the NIF will be reduced to three shifts, from the maximum of four, resulting in a 25% - 30% shot reduction at the NIF.	-23,027
Total, Inertial Confinement Fusion Ignition and High Yield	**-104,032**

Inertial Confinement Fusion Ignition and High Yield
Ignition

Description

This subprogram supports R&D to advance experimental platforms to achieve thermonuclear burn onset, ignition, and ultimately multi-megajoule fusion yield in the laboratory. Realized, these provide a set of unique capabilities critical to the long-term viability of the Stockpile Stewardship Program—particularly, the future qualification of nuclear components and the assessment and certification of nuclear weapons in the full range of relevant HED regimes. The Ignition subprogram pursues these capabilities through theory, experiments, modeling, design, and engineering. The near-term emphasis of this subprogram is to improve understanding of the key physics and engineering features that limit performance of integrated implosion experiments. In addition, the ICF Program has a goal to determine the efficacy of achieving ignition on the NIF and the development of verified physics scaling requirements to multi-megajoule fusion yields for each of the major ICF ignition concepts.

The long-term goals of this subprogram include generating necessary yields to conduct nuclear survivability tests and using burning plasma outputs to study previously inaccessible regimes relevant to nuclear weapons in a laboratory setting. The core requirements for this subprogram are described in the FY 2018 SSMP, the Ten-Year HED Strategic Plan, the National Diagnostics Strategy, and the ICF Program Framework.

Activities in Science, Advanced Simulation and Computing (ASC), Directed Stockpile Work (DSW), and other stockpile programs use data and platforms developed in this subprogram's pursuit of thermonuclear ignition to successfully execute their respective SSMP responsibilities.

FY 2020 – FY 2023 Key Milestones

- Develop experimental burn platforms to address weapon physics issues.
- Use ignition science experiments as a testbed to advance UQ methodology for SSP applications.
- Conduct a major assessment of the status of efforts towards achieving ignition on the NIF and developing scaling arguments to achieve ignition for other approaches.
- Update the national strategy towards the achievement of ignition and eventually high yield, accounting for requirements for thermonuclear-yield-producing platforms that have evolved since first established at the outset of the SSP.

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Ignition $77,932,000	**Ignition $22,434,000**	**Ignition -$55,498,000**
• Execute the Five-Year ICF Roadmap for stagnation and burn physics including: ○ The study of one-dimensional (1D) implosion platforms on the NIF and Omega facilities to study mix and hot-spot assembly initial conditions (ICs) at low convergence; ○ Elucidating hohlraum energetics and radiation symmetry for indirect-drive platforms on the NIF and Z facilities; ○ Plasma and radiation opacities and symmetry at moderate convergences and peak powers on the NIF and Z facilities, and ○ Stagnation physics at high convergence on the NIF, Z and Omega facilities. • Assess efficacy of wetted foam targets as 1D implosion platforms for investigating geometric convergence effects on ICF implosions and hot spot formations. • Elucidate correlations between time-dependent symmetries, hydrodynamic instabilities and mix, laser plasma instabilities, and effects of hot-electron generation on ICF target performance. • Determine effectiveness of Deuterium-Tritium (DT) wetted foams for direct drive. • Explore alternate capsule mounting techniques on the NIF to minimize long length-scale hydrodynamic perturbations.	• Prioritizes research efforts to understand and control hydrodynamic instability and mix, drive symmetry, and target compression for the laser indirect-drive ignition concept. • Limited research effort into capsule support engineering, improved modeling of uncertainty and performance scaling, and more detailed hohlraum studies.	• Decrease reflects the shift to higher priority NNSA efforts. • Suspends research advancing the laser direct-drive ignition concept. • Delays determination of the efficacy of achieving ignition at the NIF and establishment of validated physics scaling requirements for achieving multi-megajoule fusion yields in the laboratory. • Reduces number of institutions participating in ignition research. • Slows the overall rate of progress in developing an ignition platform for SSP applications, significantly delaying the ability to sufficiently understand nuclear survivability and boost physics.

Inertial Confinement Fusion Ignition and High Yield
Support of Other Stockpile Programs

Description

In the high energy density (HED) state, materials experience pressures greater than one million Earth atmospheres and reach temperatures and densities far exceeding those of normal or condensed matter, generating complicated behaviors predominantly described by plasma physics. This complex and dynamic state dominates energy generation in nuclear weapons, making its study a key component of the SSP. Specifically, the research supported in this subprogram addresses dynamic material properties, fluid and plasma hydrodynamics, low-energy nuclear physics, hydrodynamic instability-induced mix, burn, boost, radiation transport and opacities, and yield applications relevant to outputs, environments, and effects. This subprogram coordinates closely with the Science Campaigns program to develop and implement the experimental infrastructure and capabilities required to execute necessary experiments at all of the national HED facilities. The core requirements for this subprogram are described in the SSMP, the Ten-Year HED Strategic Plan, and the National Diagnostics Plan.

Science, ASC, DSW, and other stockpile programs are informed by and benefit from the capabilities developed by this subprogram to successfully execute respective SSMP responsibilities.

FY 2020 - FY 2023 Key Milestones

Develop platforms to:

- Study impact of aging on material response in HED regime and behavior of materials from new production science.
- Validate models for primary boost physics including the impact of initial conditions.
- Generate intense sources of x-rays and neutrons for survivability studies.
- Measure temperature of stockpile relevant materials at high pressures in the solid phase to improve fidelity of materials characterization.

Support of Other Stockpile Programs

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Support of Other Stockpile Programs $23,363,000	**Support of Other Stockpile Programs $17,397,000**	**Support of Other Stockpile Programs -$5,966,000**
• Execute the Ten-Year HED Strategic Plan to support the requirements of the SSMP, to include demonstrating an HED-coupled hydro-burn platform. • Develop platforms for experiments supporting the validation of radiation and plasma opacity models. • Demonstrate a Deuterium-Tritium (DT) burn platform that meets the needs of the Stockpile Stewardship Program. • Demonstrate new platform to acquire high-pressure materials data at high initial temperatures. • Complete data collection and analysis for the high Atwood Number (At) shear campaign on the NIF. • Perform pioneering experiment for weapons physics using a double shell platform. • Assess relative merits of Beryllium (Be) capsules, wetted foam capsules, and double shells for burning plasma experiments.	• Continued implementation of the Ten-Year HED Strategic Plan to support the requirements of the SSMP, including development of an experimental platform coupled to thermonuclear outputs. • Limited development of platforms for experiments supporting the validation of models in support of the FY 2020 Hostile Survivability PCF pegpost.	• Decrease reflects the shift to higher priority NNSA efforts. • Delays the implementation of the HED capabilities plan, places the FY 2019 Secondary Performance PCF pegpost at risk, and delays experiments supporting nuclear survivability, including the development of platforms to provide Radiation Effects Science capabilities in support of the FY 2020 Hostile Survivability PCF pegpost.

Inertial Confinement Fusion Ignition and High Yield
Diagnostics, Cryogenics, and Experimental Support

Description
Advanced experimental facilities that reproduce the extreme HED conditions present in nuclear detonations require parallel investments in diagnostic, target, and experimental platform capabilities. The Diagnostics, Cryogenics, and Experimental Support subprogram conducts the R&D for new specialized technologies needed to execute and determine the results of HED experiments. It supports developments that broaden the range of experiments that can be performed on the advanced laser- and pulsed-power facilities. The subprogram is responsible for the design and engineering of a complex array of diagnostic and measurement systems, along with associated information technology subsystems to automate data acquisition. Support from this subprogram also covers the development and deployment of supporting equipment and technologies to facilitate a broad range of experimental requirements relevant to programmatic deliverables. This subprogram provides general support for the deployment of technologies for the experimental study of matter under extreme HED conditions. The central requirements for this subprogram are presented in the SSMP, the Ten-Year HED Strategic Plan, the National Diagnostics Plan, and the ICF Program Framework.

Science, ASC, DSW, and other stockpile programs are informed by and benefit from the capabilities developed by this subprogram to successfully execute respective SSMP responsibilities.

FY 2020 – FY 2023 Key Milestones
- Research, develop, and deploy diagnostics and their associated analysis packages that can operate in harsh HED environments on NIF and Z that are necessary in understanding radiation physics and the behavior of matter in the HED regime that are critical to predicting the performance of nuclear weapons and understanding both primary and secondary nuclear weapon physics.
- In partnership with France's CEA, deploy high-energy, high-spatial-resolution toroidal x-ray imaging system on the NIF.

Diagnostics, Cryogenics, and Experimental Support

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Diagnostics, Cryogenics and Experimental Support $64,196,000	**Diagnostics, Cryogenics and Experimental Support $51,453,000**	**Diagnostics, Cryogenics and Experimental Support -$12,743,000**

• Develop and support diagnostic capabilities, cryogenic systems, user optics, laser and pulsed power capabilities at the NIF, Omega, and Z facilities, as well as other supporting facilities at a pace commensurate with program requirements.
• Implement and update the National Diagnostics Strategy.
• Develop, advance, and implement diagnostics and associated analysis packages that can operate in challenging HED environments on NIF, Omega, and Z, including:
  ○ At a minimum two line-of-sight high spatial and spectral resolution spectrometers on the NIF, and one on the OMEGA and Z facilities,
  ○ Optical Thomson scattering diagnostics on the NIF,
  ○ The GCD-3 at the NIF, and
  ○ A dual-sensor, multi-frame hybrid CMOS detector on the Z facility, with a duplicate provided to the NIF.
• Commission a third axis of a neutron time-of flight diagnostic on the NIF.
	• Continued implementation of the National Diagnostic Plan at a reduced level.
	• Prioritizes development and implementation of diagnostics and associated analysis packages that can operate in the challenging HED environments on the NIF and Z, including:
	  ○ Development of hybrid CMOS detectors for x-ray diffraction diagnostics.
	  ○ Techniques for detecting hard x-rays (>20 keV) with less than 1 nanosecond resolution.
	  ○ Time-resolved neutron spectrum for determination of the rho-r and ion temperature evolution during the burn in ICF capsules.
		• Decrease reflects the shift to higher priority NNSA efforts.
		• Decrease slows rate of development of transformational diagnostics.
		• Decrease delays the development and support of general diagnostic capabilities, cryogenic systems, user optics, laser, and pulsed-power capabilities at all national HED facilities to a pace commensurate with program requirements.
		• Modest increase included for diagnostic and experimental support at the Z Pulsed Power Facility to accommodate the subsequent increase in HED stockpile experiments.

Inertial Confinement Fusion Ignition and High Yield
Pulsed Power Inertial Confinement Fusion

Description

This subprogram advances the science and technology associated with pulsed-power-driven implosions and corresponding platforms. The subprogram supports focused-physics and integrated experiments aimed at improving understanding of the magnetic direct-drive (MDD) ignition concept, and experiments addressing uncertainties in x-ray driven platforms, such as double-ended and dynamic hohlraum platforms. Support for this major technical effort includes pulsed-power experimental design and simulation, research and development, fielding of experiments, and improvements in pulsed-power capabilities and tools. As part of an ICF Program goal, this subprogram supports the determination of requirements for an advanced pulsed-power driver capable of achieving high-yield fusion. The core requirements for this subprogram are described in the SSMP, the Ten-Year HED Strategic Plan, the National Diagnostics Plan, and the ICF Program Framework.

Science, ASC, DSW, and other stockpile program elements are informed by the capabilities developed by this subprogram to successfully execute respective SSMP responsibilities.

FY 2020 – FY 2023 Key Milestones

- Develop new platforms to generate intense sources of x-rays and neutrons for nuclear survivability studies.
- Complete scaling study of MagLIF target concept exploring sensitivity to laser energy and magnetic field strength as part of the major assessment of the status of efforts towards achieving ignition and developing scaling arguments.
- Update the national strategy towards the achievement of ignition and eventually high yield accounting for requirements for thermonuclear yield producing platforms that have evolved since first established at the outset of the SSP.

Pulsed Power Inertial Confinement Fusion

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Pulsed Power Inertial Confinement Fusion $5,616,000	**Pulsed Power Inertial Confinement Fusion $8,310,000**	**Pulsed Power Inertial Confinement Fusion +$2,694,000**
• Execute the Five Year ICF Roadmap for stagnation and burn physics including: ○ Elucidating hohlraum energetics and radiation symmetry for indirect-drive platforms on the NIF and Z facilities; ○ Plasma and radiation opacities and symmetry at moderate convergences and peak powers on the NIF and Z facilities, and ○ Stagnation physics at high convergence on the NIF, Z and Omega facilities. • Complete scaling study of MagLIF concept exploring sensitivity to laser energy and magnetic field strength. • Assess the stagnation of MagLIF target experiments and compare with simulations. • Define requirements for and perform scoping studies of a pulsed power facility that can demonstrate robust ignition and multi-mega Joule fusion yield.	• Develop platforms to provide Radiation Effects Science capabilities to support the FY 2020 Hostile Survivability PCF pegpost. • Continued support for fusion concept exploration on the Z facility, including physics scaling studies. • Compare accumulated data from magnetically-driven fusion experiments on Z with 3-D radiation magneto-hydrodynamic simulations.	• Capitalizes on recent advances in pulsed-power fusion concept development. • Increase prevents further erosion to a base capability critical to supporting radiation effects based SPP applications.

Inertial Confinement Fusion Ignition and High Yield
Joint Program in High Energy Density Laboratory Plasmas

Description

The Joint Program in High Energy Density Laboratory Plasmas (HEDLP) is a joint effort with the DOE's Office of Science to support basic HED research that strengthens the science, technology, and engineering base of the SSP. This subprogram provides support for external users at the Omega Laser Facility through the National Laser Users' Facility (NLUF) Program and also supports joint solicitation with the Office of Science for HEDLP research to be performed at universities and DOE laboratories. It includes HED-related Stockpile Stewardship Academic Alliances (SSAA) funding and other ICF-funded university programs designed to steward the study of laboratory HED plasma physics, maintain a cadre of qualified HED researchers outside of the national laboratories, and ensure the development of the next generation of specialized HED scientists to support future Stockpile Stewardship efforts.

FY 2020 – FY 2023 Key Milestones

- Provide research grants and cooperative agreements to fund individual investigators as well as research centers.

Joint Program in High Energy Density Laboratory Plasmas

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Joint Program in High Energy Density Laboratory Plasmas $9,492,000	**Joint Program in High Energy Density Laboratory Plasmas $0**	**Joint Program in High Energy Density Laboratory Plasmas -$9,492,000**
• Continue on-going High Energy Density Laboratory Plasma research through solicitations to fund individual investigator and research centers activities. Conduct solicitation for the National Laser Users' Facility (NLUF) Program. • Continue support to existing basic science research grants that are enabling academic participation in HED physics and increasing the cadre of qualified HED researchers who can comprise the future laboratory workforce.	• No funding requested in FY 2019.	• Decrease reflects the shift to higher priority NNSA efforts. • Decrease suspends direct NNSA support for stockpile science workforce development in the field of HED physics.

Inertial Confinement Fusion Ignition and High Yield
Facility Operations and Target Production

Description

This subprogram supports the safe and efficient operations of the national HED facilities, including research, design, and engineering. The Facility Operations and Target Production subprogram principally supports operational costs for the NIF, the Z facility, and the Omega Laser Facility. This funding also supports access to the HED facilities for external mission partners including DTRA and the AWE. Additionally, facility user meetings such as the Omega Laser Facility Users Group (OLUG) and the NIF Users Group are supported by this subprogram. These meetings provide a venue for receiving feedback regarding future facility improvements and an opportunity for users to exchange ideas and best-practices for use of the facilities. This subprogram also provides funding for a limited number of targeted cooperative agreements with external private-industry and academic partners, facilitating technology transfer out of the laboratories and into society and promote development of potential future staff. The core requirements for this subprogram are described in the Ten Year HED Strategic Plan, the National Diagnostics Plan, and the ICF Program Framework.

Science, ASC, DSW, and other stockpile program elements are informed by and benefit from the capabilities developed by this subprogram to successfully execute the NNSA SSMP.

FY 2020 – FY 2023 Key Milestones

- Maintain safe and efficient facility operations at NIF and Z, which work in concert to provide data contributing to:
  - The annual assessment of the stockpile in the face of increasing challenges due to aging or remanufacture;
  - Reduced response times for resolving stockpile issues, and
  - Knowledge necessary for future physics design and certification capability as required to anticipate and respond to technological changes.

Facility Operations and Target Production

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Facility Operations and Target Production $342,360,000	**Facility Operations and Target Production $319,333,000**	**Facility Operations and Target Production -$23,027,000**
• Maintain facility operations at the NIF, Omega, and Z-facility. • Emphasize the highest priority experiments in support of the stockpile. • Improve in operational efficiency at all facilities and in target fabrication. • Conduct annual assessment of infrastructure and mission needs and recommend following fiscal year investments across all HED facilities. • Perform radiographic platform development experiments using the Advanced Radiograph Capability (ARC).	• Maintain facility operations at all of the national HED facilities: NIF, Z-facility, and Omega. • Emphasize experiments in support of the stockpile. • Continue to improve operational efficiency at all facilities. • Conduct annual assessment of infrastructure and mission needs and recommend following fiscal year investments across all HED facilities.	• Decrease reflects the shift to higher priority NNSA efforts. • Reduction of one shift of operations at the NIF will result in a 25% decrease in the total number of experiments fielded (approximately 100 experiments). • Modest increase in the number of experiments fielded at the Z Pulsed Power Facility, enhancing data acquisition for HED stockpile science.

Inertial Confinement Fusion Ignition and High Yield
Performance Measures

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Performance Goal (Measure)	**High Energy Density Physics Research -** Complete high energy density physics research needed to support the nuclear weapons program as embodied in the Predictive Capability Framework (PCF).						
Target	30% of progress (cumulative)	40% of progress (cumulative)	47% of progress (cumulative)	54% of progress (cumulative)	61% of progress (cumulative)	68% of progress (cumulative)	75% of progress (cumulative)
Result	**Met** - 30						
Endpoint Target	By FY 2024, complete the ICF Program activities needed to complete the PCF pegposts.						

Inertial Confinement Fusion Ignition and High Yield
Capital Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2017 Current	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted	Outyears to Completion
Capital Operating Expenses Summary (including Major Items of Equipment (MIE))								
Capital Equipment >$500K (including MIE)	N/A	16,509	5,862	5,862	8,366	23,123	+16,261	N/A
Plant Projects (GPP and IGPP)	N/A	2,950	0	0	0	0	0	N/A
Total, Capital Operating Expenses	**N/A**	**19,459**	**5,862**	**5,862**	**8,366**	**23,123**	**+17,261**	N/A
Capital Equipment > $500K (including MIE)								
Total Non-MIE Capital Equipment	N/A	16,509	5,862	5,862	5,991	6,123	+261	N/A
NIF High Resolution VISAR, LLNL	5,400	0	0	0	0	2,700	+2,700	2,700
Energy upgrade to OTS Laser, LLNL	5,800	0	0	0	0	3,300	+3,300	2,500
Magnetized Targets, LLNL	6,200	0	0	0	200	3,500	+2,500	2,500
Time Resolved Magnetic Recoil Spectrometer, LLNL	5,475	0	0	0	175	2,800	+2,800	2,500
NIS Equator 90-214, LLNL	6,500	0	0	0	2,000	2,700	+2,700	1,800
Target LRU, LLNL	6,000	0	0	0	0	2,000	+2,000	4,000
Total, Capital Equipment (including MIE)	N/A	**16,509**	**5,862**	**5,862**	**8,366**	**23,123**	**+16,261**	**16,000**
Plant Projects (GPP and IGPP)								
Total Plant Projects (GPP/IGPP)	N/A	2,950	0	0	0	0	0	0
Total, Plant Projects (GPP/IGPP)	**N/A**	**2,950**	**0**	**0**	**0**	**0**	**0**	0
Total, Capital Summary	**N/A**	**19,459**	**5,862**	**5,862**	**8,366**	**23,123**	**+17,261**	**16,000**

Outyears for Inertial Confinement Fusion Ignition and High Yield

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Capital Operating Expenses Summary (including MIE)				
Capital Equipment >$500K (including MIE)	16,258	7,396	6,537	6,681
Plant Projects (GPP)	0	0	0	0
Total, Capital Operating Expenses	**16,258**	**7,396**	**6,537**	**6,681**

Advanced Simulation and Computing

Overview

The Advanced Simulation and Computing (ASC) program provides high-end simulation capabilities (*i.e.,* modeling codes, computing platforms, and supporting infrastructure) to meet the requirements of the Stockpile Stewardship Program (SSP). Modeling the extraordinary complexity of nuclear weapons systems is essential to maintaining confidence in the performance of our aging stockpile without underground testing. The ASC program underpins the integrated assessment capability supporting Annual Assessment and future sustainment program certification of the stockpile, and is an integral element of the Predictive Capability Framework, as described in the FY 2018 Stockpile Stewardship and Management Plan (SSMP). ASC also provides critical capabilities that help inform decision-making related to the sustainment of the nuclear stockpile and future stockpile reductions in support of U.S. nonproliferation objectives.

The ASC capabilities are used to address areas of national security in addition to the U.S. nuclear stockpile. Through coordination with other Government agencies that independently fund these services, and other organizations within the National Nuclear Security Administration (NNSA), ASC plays important roles in supporting nonproliferation, emergency response, nuclear forensics, and attribution activities.

The FY 2019 objectives include the following:

- Support assessments, certification, significant finding investigations (SFI), both current and future sustainment programs including alterations (ALTs), modifications (Mods), and life extension programs (LEPs);
- Support the objective of fielding a usable exascale computer system for national security missions;
- Influence and respond to rapid technological changes in the computing industry; and
- Improve physics models to support current and future NNSA goals (such as primary and secondary reuse; weapons safety, security, and survivability improvements; advanced manufacturing of components; and broader nuclear security applications) without nuclear testing.

In July 2015, the program published a comprehensive ASC Program Business Plan that describes the essential elements of the ASC program and provides context for the program as a necessary component of the science-based SSP. It details the essential elements including the program's structure, its clear definition of roles and responsibilities, and its investment in tools and people. The plan reinforces the critical importance of a consistent investment in the work scope of the NNSA nuclear security laboratories and emphasizes the benefits of productive partnerships with the DOE Office of Science Advanced Scientific Computing Research (ASCR) program, with vendors from within the computing industry, and with academic institutions. The ASC Program Business Plan documents the planning, tracking and oversight that coordinates this science-based enterprise.

The ASC program requests $703,401,000 in FY 2019, a $40,217,000 increase over the FY 2017 Enacted level. The request continues to fund program requirements that transition integrated codes to work efficiently on emerging high-performance computers; develop next-generation codes; maintain computing resources and facilities; and importantly, resource work with industry to assure NNSA requirements continue to be addressed as high-performance computing evolves. These capabilities are necessary to inform the annual assessment of the nuclear stockpile. This Budget Request includes $116,000,000 for activities and research leading to deployment of exascale capability for national security mission and $47,000,000 designated for two construction projects: 1) $24,000,000 for the Exascale Class Computer Cooling Equipment (EC3E) project at the Los Alamos National Laboratory (LANL), and 2) $23,000,000 for the Exascale Computing Facility Modernization (ECFM) project at the Lawrence Livermore National Laboratory (LLNL). The NNSA Office of Advanced Simulation and Computing and Institutional R&D Programs allocates budget with a different structure than the one used by the Department of Energy Office of Science ASCR program. As a result, to show comparable numbers for Exascale investment in the Exascale Crosscut, the ASC budget is shown with the platform investment budget included. The above budgets total $163,000,000.

The drivers of the ASC program that require this budget include the Nuclear Weapons Council approval of the Baseline Strategic Plan, which must remain aligned with the Department of Defense (DOD) current nuclear modernization plans keying off of the FY 2018 Nuclear Posture Review. This work will further develop simulation and computing capabilities to improve understanding of energy balance, boost, and equations of state for materials and other relevant phenomena of interest. Annual assessments, sustainment programs, and SFIs are drivers that require responsive modeling and simulation capabilities to better understand the impact of environmental and system conditions, including aging, and the resolution of historical nuclear test anomalies. Investing in physics improvements in the Integrated Design Codes (IDCs) will open design options for subsystem components for future sustainment programs. A third driver is the need to adapt current capabilities to evolving high performance computer architectures and sustaining/improving modeling and simulation capabilities for the long term.

The ASC computing capabilities are the key integrating mechanism across the nuclear weapons program through the IDCs. The assessment of the nation's stockpile requires high-fidelity physical models. The IDCs support design studies, maintenance analyses, the Annual Assessment Reports, sustainment programs, SFIs, and weapons dismantlement activities. The IDCs contain the mathematical descriptions of the physical processes of nuclear weapon systems and functions. Combined with weapon-specific data, the IDCs provide detailed simulations of nuclear weapons performance assessment without the need for nuclear testing. Since the 1992 nuclear weapons testing moratorium, IDCs embody the repository of data from experiments conducted at the NNSA's high energy density facilities and legacy underground nuclear tests, as well as the accumulated experience of the Directed Stockpile Work (DSW) program user community. The IDCs currently perform well for general mission-related activities. However, as aging takes the current stockpile further away from the data collected from underground tests, maintaining the nuclear weapons stockpile will require IDCs with enhanced predictivity and use high-performance computing (HPC) resources more effectively.

The global shift in fundamental computing architecture is an increasingly urgent driver for simulation and computing investments. ASC capabilities that support the DSW mission are beginning to experience the effects of obsolescence as high performance computing technologies continue to advance and evolve to radically different and more complex architectures (e.g., massive parallelism, heterogeneous, and low-memory bandwidth). Maintaining currency with the commercial computer sector will advance high-fidelity physics modeling capabilities required to maintain a credible deterrent and will address additional mission needs in non-proliferation, emergency response, nuclear forensics, and attribution programs. ASC is focused on minimizing the disruptive mission impact of this change in HPC.

The ASC strategy for acquiring the advanced computing technologies, needed to support current and future stockpile work, fully recognizes the need to pursue exascale computing capabilities. In the FY 2019 Budget Request, the ASC program contributes to the foundation for an exascale capability for the nation. The Advanced Technology Development and Mitigation (ATDM) subprogram consolidates the investments Congress directed for exascale, starting in FY 2014, and unified into the National Strategic Computing Initiative directed by Presidential Order in 2015 to tackle challenges facing ASC in its support of stockpile stewardship and upon which future efforts can build. The technical problems facing the program today are a subset of the exascale issues we will need to overcome to be successful. Therefore, investments in ATDM advance both exascale technologies and stockpile computing effectiveness. The ASC strategy is coordinated closely with the DOE's Office of Science ASCR program in the development and oversight of the Department's Exascale initiative.

Highlights of the FY 2019 Budget Request

- Support the development of exascale computing and associated software and applications.
- Deliver the Sierra (LLNL) system and operate the ASC Trinity (LANL) in classified environment.
- Preserve the current integrated design codes.
- Increase attention to survivability and hostile environment modeling.
- Transition period for ATDM as research and development (R&D) transitions to platform-specific R&D and acquisition of testbeds/prototypes to address scaling and technology impacts.
- Prepare the ASC facilities at the NNSA National Laboratories for the next-generation platforms.

FY 2017 Accomplishments

- Utilizing machine learning, a new methodology for simulating LEP stockpile components in abnormal thermal environments was developed, enabling rapid uncertainty quantification and robust design optimization with thorough tracking of uncertainty sources.
- LANL improved model of hostile blast response for the W88-refresh certification process.
- Trinity fully transitioned to classified network on July 5, 2017.
- Commodity Technology Systems-1 at LANL, LLNL, and Sandia National Laboratory (SNL) available for classified work.

- ASC Sierra Early Access systems installed at LLNL.

Major Outyear Priorities and Assumptions
Outyear funding levels currently estimated for the ASC program total $3,002,868,000 for FY 2020 through FY 2023 reflect the following:

ASC Program Priorities
- Exascale-ready facilities and computing environment.
- Procurement of Exascale platform, named El Capitan, at LLNL.
- Development of simulation and computing capabilities to improve understanding of hostile environments, boost, material properties and aging, and other relevant phenomena of interest.
- Applications of machine learning and artificial intelligence to the NNSA mission.

ASC Program Assumptions
- The need to adapt current capabilities to evolving advanced computer architectures persists and improvement of modeling and simulation capabilities for the long-term is successful.
- LLNL facility project, ECFM, at completion integrates with exascale computing center enhancements to reflect system siting requirements and provides the environment for effective and efficient operations of ATS-4/El Capitan.

The ASC program anticipates that the out-year funding amounts will get updated as activities and projects, including platform procurements, are finalized.

Advanced Simulation and Computing
Funding

	(Dollars in Thousands)			
	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Research, Development, Test and Evaluation				
Advanced Simulation and Computing				
Integrated Codes	145,830	144,840	146,645	+815
Physics and Engineering Models	65,196	64,753	63,565	-1,631
Verification and Validation	50,428	50,086	51,814	+1,386
Advanced Technology Development and Mitigation	95,299	94,652	95,073	-226
Computational Systems and Software Environment	131,736	130,841	123,645	-8,091
Facility Operations and User Support	174,695	173,509	175,659	+964
Construction	0	0	47,000	+47,000
Total, Advanced Simulation and Computing	**663,184**	**658,680**	**703,401**	**+40,217**

Outyears for Advanced Simulation and Computing
Funding

	(Dollars in Thousands)			
	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Research, Development, Test and Evaluation				
Advanced Simulation and Computing				
Integrated Codes	146,645	146,645	149,724	152,879
Physics and Engineering Models	63,565	63,565	65,154	66,783
Verification and Validation	51,908	54,908	60,906	61,928
Advanced Technology Development and Mitigation	50,000	61,000	56,000	36,000
Computational Systems and Software Environment	161,421	174,223	277,495	285,358
Facility Operations and User Support	175,659	175,659	177,468	179,324
Construction	68,651	27,000	13,000	0
Total, Advanced Simulation and Computing	**717,849**	**703,000**	**799,747**	**782,272**

Advanced Simulation and Computing
Explanation of Major Changes
(Dollars in Thousands)

	FY 2019 Request vs FY 2017 Enacted
Advanced Simulation and Computing	
Integrated Codes (IC): The slight increase is in-line with fluctuating work scope from year to year and reflects the integrated nature of the simulation side of the program.	+815
Physics and Engineering Models (PEM): The decrease is in-line with fluctuating work scope from year to year and reflects the integrated nature of the simulation side of the program.	-1,631
Verification and Validation (V&V): The increase is in-line with fluctuating work scope from year to year and reflects the integrated nature of the simulation side of the program.	+1,386
Advanced Technology Development and Mitigation (ATDM): The slight decrease is in-line with fluctuating work scope from year to year and reflects continued work on next-gen code development and evaluation of performance on advanced hardware test beds. Pursues technologies critical to an exascale capability for the nation.	-226
Computational Systems and Software Environment (CSSE): Decrease reflects normal fluctuations in platform procurement profiles.	-8,091
Facility Operations and User Support (FOUS): Increase reflects the integrated nature of the computing side of the program between platform procurement/deployment and computing center operations.	+964
Construction: Increase accommodates construction line item 18-D-670, Exascale Class Computer Cooling Equipment, and 18-D-620, Exascale Computing Facility Modernization Project. The total does not include other project costs.	+47,000
Total, Advanced Simulation and Computing	**+40,217**

Advanced Simulation and Computing
Integrated Codes

Description

Integrated codes (IC) contain the mathematical descriptions of the physical processes of nuclear weapon systems and functions. Combined with weapon-specific input data created by the nuclear weapons designers and engineers, IC provides detailed simulations of nuclear weapons performance assessment, without the need for underground nuclear testing.

The IC subprogram produces large-scale, integrated design codes (IDCs) that can be used to evaluate the safety, security, and performance of nuclear weapons. They are used for physics and engineering stockpile assessments to support design studies, certification, maintenance analyses, LEPs, Alts, SFIs, and weapons dismantlement activities. The IDCs represent a repository of knowledge gained from experiments on NNSA's wide range of facilities and legacy UGTs, as well as enhancements made to support DSW. The improved predictive capabilities support a variety of national security missions.

The IC subprogram also maintains selected legacy codes and is responsible for emerging and specialized codes and libraries that support the weapons mission. Examples include codes for generating meshes used in the IDCs, codes for simulating materials at the molecular level used to generate data points for modeling materials at the mesoscale used to understand material behavior, codes and modules for simulating Inertial Confinement Fusion (ICF) physics, including laser loading for the National Ignition Facility (NIF), and magneto-hydrodynamics (MHD) for simulating dynamic materials testing on the Z-machine. The specialized codes support the weapons mission by enabling simulation workflow, generating models or information used by the IDCs, or facilitating validation of the IDCs by comparison with experiments.

The IC subprogram funds the critical skills needed to develop, maintain, and advance the capabilities of the large-scale integrated simulation codes that are needed for the following SSP and DSW activities: on-going predictive capability based assessments; annual assessment; sustainment program reuse/remanufacture design decisions, qualification, and certification; SFI resolution; and safety assessments to support transportation and dismantlement. In addition, these capabilities are necessary for a host of related requirements such as nuclear counter-terrorism efforts (e.g. nuclear forensics, foreign assessments, and device disablement techniques).

The goals for the IC subprogram include covering the application mission space and ensuring the performance of the application software on current and future computing platforms, as follows:

- Complete coverage for nuclear national security mission space. The IC subprogram provides application software for the full spectrum of stockpile mission areas and will cover as much of the mission space for foreign weapon assessment as possible with the resources available. The stockpile mission space includes weapon performance and engineering calculations in normal, abnormal, and hostile environments, as well as outputs to enable effects estimates.
- Efficiency and resilience on existing and future architectures. Application software will leverage the available computing resources at all times.

The goal of the ASC academic alliance activities is to establish validated, large-scale, multidisciplinary simulation as a major academic and applied research program. This aspect of the ASC Program has the potential to expand the pipeline of staff for the NNSA national security laboratories. Although the work is open science and unclassified, it still provides students relevant experience for the weapons code development and design communities.

ASC's contribution to the DOE Computational Science Graduate Fellowships will continue as part of a joint DOE Office of Science Advanced Scientific Computing Research (ASCR) collaboration.

Integrated Codes

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Integrated Codes $145,830,000	**Integrated Codes $146,645,000**	**Integrated Codes +$815,000**
Ongoing user support and maintenance • Code builds and ports. • As needed, user training and assistance. • Regularly scheduled testing and bug fixes. Capability development • Further develop nuclear performance assessment codes for boost and secondary performance, safety codes to address multi-point safety issues, engineering assessment codes for hostile environments, and engineering assessment codes for normal and abnormal environments. • Adapt existing codes to new architectures. • Migrate current design and safety codes to run efficiently on hybrid computer architectures. • Support the Kansas City National Security Campus in the use of ASC codes and computing resources to solve production manufacturing problems. Workforce and accession • Maintain mentoring program for early career staff. • Collaborate with PSAAP2 centers on technical topics and staff recruitment.	Continue ongoing user support and maintenance • Code builds and ports. • As needed, user training and assistance. • Regularly scheduled testing and bug fixes. Continue capability development • Further develop nuclear performance assessment codes for boost and secondary performance, safety codes to address multi-point safety issues, engineering assessment codes for hostile environments, and engineering assessment codes for normal and abnormal environments. • Adapt existing codes to new architectures. • Migrate current design and safety codes to run efficiently on hybrid computer architectures. • Support the Kansas City National Security Campus in the use of ASC codes and computing resources to solve production manufacturing problems. Ongoing workforce and accession • Maintain mentoring program for early career staff. • Collaborate with academic alliance centers on technical topics and staff recruitment.	• Increase accounts for inflation and provide increased emphasis on modeling hostile environments.

Advanced Simulation and Computing
Physics and Engineering Models

Description

The Physics and Engineering Models (PEM) subprogram provides the models and databases used in simulations supporting the U.S. stockpile. These models and databases describe a wide variety of physical and engineering processes occurring in a nuclear weapon life-cycle. The capability to accurately simulate these processes is required for annual assessment; design, qualification, and certification of warheads undergoing sustainment programs; resolution (and in some cases generation) of SFIs; and the development of future stockpile technologies. The PEM subprogram is closely linked to the Science program within the Office of Defense Programs, Research, Development, Test, and Evaluation, which provides the experimental data that informs development of new models used in simulation codes.

The general goals for the PEM subprogram are threefold: 1) To provide mathematical models and databases to represent physical behavior and physical data (for example, Equation of State (EOS), strength parameters, radiation opacities and nuclear cross sections) for use in the IDCs, 2) To collaborate with the IC subprogram to implement these models and data in the IDCs; and, 3) To collaborate with the V&V subprogram to ensure the models have been implemented correctly (verified) and have been compared to experimental data (validated). The specific goals follow:

- Improved material models and fundamental data to underwrite predictive capability. The PEM subprogram will provide models of material behavior (high-explosive initiation and burn, strength, damage, EOS, spall and ejecta, turbulence, manufacturing effects, and aging) as well as fundamental data such as nuclear reaction cross sections and atomic opacities.
- Implementation and evaluation of science-based models in IDCs. The PEM subprogram will collaborate with the IC subprogram to ensure that models and data are implemented appropriately in the IDCs and will collaborate with both the IC and V&V subprograms on testing the implementations for accuracy and efficiency.

Physics and Engineering Models

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Physics and Engineering Models $65,196,000	**Physics and Engineering Models $63,565,000**	**Physics and Engineering Models -$1,631,000**
Model Development • Further develop reactive flow models for high explosives (HE) detonation and burn that capture grain scale material heterogeneity and are computationally efficient. • Develop additional models for complex hydrodynamic processes that are sufficiently predictive to help the design and assessment of various stockpile options. • Further refinement of models needed for certification on new safety options. • Continue to adapt/develop models for components built by advanced/adaptive manufacturing techniques.	Continue Model Development • Further develop reactive flow models for HE detonation and burn that capture grain scale material heterogeneity and are computationally efficient. • Develop additional models for complex hydrodynamic processes that are sufficiently predictive to help the design and assessment of various stockpile options. • Further refinement of models needed for certification on new safety options. Continue to adapt/develop models for components built by advanced/adaptive manufacturing techniques.	• Decrease reflects year to year fluctuations in work scope.

Advanced Simulation and Computing
Verification and Validation

Description

The Verification and Validation (V&V) subprogram is a bridge between the IC and PEM subprograms and the DSW program. It brings these efforts together to evaluate the capability of IDCs. Verification activities demonstrate that the IDCs and PEM models are correctly solving their respective governing equations. Validation activities ensure that the codes (both science codes and IDCs) are solving the correct equations, and that the models themselves are correct for the intended application. Together, these subprogram activities provide a technically rigorous, credible, and sensible foundation for computational science and engineering calculations by developing, exercising, and implementing tools that provide confidence in simulations of high-consequence nuclear stockpile problems.

The V&V subprogram funds the critical skills needed to apply systematic measurement, documentation, and demonstration of the ability of the models and codes to predict physical behavior. The V&V subprogram is developing and implementing uncertainty quantification (UQ) methodologies as part of the foundation for the Quantification of Margins and Uncertainties (QMU) process of weapons assessment and certification. The V&V subprogram also drives software engineering practices to improve the quality, robustness, reliability, and maintainability of the codes that evaluate and address the unique complexities of the stockpile. As the stockpile ages, and as weapons designers with test experience leave the NNSA nuclear security enterprise, it has become increasingly important that the codes are verified and validated, so that future generations of designers are confident in the use of these foundational tools.

During the planning period, V&V efforts will enhance our abilities in dealing with complex safety and engineering issues within the nuclear weapons stockpile. With major modifications to adapt existing codes to future hardware a primary focus of the IC subprogram, and development of new codes a primary focus of the ATDM subprogram, the primary focus for the V&V subprogram will be ensuring the modifications and new codes are subjected to thorough verification and validation methodologies.

The V&V subprogram exists to assess the fidelity of the simulation tools in collaboration with the code, model development, and weapon application communities, as follows:

- Comprehensive assessments of new models and code features. The V&V subprogram will provide the tools and methods necessary for evaluation of new PEM models and IDC versions. Where possible, the V&V subprogram will coordinate with the PEM and IC communities to perform these assessments together and provide feedback to PEM and IC on potential improvements or insufficiencies.
- Improved simulation uncertainty treatment. The V&V subprogram will provide the tools and methodologies for estimating the uncertainty in weapon simulation results from the IDCs. Part of the uncertainty estimate will help analysts connect the physical processes in the models to the relevant experimental data.

Verification and Validation

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Verification and Validation $50,428,000	**Verification and Validation $51,814,000**	**Verification and Validation +$1,386,000**
Verification and Validation • Verify improvements in nuclear performance codes. • Verify improvement in safety codes to address multi-point safety issues. • Validate improvements to physics and material models. • Verify improvements in engineering codes for normal, abnormal, and hostile environments. • Broaden development of V&V protocols for algorithms running on hybrid HPC architectures. Predictive Capability Assessment • Assess predictive capability as improvements to codes and models, including new nuclear material data, are made available. • Ongoing development of the primary and secondary common models. On-going user support and training • Provide training on the use of UQ tools. • Implement quality assurance controls to ensure material and nuclear databases are correctly updated and maintained.	Continue Verification and Validation • Verify improvements in nuclear performance codes. • Verify improvement in safety codes to address multi-point safety issues. • Validate improvements to physics and material models. • Validate improvements in engineering codes for normal, abnormal, and hostile environments. • Broaden development of V&V protocols for algorithms running on hybrid HPC architectures. Continue Predictive Capability Assessment • Assess predictive capability as improvements to codes and models, including new nuclear material data, are made available. • Ongoing development of the primary and secondary common models. On-going user support and training • Provide training on the use of UQ tools. • Implement quality assurance controls to ensure material and nuclear databases are correctly updated and maintained.	• Continuation of FY 2018 work scope. • Increase supports need to address new architectures and next-generation codes.

Advanced Simulation and Computing
Advanced Technology Development and Mitigation

Description

The Advanced Technology Development and Mitigation (ATDM) sub-program includes laboratory code and computer engineering and computer science projects that support long-term simulation and computing goals relevant to both exascale computing and the broad national security missions of the NNSA. This subprogram addresses the need to build new IDCs that are more aligned to the emerging technologies, to engage in co-design ventures with industry to evolve operating systems and other support software, and to work with HPC vendors to deploy technologies that are useful for stockpile stewardship.

The ASC capabilities that support the DSW mission are challenged, as HPC technologies are evolving to radically different and more complex (many-core or heterogeneous) architectures. The efficiency of the current generation of IDCs is deteriorating as these codes are migrated to the latest HPC platforms. This trend is expected to continue and accelerate on future platforms unless mitigated. The sub-program must address three major challenges: 1) the radical shift in computer architectures, 2) maintaining the current IDCs took more than a decade to develop and validate, and 3) adapting current capabilities as evolving computer technologies become increasingly disruptive to the broad national security missions of NNSA.

The ATDM sub-program tackles the most critical subset of issues that are occurring during this period of disruptive change in HPC architectures in order to continue the current level of support to the DSW mission. There are three focus areas for investment. Next Generation Code Development and Application is focused on long-term investigation of how future code development must address new HPC challenges of massive, heterogeneous parallelism using new programming models and data management techniques developed through co-design of applications and systems with industry. Next Generation Architecture and Software Development is focused on computing technology research of extreme, heterogeneous architectures, mitigating its impact and advancing its capabilities for ASC simulation codes. Inter-agency Co-Design will leverage NNSA HPC advanced architecture activities and software technologies to address the sponsor agencies' mission needs. The other agencies will also have the opportunity to participate in co-design activities with vendors and academia, in addition to workforce development and training opportunities.

The long-term goals for the ATDM subprogram include the following:

- New IDCs for stockpile mission needs. The ATDM subprogram will develop new IDCs for the stockpile missions (one at each laboratory) that will ensure mission continuity on future computing architectures. Lessons learned, developed codes, and code infrastructures will be shared with the IC subprogram – when appropriate.
- Effective technologies for simulation on future architectures at scale. The ATDM subprogram will develop technologies for simulation at scale and share those technologies with the CSSE and IC subprograms.

FY 2020 - FY 2023 Key Milestones

- Advanced Technology Development and Mitigation: Next-gen IDC and hostile environment initial capability demo, FY 2020.

Advanced Technology Development and Mitigation

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Advanced Technology Development and Mitigation $95,299,000	**Advanced Technology Development and Mitigation $95,073,000**	**Advanced Technology Development and Mitigation -$226,000**
• Expand development of next generation programming models and ASC physics & engineering codes. • Initiate hostile environment simulation capabilities for next generation codes. • Improve NNSA proxy applications and to enhance co-design interactions with computer vendors. • Continue laboratory personnel's participation in Crossroads Application Center of Excellence collaboration with system vendor. • Jointly manage with DOE Office of Science the Exascale Path Forward projects. • Initiate acquisition of peta-FLOPS-class, Arm-based testbed to evaluate the technology.	• Sustain development of next-generation programming models and ASC physics & engineering codes. • Continue development of hostile environment simulation capabilities for next-gen codes. • Continue laboratory personnel's participation in ASC Crossroads and El Capitan projects' Application Center of Excellence collaboration with system vendors. • Deploy initial peta-FLOPS-class, Arm-based testbed with software stack to evaluate feasibility of architecture for ATDM codes.	• Decrease reflects R&D transitions to platform-specific R&D and acquisition of testbeds/prototypes to address scaling and technology impacts.

Advanced Simulation and Computing
Computational Systems and Software Environment

Description

The Computational Systems and Software Environment (CSSE) subprogram builds integrated, balanced, and scalable computational capabilities. The complexity and scale of weapons simulations require the ASC Program to lead the mainstream HPC community by investing in and influencing the evolution of computing environments. This subprogram provides the stability to ensure productive system use and protect NNSA's investment in IDCs.

Along with the powerful Commodity Technology (CT) and Advanced Technology (AT) systems that the program fields, the supporting software infrastructure that is deployed on these platforms includes many critical components, from system software to input/output (I/O), storage and networking, and post-processing visualization and data analysis tools. CSSE also examines possible future technologies beyond exascale, such as quantum, neuromorphic, and non-complementary metal-oxide-semiconductor (CMOS)-based computing techniques.

The CSSE subprogram provides the computational infrastructure, both hardware and software, necessary to support weapon applications, as follows:

- Design and develop usable computing systems. The CSSE subprogram will design and procure the computer systems required to support stockpile stewardship and broader nuclear security issues. These systems will include test beds for system development, CT systems for most stockpile computing work, and AT systems for large-scale computing requirements and future technology readiness.
- Comprehensive, stable computing and development environments. The CSSE subprogram will also provide the system software and code development environments necessary for code development and simulation using the computing hardware.

FY 2020 - FY 2023 Key Milestones

- Computational Systems and Software Environment: ATS-3/Crossroads acceptance, FY 2021; Exascale computing environment, FY 2022; ATS-4/El Capitan acceptance, FY 2023

The ATS-4/El Capitan project plan is in initial development phase. The Office for Advanced Simulation and Computing (ASC) will conduct market surveys, Request for Information (RFI) and Request for Proposal (RFP) with industry to finalize cost estimates for this project. The ASC Program assesses that the FY 2019 requested amount is sufficient for the project to remain on schedule, but anticipates that the out-year funding amounts will need to be updated as the project cost is estimated more accurately.

Computational Systems and Software Environment

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Computational Systems and Software Environment $131,736,000	**Computational Systems and Software Environment $123,645,000**	**Computational Systems and Software Environment -$8,091,000**
Platform Operations: • Continue deployment of CTS1 systems. • Continue deployment of ASC Sierra hardware with anticipated system acceptance Q4 FY 2018. • Provide Trinity's maintenance contract. • Initiate ASC Crossroads non-recurring engineering work with system vendor on high-bandwidth memory, novel power management and advanced programming models. • Initiate procurement of ATS-4 for system delivery in 2023. • Installed first partition of Trinity (ATS-1) at LANL for classified use. The final partition of ATS-1 was installed and made available for unclassified applications to complete the 41-peta-FLOPS system Capability Development: • Support ASC application porting to and scaling on Sierra's Initial Delivery system. • Further development of tri-lab computing environment consisting of user tools, networks, file system, archival storage, and visualization and data analysis. • Fund and evaluate the suitability of various post-CMOS technologies, such as quantum and neuromorphic computing, to NNSA's national security mission.	Platform Operations: • Continue operation of CTS1 systems at tri-labs. • Initiate operation of ASC Sierra system in the classified environment. • Continue ASC Crossroads non-recurring engineering work with system vendor on high-bandwidth memory, novel power management and advanced programming models. • Initiate ASC El Capitan (ATS-4)'s non-recurring engineering work with system vendor. Capability Development: • Continue ASC application porting and scaling on Sierra system. • Further development of tri-lab computing environment consisting of user tools, networks, file system, archival storage, and visualization and data analysis. • Fund and evaluate the suitability of various post-CMOS technologies, such as quantum (D-Wave system) and neuromorphic computing (TrueNorth system), to NNSA's national security mission.	Decrease reflects year-to-year fluctuations in platform procurement profile.

Advanced Simulation and Computing
Facility Operations and User Support

Description

The Facility Operations and User Support (FOUS) subprogram provides the facilities and services required to provide nuclear weapons simulations. Facility Operations includes physical space, power, and other utility infrastructure, and Local Area/Wide Area Networking for local and remote access, as well as system administration, cyber-security, and operations services for ongoing support. User Support includes computer center hotline and help-desk services, account management, web-based system documentation, system status information tools, user training, trouble-ticketing systems, common computing environment, and application analyst support.

The FOUS subprogram is responsible for management of the computer operations and maintenance, and for system administration and user support.

- Effective management of computing hardware infrastructure. The FOUS subprogram will provide adequate power, cooling, and integrated facilities to support the computing system hardware, and it will provide the requisite networking and storage infrastructure.
- Responsive system administration, maintenance, and user support. The FOUS subprogram will administer the computational systems, manage the job scheduling capability, and provide responsive support to the user community.

FY 2020 - FY 2023 Key Milestones

- Facility Operations and User Support-Construction: ECFM completion, FY 2022.

Facility Operations and User Support

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Facility Operations and User Support $174,695,000	**Facility Operations and User Support $175,659,000**	**Facility Operations and User Support +$964,000**
Continued User Support • Integrated Tri-Lab Operating System stack onto the first-deployment CTS1 systems. • Pursue a common computing environment for users. • Maintain maximum availability of computer cycles to end users. Implement best practices. • Provide operational support for reliable and secure production computing environment. • Prepare for incorporation of next generation architectures. Ongoing Capability Deployment • Implement contingency response plans, as necessary. • Deploy the needed file system and archival storage technologies. • Conduct facility assessment for future operations.	Continue User Support • Continue full operation of CTS1 systems. • Pursue a common computing environment for users. • Maintain maximum availability of computer cycles to end users. Implement best practices. • Provide operational support for reliable and secure production computing environment. • Prepare for incorporation of next generation architectures. Ongoing Capability Deployment • Implement contingency response plans, as necessary. • Deploy the needed file system and archival storage technologies. • Conduct facility assessment for future operations.	• Supports continued ongoing operations.

Advanced Simulation and Computing
Construction

Description

The Construction program plays a critical role in NNSA's Exascale Initiative. Line Item funding is requested for Exascale Class Computer Cooling Equipment (EC3E) project at the Los Alamos National Laboratory Nicholas C. Metropolis Center for Modeling and Simulation, also known as the Strategic Computing Complex (SCC). This project is an expansion of the SCC's existing warm water cooling system. The EC3E project will use open-cell cooling towers that cool the water via evaporation, and will provide needed cooling capability for future computers on the path to exascale at LANL. This project will provide a minimum of 3,800 tons (13.4MW) of additional warm water cooling capacity at the SCC by installing five open-celled cooling towers to the north of the existing towers, extending the process loop piping to the east of the existing piping loop, adding six process water pumps and four heat exchangers, and adding the associated large diameter piping. The project will also include the installation of supporting electrical equipment and components necessary for the function of the mechanical equipment as well as additions to the building's automated control system.

Additionally, funding is requested for the Exascale Computing Facility Modernization (ECFM) project. The purpose of the ECFM project is to provide capable facilities and infrastructure to site an exascale-class system at the Lawrence Livermore National Laboratory in FY 2023. The requested funding will cover construction costs associated with this project.

Construction

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Construction $0	**Construction $47,000,000**	**Construction +$47,000,000**
• The EC3E project was included as a Major Item of Equipment (MIE) in FY 2017. The FY 2018 budget request included TEC and OPC funding for EC3E and ECFM.	• Continue construction plan for both EC3E and ECFM projects.	• Supports existing construction plan.

Advanced Simulation and Computing
Performance Measures

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Performance Goal (Measure)	**Reduced Reliance on Calibration** - The cumulative percentage reduction in the use of calibration "knobs" to successfully simulate nuclear weapons performance.						
Target	60% cumulative reduction in the use of calibration "knobs"	63% cumulative reduction in the use of calibration "knobs"	71% cumulative reduction in the use of calibration "knobs"	78% cumulative reduction in the use of calibration "knobs"	81% cumulative reduction in the use of calibration "knobs"	89% cumulative reduction in the use of calibration "knobs"	92% cumulative reduction in the use of calibration "knobs"
Result	**Met** - 60						
Endpoint Target	By the end of FY 2024, 100% of selected calibration knobs (non-science based models) affecting weapons performance simulation have been replaced by science-based, predictive phenomenological models.						

Advanced Simulation and Computing
Capital Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2017 Current	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted	Outyears to Completion
Capital Operating Expenses Summary (including Major Items of Equipment (MIE))								
Capital Equipment >$500K (including MIE)	N/A	410,253	206,773	206,773	184,837	188,953	-17,820	N/A
Plant Projects (GPP and IGPP)	N/A	17,060	13,954	13,954	9,263	9,467	-4,487	N/A
Total, Capital Operating Expenses	**N/A**	**427,313**	**220,727**	**220,727**	**194,100**	**198,420**	**-22,307**	N/A
Capital Equipment > $500K (including MIE)								
Total Non-MIE Capital Equipment	N/A	187,603	107,473	107,473	109,837	112,253	+4,780	N/A
Trinity (ATS-1) system, LANL	182,000	155,600	16,000	16,000	5,400	5,000	-11,000	0
Sierra (ATS-2) System, LLNL	161,000	40,000	56,000	56,000	46,200	9,000	-47,000	9,800
Crossroads (ATS-3) system, LANL	182,000	6,000	3,000	3,000	10,400	50,250	+47,250	112,350
CTS-1, LLNL	40,000	12,250	13,300	13,300	10,000	4,450	-8,850	0
El Capitan (ATS-4), LLNL	600,000	0	0	0	3,000	8,000	+8,000	589,000
Exascale Class Computer Cooling Equipment (ECCCE), LANL[a]	19,800	8,800	11,000	11,000	0	-	-11,000	0
Total, Capital Equipment (including MIE)	N/A	**410,253**	**206,773**	**206,773**	**184,837**	**188,953**	**-17,820**	**711,150**
Plant Projects (GPP and IGPP)								
Total Plant Projects (GPP/IGPP)	N/A	6,950	9,064	9,064	9,263	9,467	+403	0
B-453 Power Modernization	5,500	2,810	2,690	2,690	0	0	-2,690	0
B-453 Sierra Site Prep	9,500	7,300	2,200	2,200	0	0	-2,200	0
Total, Plant Projects (GPP/IGPP)	**N/A**	**17,060**	**13,954**	**13,954**	**9,263**	**9,467**	**-4,487**	**0**
Total, Capital Summary	**N/A**	**427,313**	**220,727**	**220,727**	**194,100**	**198,420**	**-22,307**	**711,150**

[a] Consistent with the FY 2017 Congressional Budget Request, funding was included in the Consolidated Appropriations Act 2017 for the Exascale Class Computer Cooling Equipment as a major item of equipment. The Project Management Executive subsequently determined to change the approach of the project, and the funding classification has been revised to a line item construction project in the FY 2018 Budget Request.

Outyears for Advanced Simulation and Computing

	(Dollars in Thousands)			
	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Capital Operating Expenses Summary (including MIE)				
Capital Equipment >$500K (including MIE)	190,923	204,847	268,826	286,012
Plant Projects (GPP)	9,675	9,888	10,106	10,328
Total, Capital Operating Expenses	**200,598**	**214,735**	**278,932**	**296,340**

Construction Projects Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2017 Current	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
18-D-670, Exascale Class Computer Cooling Equipment, LANL							
Total Estimated Cost (TEC)	66,989	0	2,338	2,338	22,000	24,000	+21,662
Other Project Cost (OPC)	3,802	1,775	584	584	0	1,000	+416
Total Project Cost, 18-D-670, Exascale Class Computer Cooling Equipment, LANL	**70,791**	**1,775**	**2,922**	**2,922**	**22,000**	**25,000**	**+22,078**
18-D-620, Exascale Computing Facility Modernization Project, LLNL							
TEC	116,000	0	0	0	3,000	23,000	+23,000
OPC	9,000	0	2,000	2,000	2,000	0	-2,000
Total Project Cost, 18-D-620, Exascale Computing Facility Modernization Project, LLNL	**125,000**	**0**	**2,000**	**2,000**	**5,000**	**23,000**	**+21,000**
Total All Construction Projects							
TEC	182,989	0	2,338	2,338	25,000	47,000	+44,662
OPC	12,802	1,775	2,584	2,584	2,000	1,000	-1,584
Total Project Cost (TPC) All Construction Projects	**195,791**	**1,775**	**4,922**	**4,922**	**27,000**	**48,000**	**+43,078**

Outyears to Completion for Advanced Simulation and Computing

	(Dollars in Thousands)			
	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
18-D-670, Exascale Class Computer Cooling Equipment, LANL				
TEC	18,591	0	0	0
OPC	249	194	0	0
Total Project Cost, 18-D-670, Exascale Class Computer Cooling Equipment, LANL	**18,840**	**194**	**0**	**0**
18-D-620, Exascale Computing Facility Modernization Project, LLNL				
TEC	50,000	27,000	13,000	0
OPC	0	3,000	2,000	0
Total Project Cost, 18-D-620, Exascale Computing Facility Modernization Project, LLNL	**50,000**	**30,000**	**15,000**	**0**
Total All Construction Projects				
TEC	68,651	27,000	13,000	0
OPC	249	3,194	2,000	0
Total Project Cost (TPC) All Construction Projects	**68,900**	**30,194**	**15,000**	**0**

18-D-670, Exascale Class Computer Cooling Equipment (ECCCE)
Los Alamos National Laboratory, Los Alamos, New Mexico
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary: The FY 2019 Request for the Exascale Class Computer Cooling Equipment project is $24,000K. The current Total Project Cost (TPC) high end of the range is $70,791K. CD-1 was approved on June 2, 2017.

The project has not yet been approved for CD-2/3, and therefore has not yet been baselined. As such, the Office for Advanced Simulation and Computing (ASC) continues to follow DOE O 413.3B to estimate the cost for this project. Outyear funding amounts may be revised in future budget requests once NNSA baselines the project to support *Critical Decision (CD)-2/3, Approve Performance Baseline and Approve Start of Construction* consistent with DOE Order 413.3B Change 4.

NNSA initiated this effort in FY 2016 as a Major Item of Equipment (MIE) under the Advanced Simulation and Computing (ASC) Program. After further analysis, the decision was made in FY 2017 to change the acquisition approach of the project, and the funding classification was revised to a Line Item Construction project. A FY 2018 CPDS was submitted to reflect the shift from MIE to Line Item (LI). Subsequently, funds previously appropriated for the MIE have been and will continue to be used to support project execution. The cost and schedule estimates are updated as the Program moves towards CD-2/3 approval, finalizing the design of the project and baselining the cost of the project.

Significant Changes:
The Project Management Executive (PME) approved the CD-1 package on June 2, 2017 with a Total Project Cost (TPC) range of $53M to $71M, and a CD-4 approval range of 4Q FY 2019 to 1Q FY2021. CD-2/3 approval is planned for 2Q 2018, and an Independent Cost Estimate (ICE) and an Independent Project Review (IPR) were completed to support the upcoming CD 2/3 decision.

A certified Federal Project Director has been assigned to this Project and has reviewed this data sheet. Through the independent AoA process, it was determined that the ECCCE Project will use open cell cooling towers that cool the water via evaporation.

Critical Milestone History

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2018	2/28/2017	7/29/2016	3QFY2017	3QFY2018	3QFY2018	3QFY2018	N/A	1QFY2021
FY 2019	2/28/2017	7/29/2016	6/2/2017	2QFY2018	2QFY2018	2QFY2018	N/A	1QFY2021

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete (d)
CD-3 – Approve Start of Construction
D&D Complete – Completion of D&D work
CD-4 – Approve Start of Operations or Project Closeout

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2018	7,962	59,027	66,989	3,802	N/A	3,802	70,791
FY 2019	7,962	59,027	66,989	3,802	N/A	3,802	70,791

2. Project Scope and Justification

Scope

This Project will provide a minimum of 3,800 tons (13.4MW) of additional warm water cooling capacity at the Nicholas C. Metropolis Center for Modeling and Simulation, otherwise referred to as the Strategic Computing Complex (SCC). The Project will install five additional open celled cooling towers to the north of the existing towers, extend the process loop piping to the east of the existing piping loop, add seven process water pumps and four heat exchangers, and add the associated large diameter piping. The project will also include the installation of supporting electrical equipment and components necessary for the function of the mechanical equipment as well as additions to the building's automated control system.

Justification

The SCC currently has an installed warm-water cooling capability of 4,200 tons (14.8 MW). In 2020, the estimated 8,000 tons (28.2 MW) minimum water cooling requirement for concurrent operation of two Advanced Technology supercomputers and a Commodity Technology System will exceed the existing cooling capability. Due to the lead time required for designing and integrating new cooling infrastructure, along with the necessity of expanding system capacity prior to the delivery of next generation computing systems, prudent risk management calls for a warm-water computer cooling capability that at least meets the upper bounds of existing best estimates prior to delivery of Crossroads (the next generation Advanced Technology System) in 2020.

Funds appropriated under this data sheet may be used for contracted support services to the Federal Program Manager and the Federal Project Director to conduct independent assessments of the planning and execution of this Project required by DOE O 413.3B and to conduct technical reviews of design and construction documents. The project is being conducted in accordance with the project management requirements in DOE O 413.3B, Program and Project Management for the Acquisition of Capital Assets. As allowed by DOE O 413.3B, work will be phased to improve overall efficiency. OPCs are funded out of the Advanced Simulation and Computing program. Construction will not start with MIE or LI funds until the project achieves CD-3.

Key Performance Parameters (KPPs)

The KPPs represent the minimum acceptable performance that the project must achieve. Achievement of the KPPs will be a prerequisite for approval of CD-4, Project Completion. The KPPs represent the desired project performance.

Performance Measure	Objective
A mechanical distribution system to increase the computer cooling capacity	3,800 tons

3. Project Cost and Schedule

Financial Schedule

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2017[a]	2,338	2,338	2,338
FY 2018	3,659	3,659	2,744
FY 2019	1,965	1,965	2,389
FY 2020	0	0	491
FY 2021	0	0	0
Total Design	7,962	7,962	7,962
Construction			
FY 2017	0	0	0
FY 2018	18,341	18,341	13,756
FY 2019	22,035	22,035	21,112
FY 2020[b]	18,651	18,651	19,497
FY 2021	0	0	4,662
Total Construction	59,027	59,027	59,027
Total Estimated Costs (TEC)			
FY 2017[a]	2,338	2,338	2,338
FY 2018	22,000	22,000	16,500
FY 2019	24,000	24,000	23,501
FY 2020[b]	18,651	18,651	19,988
FY 2021	0	0	4,662
Total TEC[b]	66,989	66,989	66,989
Other Project Costs			
FY 2016[a]	1,775	1,775	1,775
FY 2017[a]	584	584	584

[a] Consistent with the FY 2017 Congressional Budget Request, funding was included in the Consolidated Appropriations Act 2017 for the Exascale Class Computer Cooling Equipment as a major item of equipment. The Project Management Executive subsequently determined to change the approach of the project, and the funding classification has been revised to a line item construction project in the FY 2018 budget request.

[b] The TPC values for out years reflected in the table may be updated prior to CD-2/3 approval.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2018	0	0	0
FY 2019	1,000	1,000	750
FY 2020 [b]	249	249	437
FY 2021	194	194	256
Total OPC	3,802	3,802	3,802
Total Project Costs (TPC)			
FY 2016[a]	1,775	1,775	1,775
FY 2017[a]	2,922	2,922	2,922
FY 2018	22,000	22,000	16,500
FY 2019	25,000	25,000	24,251
FY 2020 [b]	18,900	18,900	20,425
FY 2021	194	194	4,918
Grand Total [b]	70,791	70,791	70,791

Details of Project Cost Estimate

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	5,194	5,194	0
Project Management	300	300	0
Federal Support	500	0	0
Contingency	1,968	2,468	0
Total, Design	7,962	7,962	0
Construction			
Site Work	0	0	0
Equipment	0	0	0

[a] Consistent with the FY 2017 Congressional Budget Request, funding was included in the Consolidated Appropriations Act 2017 for the Exascale Class Computer Cooling Equipment as a major item of equipment. The Project Management Executive subsequently determined to change the approach of the project, and the funding classification has been revised to a line item construction project in the FY 2018 budget request.

[b]The TPC values for out years reflected in the table may be updated prior to CD-2/3 approval.

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Construction	51,737	51,737	0
Construction Management	1,471	1,471	0
Federal Support	1,500	0	0
Contingency	4,319	5,819	0
Total, Construction	59,027	59,027	0
Other TEC (if any)			
Cold Startup	0	0	0
Contingency	0	0	0
Total, Other TEC	0	0	0
Total Estimated Cost	66,989	66,989	0
Contingency, TEC	6,287	8,287	0
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	0
Conceptual Planning	0	0	0
Conceptual Design	2,359	2,359	0
Other OPC Costs	799	799	0
Federal Support	200	0	0
Contingency	444	644	0
Total, OPC	3,802	3,802	0
Contingency, OPC	444	644	0
Total Project Cost	70,791	70,791	0
Total Contingency (TEC+OPC)	6,731	8,931	0

Schedule of Appropriations Requests (Dollars in Thousands)

Request Year	Type	Prior Years	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	Total
FY 2018	TEC	0	2,338	22,000	42,651	0	0	0	0	66,989
	OPC	1,775	584	0	1,249	194	0	0	0	3,802
	TPC	1,775	2,922	22,000	43,900	194	0	0	0	70,791
FY 2019	TEC[a]	0	2,338	22,000	24,000	18,651	0	0	0	66,989
	OPC	1,775	584	0	1,000	249	194	0	0	3,802
	TPC[a]	1,775	2,922	22,000	25,000	18,900	194	0	0	70,791

[a] The TPC values for out years reflected in the table may be updated prior to CD-2/3 approval.

4. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	1Q FY 2021
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	N/A

Related Funding Requirements

(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	2.1	2.1	75.2	75.2

5. D&D Information

There is no new square footage being constructed with this Project.

6. Acquisition Approach

The ASC Program contracted a Business Case Analysis (BCA) with respect to the Acquisition Strategy. At the recommendation of the study, and as approved by the PME at CD-1, the Project will be managed and construction executed by the LANL Management and Operating (M&O) contractor.

18-D-620, Exascale Computing Facility Modernization (ECFM)
Lawrence Livermore National Laboratory, Livermore, California
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary: The most recent DOE Order 413.3B approved Critical Decision (CD) is CD-0, Approve Mission Need, which was approved by the Project Management Executive on April 28, 2017. The project is preparing for CD-1, Approve Alternative Selection and Cost Range, with a Total Project Cost (TPC) range of $57,000 to $125,000 and a CD-4 approval of 4Q FY 2022, for the Exascale Computing Facility Modernization (ECFM) Project at the Terascale Simulation Facility at the Lawrence Livermore National Laboratory (LLNL) in Livermore, California. This project will reach CD-1 in 2Q FY 2018.

This project is linked to the Exascale Computing Project, and the Advanced Simulation and Computing (ASC) Program is working to ensure that LLNL will have a facility capable of housing an anticipated future machine of this class.

A Federal Project Director has not yet been assigned to this Project.

Significant Changes:
This Construction Project Data Sheet (CPDS) is an update of the FY 2018 CPDS and does not include a new start for the budget year.

The total project cost increased from $107,000 to $125,000 as the result of an Independent Project Review (IPR) completed on July 28, 2017 and an Independent Cost Review (ICR) completed on August 30, 2017. The IPR directed the team to utilize the +50% guideline from DOE O 413.3B to define the high-end of the cost range (rather than the +30% the Independent Project Team had used). This explains the increase in the high-end of the cost range. The two reviews also led to, smaller, further refinements in the cost profile for the various stages of the project and to a revised critical milestone schedule as detailed below. The project has not yet been approved for CD-2, and therefore has not yet been baselined. The project is now planning for a combined CD-2 and CD-3 in Q2 FY 2019. The revised critical milestone schedule reflects direction to the program to include all schedule contingency when calculating the CD-4 date. Outyear funding for the project may be revised in future budget requests once NNSA baselines the project. Design costs have been increased to reflect a change from a design/build contract to a design/bid/build approach which requires a much more detailed design before issuing a construction contract.

Critical Milestone History

Fiscal Quarter or Date[a]

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2018	4/28/2017	05/10/2017	1QFY2018	4QFY2018	4QFY2018	1QFY2019	N/A	3QFY2021
FY 2019	4/28/2017	05/10/2017	2QFY2018	2QFY2019	2QFY2019	2QFY2019	N/A	4QFY2022

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete (d)
CD-3 – Approve Start of Construction
D&D Complete – Completion of D&D work
CD-4 – Approve Start of Operations or Project Closeout

[a] The schedules are only estimates until the project baseline is approved.

Project Cost History[b]

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2018	3,000	92,000	95,000	12,000	0	12,000	107,000
FY 2019	15,000	101,000	116,000	9,000	0	9,000	125,000

2. Project Scope and Justification

Scope

The proposed project will modify Building 453 (B453) at LLNL to accommodate the increased infrastructure demands of exascale computing platforms. Commissioned in 2004, B453 has been capable of housing the largest, most advanced classified systems to date but requires upgrades to the electrical, mechanical, and structural capabilities for the new systems. The project alters approximately 20,000 ft^2 of floor space in the facility. Load bearing steel columns and foundation and wall improvements will be added to increase the floor load limits to handle computing racks up to 7,500 lbs. The existing cooling tower complex will be expanded by 13,700 tons of capacity, including required piping and pumps. Lastly, the existing electrical system will be upgraded to allow for an additional 40 MW of power for High Performance Computing, including the required feeders for mechanical and data systems; secondary electrical panels and feeders; and substation transformers, switchgear, switches, and bussing.

Justification

The NNSA requires vastly more powerful computers to address increasingly challenging certification requirements associated with meeting the Stockpile Stewardship Program mission as the nuclear weapons stockpile ages. These next-generation computers will require unprecedented electrical power and cooling. In addition, compact architectures will demand higher rack densities that will exert floor weights substantially beyond current systems. Supporting future generations of computing systems will therefore impose requirements on NNSA facilities that exceed their current thresholds in terms of power, water, and structural floor loads.

The ASC has a mission need to acquire infrastructure capable of meeting the projected structural, electrical, and mechanical requirements for the new generation of computers. Along with the necessity of expanding system capacity prior to the delivery of next generation computing systems, prudent risk management calls for an infrastructure necessary to accommodate new computer designs having increased requirements across an array of factors, including number of processors per system, density of processors per rack, and new approaches to power and cooling.

Funds appropriated under this data sheet may be used for contracted support services to the Federal Program Manager and the Federal Project Director to conduct independent assessments of the planning and execution of this Project required by DOE O 413.3B and to conduct technical reviews of design and construction documents.

The Project is being conducted in accordance with the project management requirements in DOE O 413.3B, Program and Project Management for the Acquisition of Capital Assets. As allowed by DOE O 413.3B, work will be phased to improve overall efficiency. NNSA is planning to use a Design-Build approach for this project. OPCs are included in the ASC program within RDT&E.

Key Performance Parameters (KPPs)

The KPPs represent the minimum acceptable performance that the project must achieve. Achievement of the KPPs will be a prerequisite for approval of CD-4, Project Completion. The KPPs represent the desired project performance.

[b] The costs are estimates only until approval of the project baseline.

Performance Measure	Objective
Provide adequate square footage to site exascale class computers systems and related systems.	20,000 square feet
Increase power capacity to meet exascale systems demand.	85 MW
Increase mechanical liquid-cooling water capacity to meet exascale systems demand.	18,000 tons
Increase the load carrying capability of the computer floor to accommodate heavier computer racks.	315 lbs./ft2

3. Project Cost and Schedule[c]

Financial Schedule

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2018	3,000	3,000	2,500
FY 2019	12,000	12,000	11,000
FY 2020	0	0	1,500
Total, Design	15,000	15,000	15,000
Construction			
FY 2019	11,000	11,000	10,500
FY 2020	50,000	50,000	47,500
FY 2021	27,000	27,000	27,500
FY 2022	13,000	13,000	15,500
Total, Construction	101,000	101,000	101,000
Total Estimated Costs (TEC)			
FY 2018	3,000	3,000	2,500
FY 2019	23,000	23,000	21,500
FY 2020	50,000	50,000	49,000
FY 2021	27,000	27,000	27,500
FY 2022	13,000	13,000	15,500
Total TEC	116,000	116,000	116,000
Other Project Costs			
FY 2017	2,000	2,000	2,000
FY 2018	2,000	2,000	2,000

[c] The costs are estimates only until approval of the project baseline.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2019	0	0	0
FY 2020	0	0	0
FY 2021	3,000	3,000	3,000
FY 2022	2,000	2,000	2,000
Total OPC	9,000	9,000	9,000
Total Project Costs (TPC)			
FY 2016	0	0	0
FY 2017	2,000	2,000	2,000
FY 2018	5,000	5,000	4,500
FY 2019	23,000	23,000	21,500
FY 2020	50,000	50,000	49,000
FY 2021	30,000	30,000	30,500
FY 2022	15,000	15,000	17,500
Grand Total	125,000	125,000	125,000

Details of Project Cost Estimate

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	7,000	2,000	N/A
Project Management	4,300	500	N/A
Federal Support	500	200	N/A
Contingency	3,200	300	N/A
Total, Design	15,000	3,000	N/A
Construction			
Site Work	--	--	N/A
Equipment	--	--	N/A
Construction	75,800	79,000	N/A
Construction Management	3,600	5,000	N/A
Federal Support	1,600	0	N/A
Contingency	20,000	8,000	N/A
Total, Construction	101,000	92,000	N/A

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Other TEC (if any)			
Cold Startup	0	0	N/A
Contingency	0	0	N/A
Total, Other TEC	0	0	N/A
Total Estimated Cost	116,000	95,000	N/A
Contingency, TEC	23,200	8,300	N/A
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	N/A
Conceptual Planning	3,500	3,000	N/A
Conceptual Design	1,500	2,000	N/A
Federal Support	500	5,000	N/A
Contractor Support	2,200	500	N/A
Security	0	500	N/A
Other OPC Costs	0	0	N/A
Contingency	1,300	1,000	N/A
Total, OPC	9,000	12,000	N/A
Contingency, OPC	1,300	1,000	N/A
Total Project Cost	125,000	107,000	N/A
Total Contingency (TEC+OPC)	24,500	9,300	N/A

Schedule of Appropriations Requests

(Dollars in Thousands)[d]

Request Year	Type	Prior Years	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	Total
FY 2018	TEC	0	3,000	40,000	44,000	8,000	0	0	95,000
	OPC	2,000	2,000	3,000	3,000	2,000	0	0	12,000
	TPC	2,000	5,000	43,000	47,000	10,000	0	0	107,000
FY 2019	TEC	0	3,000	23,000	50,000	27,000	13,000	0	116,000
	OPC	2,000	2,000	0	0	3,000	2,000	0	9,000
	TPC	2,000	5,000	23,000	50,000	30,000	15,000	0	125,000

4. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY2022
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	N/A

Related Funding Requirements

(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	28.1	28.1	101.0	101.0

5. D&D Information

There is no new square footage being constructed with this Project.

6. Acquisition Approach

The ASC Program is undertaking an analysis to determine the best value for the government in terms of the Acquisition Strategy. The Program is working with the U.S. Army Corp of Engineers and the LLNL Management & Operating (M&O) to determine which provides the best value at the least risk for the execution Design and Construction Management of this project. The selected Acquisition Strategy moving forward will be to execute a design-bid-build contract on firm-fixed base that will be awarded by the M&O Contractor. Note that the high end of the cost range $125M covers all acquisition approach alternatives being considered.

[d] Outyear funding for the project may be revised in future budget requests once NNSA baselines the project.

Advanced Manufacturing Development

Overview

The Advanced Manufacturing Development (AMD) Program develops, demonstrates, and transitions improved production processes. These include tools, fixtures, parts, and materials designed to ensure the safety, security, and performance of the nuclear weapons stockpile. AMD conducts developmental work to benefit the weapons complex while maintaining the base capability to respond to emerging issues with the current stockpile and adapting new processes for follow-on use, with the objective to provide significant reductions in production time, waste, and floor space requirements. In accomplishing its mission, the AMD Program enables the National Nuclear Security Administration (NNSA) to meet Department of Defense (DOD) requirements while enhancing safety and security and remaining vigilant and responsive to evolving national security requirements.

AMD is essential to NNSA's ability to support the current and long-term stockpile stewardship needs safely, efficiently, and cost effectively. The program significantly reduces cost and schedule risks associated with the improvement of manufacturing capabilities and deployment of technologies necessary to enhance production capabilities in the stockpile including components, materials, and processes. AMD develops and evaluates a suite of advanced technologies, such as additive manufacturing, automation, intelligent production systems, and high precision manufacturing processes before transitioning those technologies to other programs. The list does not include robotics because the current state of the art robotics in private industry does not produce the low volume of components at the precision required to support NNSA Defense Programs. However, the NNSA is still understanding the viability and applicability of robotics for hazardous material assembly and production through funding sources such as Plant Directed Research and Development (PDRD) and Lab Directed Research and Development (LDRD) before deploying the technology. Given the rigorous qualification requirements for nuclear weapons, it frequently takes 7 to 10 years to develop and test new components, which includes the advanced manufacturing technologies used to produce those components. Accordingly, this process must begin prior to commencement of a Life Extension Program (LEP), Alteration (Alt), or modification (Mod) to ensure AMD can confidently mature the technologies in time for insertion into a weapon system or production line.

AMD focuses on the development of both evolutionary and revolutionary technologies that the NNSA can apply to production processes throughout the NNSA nuclear security enterprise and support multiple weapon systems. The AMD program is composed of the following three subprograms:

1. **Additive Manufacturing (AM):** Capitalizes on three-dimensional printing of polymers and metals for stockpile applications that shorten production schedules and design cycles, which may ultimately lead to lower life-cycle costs. It also allows the NNSA nuclear security enterprise better control over the manufacturing processes and reduces reliance on outside vendors. This subprogram focuses on characterizing AM processes and developing methodologies that will ultimately enable qualification and certification of AM components for weapon applications. The NNSA has demonstrated a multi-million dollar cost benefit in utilizing AM for tools, fixtures, and molds that supports both the major modernization programs and the testing and evaluation programs. The NNSA designs and fabricates approximately 12 percent of current tooling, fixtures, and molds with additive manufacturing. Additionally, all of the current major modernization programs have baselined the AM production process for a limited amount of components, and the AM subprogram will continue to expand the use of AM, as viable.
2. **Component Manufacturing Development (CMD):** Develops innovative manufacturing processes needed to replace sunset technologies, upgrade existing technologies, and introduce future technologies in support of maintaining the safety, security, and effectiveness of the nuclear weapon stockpile. CMD improves required manufacturing scientific and engineering capabilities while providing NNSA with cost-effective production processes that reduce risks for future weapon systems. This subprogram is responsible for developing manufacturing process proof of concepts and validating that those processes meet component design requirements with initial prototype builds. CMD coordinates with other programs to ensure proper transition of the technology.
3. **Process Technology Development:** Develops, demonstrates, and applies new production technologies to reduce costs and improve manufacturing processes for nuclear weapon materials. This subprogram ensures dedicated funding for new technologies with the potential to shorten production schedules, reduce risks, or enhance personnel safety, and enable maturation without competing with other programmatic priorities. Presently, the subprogram is focused on uranium processing technology, including the development and acquisition of major items of equipment (MIEs) in support of the Y-12 National Security Complex (Y-12) mission.

Highlights of the FY 2019 Budget Request

- Leverage the adaptability of additive manufacturing for broader implementation in the future stockpile by defining and characterizing the process, structure, and performance of AM processes and materials not previously explored in the AM subprogram.
- Reduce the development schedule utilizing advanced manufacturing processes, such as using AM to develop prototypes for the Integrated Surety Architecture Multi-Application Transportation Attachment Device (MTAD) to increase the security of nuclear weapons during transportation.
- Develop manufacturing process control diagnostics, such as detecting defects to qualify and certify parts made via advanced manufacturing processes.
- Address the impacts of material obsolescence to reduce schedule risks for future programs and ensure a secure supply chain.
- Continue to execute the calciner and electro-refiner MIEs to include additional electro-refiner scope to meet updated production requirements, completion activities for the direct chip melt furnace(s), and additional planning for future capabilities. These efforts support phasing out mission dependency on Building 9212 at Y-12.

Major Outyear Priorities and Assumptions

Outyear funding levels for the Advanced Manufacturing Development program total $465,490,000 for FY 2020 through FY 2023. The Advanced Manufacturing Development (AMD) program priorities include the following:

- Develop a science-based understanding of how to control and characterize the Additive Manufacturing (AM) process for metal materials to produce qualified and certified components to meet specific program needs.
- Mature the Manufacturing Readiness Levels (MRLs) for advanced special material component manufacturing and microelectronics development for insertion into future weapon and demonstrator programs.
- Pursue alternatives for obsolete or hazardous materials and aging production processes, which includes new approaches designed to better conserve materials that are scarcely available or challenging to manufacture.
- Develop advanced manufacturing process monitoring and control diagnostics to provide a path to qualification and certification and assure the integrity of the nuclear weapon supply chain.

FY 2017 Accomplishments

- Developed Direct Ink Write (DIW) technology, which the W88 Alt 370 baselined as the preferred manufacturing method, compared to the conventional manufacturing method. DIW technology will allow the W88 Alt 370 to reduce the pad production schedule by 50%.
- Developed the first small batch of additively manufactured chip slapper detonators (Chip slappers are a type of detonator baselined for insertion in the B61-12 LEP and have been used for the Gemini Subcrit program); compared to the existing fabrication process, this method reduced the process development time by 50% and exceeded expectations on product quality.
- Introduced a new additively manufactured electrical connection to prevent the accumulation of frost on Stronglinks; this allowed the Stronglink production team to develop this solution at a reduced cost and time compared to conventional manufacturing techniques.
- Developed a new cleaning process with a coating known as “OxyPeel”, which Y-12 can paint on dismantled components, bake it to high temperature, and eventually peel off to remove any contaminates. Compared to the current baseline process of manual sanding the parts, Y-12 has shown this process with “OxyPeel” to be quicker, cleaner and less labor intensive.
- Aligned product acceptance testers to assure readiness in meeting WR production capacity for the B61-12 LEP, W88 Alt-370, and MK21 Fuze programs.
- Charted a path forward to qualify and certify newly manufactured Insensitive High Explosives (IHE) in support of the B61-12, W80-4, and future weapon systems; for over a quarter century, the United States did not produce one of the constituents in the IHE, and the complex has experienced significant difficulties in meeting legacy characteristics and performance.
- Transitioned Application Specific Integrated Circuit (ASIC) production control software from Fabrication FACTORY works to a system called Electronic Production Control System (EPCS). The EPCS automates the tracking of ASICs through the production process, which will reduce human error in recording the information. This transition will result in an estimated cost avoidance of approximately $17.6 million.

- Developed a single manufacturing process to support production of joint radar modules, which are currently baselined for multiple systems; this increased process efficiency and reduced floor space.
- Upgraded the arming and fuzing production line to increase process efficiency, and reduce material waste streams; this will benefit current and future major modern programs during production.
- Completed piping demolition in the deployment area for the calciner project.
- Completed planning for the additional electro-refiner scope to meet increased production needs, and the incorporation of a new process necessary to deploy this technology.
- Continued development testing and technology maturation progress on the direct chip melt furnace(s).

Advanced Manufacturing Development
Funding

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Research, Development, Test and Evaluation				
Advanced Manufacturing Development				
Additive Manufacturing	12,000	11,919	17,447	+5,447
Component Manufacturing Development	46,583	46,267	48,477	+1,894
Process Technology Development	28,522	28,328	30,914	+2,392
Total, Advanced Manufacturing Development	**87,105**	**86,514**	**96,838**	**+9,733**

Outyears for Advanced Manufacturing Development
Funding

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Research, Development, Test and Evaluation				
Advanced Manufacturing Development				
Additive Manufacturing	18,500	19,761	19,761	20,205
Component Manufacturing Development	58,410	68,566	70,006	71,476
Process Technology Development	28,198	29,244	29,835	31,528
Total, Advanced Manufacturing Development	**105,108**	**117,571**	**119,602**	**123,209**

Advanced Manufacturing Development
Explanation of Major Changes
(Dollars in Thousands)

Advanced Manufacturing Development	FY 2019 Request vs FY 2017 Enacted
Additive Manufacturing: The increase enables the NNSA NSE to define and characterize Additive Manufacturing (AM) processes and materials not previously explored in the subprogram will help to improve process reliability and repeatability needed for qualification and certification of AM processes to produce stockpile components.	+5,447
Component Manufacturing Development: The increase reflects initial investments to introduce new technologies into the aging production lines to avoid increases in weapon lifecycle costs, strengthen the NNSA NSE's supply chain resiliency, and address emerging requirements for future weapon programs.	+1,894
Process Technology Development: The increase reflects the continued execution of the calciner and electro-refiner projects, additional electro-refiner scope to meet updated production requirements, completion activities for the direct chip melt furnace(s), and planning for future capabilities.	+2,392
Total, Advanced Manufacturing Development	**+9,733**

Advanced Manufacturing Development
Additive Manufacturing

Description

The Additive Manufacturing subprogram leverages the adaptability of additive manufacturing for broader implementation in the future stockpile. The focus is to fund activities that have the greatest likelihood to improve the reliability and effectiveness of the enduring stockpile; improve infrastructure responsiveness; and attract, train, and retain an expert workforce through implementation of 21st century manufacturing technology.

Additive manufacturing is a revolutionary approach designed to capitalize on three-dimensional printing of polymers and metals for stockpile applications that can shorten production schedules and design cycles that may ultimately lead to lower life-cycle costs. Additive manufacturing can benefit the stockpile by reducing risk to program schedule and improving cost performance. It is a production tool that can support modeling, subcritical experiments, Joint Test Assemblies (JTAs), tooling, and stockpile components used in LEPs.

The Additive Manufacturing subprogram mission scope addresses the following four focus areas:

1. **Initial Capabilities.** Establish advanced and exploratory additive manufacturing capabilities.

2. **Prototype Production.** Produce additive manufacturing prototypes that demonstrate the range of their benefits.

3. **Science-based Manufacturing.** Develop methods that meet design and qualification requirements.

4. **Accelerated Qualification and Certification.** Accelerate qualification and certification thus reducing time between product design and production of critical components.

When deploying any new technology, ensuring that it is sufficiently safe and reliable for stockpile applications is a major challenge. By making measured investments and leveraging existing programmatic work, NNSA can realize the near-term benefits of additive manufacturing, while assessing its feasibility of making long-term investments for more challenging applications.

FY 2020 – FY 2023 Key Milestones

- Placed filled additively manufactured gas bottles into long-term storage by FY 2021 to gather the material and component performance data over time, which will assist in determining the viability for future systems.
- Develop a report on the applicability and viability of additively manufactured energetics and new types of plastics by FY 2022.
- Develop the methodologies required to qualify and certify AM for metal lattices by FY 2023.

Additive Manufacturing

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Additive Manufacturing $12,000,000	**Additive Manufacturing $17,447,000**	**Additive Manufacturing +$5,447,000**
• Continue developing manufacturing processes, prototypes, and first production units for stockpile applications, such as: o Critical Tooling o Pads and Cushions o Other assemblies o Simple metal parts • Further improve understanding of the science behind additive manufacturing through material performance and process controls. • Continue to examine how additive manufacturing can be used to reduce qualification time for improved technologies and production processes.	• Continue developing manufacturing processes, prototypes, and first production units for stockpile application for: o Energetics o Lattices, both metal and polymers o Gas Bottle qualification and certification o Thermosets (i.e. epoxies) o Pads and Cushions • Continue to further improve understanding of the science behind additive manufacturing through material performance and process controls. • Explore methodologies to improve process reliability and repeatability. • Begin development of qualification and certification methods to enable the use of AM in the stockpile.	• The increase enables the NNSA nuclear security enterprise (NSE) to explore new AM processes and characterize materials not yet explored in the AM subprogram. This will allow the complex to: o Understand end-product material science properties; o Improve process reliability and repeatability; and o Develop qualification and certification methods of AM for use in the stockpile.

Advanced Manufacturing Development
Component Manufacturing Development

Description

The Component Manufacturing Development (CMD) subprogram develops innovative manufacturing processes needed to replace sunset technologies, upgrade existing technologies, and introduce future technologies in support of maintaining the safety, security, and effectiveness of the nuclear weapons stockpile. This entails improving required manufacturing, scientific and engineering capabilities, and providing NNSA with cost-effective production processes that reduce risks for future weapon systems. This subprogram is responsible for developing manufacturing process proof of concepts and validating those processes meet component design requirements with initial prototype builds. CMD coordinates with other programs to ensure proper transition of the technology.

The CMD subprogram mission scope has four focus areas:

1. **Advanced Production Development.** Draws on exploratory manufacturing research at the national laboratories and production plants to inform decisions on process improvements. This is intended to improve current capabilities through the development of manufacturing new materials and production processes.

2. **Manufacturing Process Integration.** Facilitates introduction of new manufacturing techniques into production lines. It ensures that materials and components produced by novel manufacturing processes meet design requirements and are on a well-defined path to insert into a weapon system or production line.

3. **Manufacturing Diagnostic Development**. Enables new manufacturing processes by developing process monitoring and control diagnostics required to observe and study novel production methods and materials. These diagnostics provide a path to qualification and certification for manufacturing processes and assure the integrity of the nuclear weapon supply chain.

4. **Material Obsolescence and Sunset Processes.** Pursues alternatives for replacing obsolete or hazardous materials and aging production processes, and includes new approaches designed to better conserve materials that are scarcely available or challenging to produce. It is critical to develop new techniques or materials before aging issues or material shortages affect the success of LEPs, Alts, or Mods.

FY 2020 – FY 2023 Key Milestones

- Transfer Multi-Transportation Attachment Device (MTAD) manufacturing processes and associated technologies to Stockpile Systems in FY 2020.
- Develop and implement solutions to manufacture useable magnesium oxide (MgO) for thermal batteries by FY 2021, to replace the defunct commercial supplier.
- Mature the MRLs for multiple advanced manufacturing processes by FY 2023 to support stockpile insertion opportunities, such as additively manufactured metal lattices, advanced special material component manufacturing, and advanced microelectronics development.
- Introduce several new manufacturing process control diagnostics by FY 2023 to mitigate supply chain risks, such as counterfeit and defect detection capabilities.

Component Manufacturing Development

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Component Manufacturing Development $46,583,000	**Component Manufacturing Development $48,477,000**	**Component Manufacturing Development +$1,894,000**
• Developed a single manufacturing process to support production of joint radar modules, which are currently baselined for multiple systems; this will increase process efficiency and reduce floor space. • Upgraded the arming and fuzing production line to increase process efficiency, and reduce material waste streams; this will benefit current and future major modernization programs during production. • Continued development of capability or work associated with trusted and secure manufacturing, computational simulations for additive manufacturing, and advanced additive metal production process. • Continued developmental IHE (e.g., TATB, PBX9502, LX-21) production and qualification activities. • Continued work associated with additive manufacturing of mission tooling and materials, PBX9502/TATB production maturation and qualification, and extrudable explosives (XTX) production maturation and qualification. • Continued neutron generator tester development and thermally conductive polymers and foams. • Continued limited life component work regarding advanced materials development and aluminum vessels for tritium service. • Continued projects that expand application of advanced manufacturing throughout the NNSA NSE.	• Continue development associated with advanced additive manufacturing, advanced materials, and digital manufacturing. • Accelerate AM prototype development for one of the Integrated Surety Architecture (ISA) technologies, the Multi- Application Transportation Attachment Device (MTAD). • Compress the schedule for additive manufacturing work on specific applications to produce components faster and less expensively while still meeting design performance requirements. • Continue LANL production development work for specific components in collaboration with Y-12. • Accelerate development of manufacturing process control diagnostics in order to mitigate supply chain risks, such as counterfeit detection and defect detection. • Condense development on advanced materials development and aluminum reservoirs. • Complete CNS evaluation and implementation of additive manufacturing methods in unexplored tooling and engineering applications. • Begin development of new technologies to introduce into the aging production line.	• The increase reflects: ○ Introduction of new technologies into the aging production line to avoid increases in weapon lifecycle costs, strengthen the NNSA NSE’s supply chain resiliency, and address emerging requirements for future weapon programs; ○ Accelerates some development schedules to support future system needs, after prior year funding reductions; and ○ Allows for better project definition, schedule reduction on mission critical development activities, and enhance collaborative efforts integrating design and production agencies for quicker certification and qualification of needed capabilities and products.

Advanced Manufacturing Development
Process Technology Development

Description

The Process Technology Development subprogram supports the development, demonstration, and utilization of new production technologies to reduce costs and enhance nuclear manufacturing capabilities for nuclear weapon materials. Process Technology Development ensures new technologies with the potential to shorten production schedules, reduce risks, or enhance personnel safety have a dedicated funding source to reach optimal levels of maturity without competing with other programmatic priorities. Presently, the subprogram is focused on uranium processing technology, including the development and acquisition of major items of equipment (MIE) for Y-12.

The purpose of this subprogram is to develop and implement new technology, primarily through MIE in support of phasing our mission dependency on Building 9212 at Y-12. The MIE include a calciner, electro-refiner, and chip melt furnace(s).

Additional work related to the Uranium Mission Strategy and phasing out mission dependency on Building 9212 is described in Uranium Sustainment within Strategic Materials, under Directed Stockpile Work.

FY 2020 – FY 2023 Key Milestones

- Complete installation and start-up of the calciner in FY 2021 in support of phasing out mission dependency on Building 9212.
- Complete installation and start-up of the electro-refiner process line in FY 2022 to replace metal purification production activities currently being performed in Building 9212.
- Mature additional technologies to enhance manufacturing capabilities and meet emerging production needs.

Process Technology Development
Activities and Explanation of Changes

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Process Technology Development $28,522,000	**Process Technology Development $30,914,000**	**Process Technology Development +$2,392,000**
• Continue to support three MIE and associated technology development efforts and refine the scope for the direct electrolytic reduction MIE: o Calciner – a rotary drum calciner will stop the practice of recovering low equity EU materials by segregating salvage and accountability functions so they no longer go through purification. o Electro-refiner – an electrically-based chemical purification system to provide a replacement capability for current aqueous-based process. o Machine Chip Processing Furnace(s) – install chip melt furnace(s) for recovery of EU machine tool turnings for subsequent reuse in manufacturing processes.	• Continue to execute the calciner, electro-refiner, and direct chip melt furnace(s) MIE and associated technology development efforts and refine the scope for the direct electrolytic reduction MIE: o Calciner – install a rotary drum calciner to stop the practice of recovering low equity enriched uranium from materials by segregating salvage and accountability functions so the uranium recovery would no longer need to be performed in complex aqueous-based chemical recovery processes. o Electro-refiner - install an electrically based metal purification system to provide a replacement capability for the current aqueous-based recovery and high-hazard metal conversion processes. o Direct chip melt furnace(s) – install direct chip melt furnace(s) for recovery of EU machine tool turnings for subsequent reuse in manufacturing processes and replace the current 9 step briquette process in building 9212 at Y-12.	• This increase will allow the performance of activities in direct support of phasing out mission dependency on Building 9212: o Continued progress on calciner, o Additional electro-refiner scope to meet updated production requirements, o Completion activities for operation of the first direct chip melt furnace: and o Installation of a second chip melt furnace.

Advanced Manufacturing Development
Performance Measures

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Performance Goal (Measure)	**Component Manufacturing Development** - Complete maturation of production technologies and manufacturing capabilities to support Directed Stockpile Work, nuclear weapons refurbishment, and assessment activities						
Target	6 deliverables	5 deliverables	5 deliverables	5 deliverables	5 deliverables	5 deliverables	5 deliverables
Result	**Met** - 6						
Endpoint Target	Annually complete deliverables required to mature production technologies and manufacturing capabilities until last nuclear weapon system in the stockpile is dismantled.						

Advanced Manufacturing Development
Capital Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2017 Current	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted	Outyears to Completion
Capital Operating Expenses Summary (including Major Items of Equipment (MIE))								
Capital Equipment >$500K (including MIE)	N/A	75,196	61,382	61,382	81,173	95,517	+34,135	N/A
Plant Projects (GPP and IGPP)	N/A	0	1,456	1,456	1,488	1,521	+65	N/A
Total, Capital Operating Expenses	**N/A**	**75,196**	**62,838**	**62,838**	**82,661**	**97,038**	**+34,200**	**N/A**
Capital Equipment > $500K (including MIE)								
Total Non-MIE Capital Equipment	N/A	41,790	33,132	33,132	33,861	34,606	+1,474	N/A
Calciner, Y-12	65,463	16,335	3,750	3,750	10,564	18,645	+14,895	16,169
Machine Chip Processing Furnance 1, Y-12	9,750	740	4,500	4,500	4,510	0	-4,500	0
Machine Chip Processing Furnance 2, Y-12	9,750	0	0	0	9,750	0	0	0
Machine Chip Processing Furnance 3, Y-12	9,750	0	0	0	0	9,750	+9,750	0
Machine Chip Processing Furnance 4, Y-12	9,750	0	0	0	0	9,750	+9,750	0
Electrofiners, Y-12	80,950	16,331	20,000	20,000	18,250	20,500	+500	5,869
Direct Electrolytic Reduction , Y-12	45,250	0	0	0	0	0	0	45,250
Service Hood System, Y-12	6,504	0	0	0	4,238	2,266	+2,266	0
Total, Capital Equipment (including MIE)	N/A	**75,196**	**61,382**	**61,382**	**81,173**	**95,517**	**+34,135**	**67,288**
Plant Projects (GPP and IGPP)								
Total Plant Projects (GPP/IGPP)	N/A	0	1,456	1,456	1,488	1,521	+65	0
Total, Plant Projects (GPP/IGPP)	**N/A**	**0**	**1,456**	**1,456**	**1,488**	**1,521**	**+65**	**0**
Total, Capital Summary	**N/A**	**75,196**	**62,838**	**62,838**	**82,661**	**97,038**	**+34,200**	**67,288**

Outyears for Advanced Manufacturing Development

	(Dollars in Thousands) FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Capital Operating Expenses Summary (including MIE)				
Capital Equipment >$500K (including MIE)	54,750	38,784	36,956	37,753
Plant Projects (GPP)	1,554	1,588	1,623	1,659
Total, Capital Operating Expenses	**56,304**	**40,372**	**38,579**	**39,412**

Infrastructure and Operations

Overview
The Infrastructure and Operations program maintains, operates, and modernizes the National Nuclear Security Administration (NNSA) infrastructure in a safe, secure, and cost-effective manner to support program results. Infrastructure and Operations efforts provide a comprehensive approach to arresting the declining state of NNSA infrastructure while maximizing return on investment, enabling program results, and reducing enterprise risk. The program also plans, prioritizes, and constructs state-of-the-art facilities, infrastructure, and scientific tools.

Operations of Facilities
The Operations of Facilities program provides the funding required to operate NNSA facilities in a safe and secure manner and is fundamental to achieving NNSA's plutonium, uranium, tritium, lithium, high explosives, and other mission objectives. This program includes essential support such as water and electrical utilities; safety systems; lease agreements; and activities associated with Federal, state, and local environmental, worker safety, and health regulations.

Safety and Environmental Operations
The Safety and Environmental Operations program provides for the Department's Nuclear Criticality Safety Program (NCSP), Nuclear Safety Research and Development (NSR&D), Packaging subprogram, and Long Term Stewardship (LTS) subprogram. These activities support safe, efficient operation of the nuclear security enterprise through the provision of safety data, environmental monitoring, and nuclear material packaging.

Maintenance and Repair of Facilities
The Maintenance and Repair of Facilities program (Maintenance) provides direct-funded maintenance activities across the NNSA enterprise for the recurring day-to-day work required to sustain and preserve NNSA facilities and equipment in a condition suitable for their designated purpose. These efforts include predictive, preventive, and corrective maintenance activities to maintain facilities, property, assets, systems, roads, equipment, and vital safety systems.

Recapitalization
The Recapitalization program, comprised of the Infrastructure and Safety subprogram and the Capability Based Investments subprogram, is key to arresting the declining state of NNSA's infrastructure. A sustained investment in Recapitalization is needed to address numerous obsolete support and safety systems; revitalize facilities that are beyond the end of their design life; and improve the reliability, efficiency, and capability of core infrastructure to meet mission requirements. The Recapitalization program modernizes NNSA infrastructure by prioritizing investments to improve the condition and extend the life of structures, capabilities, and systems thereby improving the safety and quality of the workplace. Recapitalization investments help achieve operational efficiencies and reduce safety, security, environmental, and program risk.

The Recapitalization program includes minor construction projects, capital equipment, Other Project Costs (OPC) for Infrastructure and Operations funded line item construction projects (excluding CMRR, UPF, Lithium Production Capability, and U1a Complex Enhancements Project (UCEP)), and deactivation and disposal of excess infrastructure.

Line Item Construction
Infrastructure and Operations line item construction projects are critical to revitalizing the infrastructure and program-specific capabilities that directly support the nuclear weapons programs. These projects will replace obsolete, unreliable facilities and infrastructure to reduce safety and program risk while improving responsiveness, capacity, and capabilities.

Highlights of the FY 2019 Budget Request
The FY 2019 Infrastructure and Operations Budget Request totals $3,002,736,000, which represents the continuation of a long-term effort to reverse the declining state of NNSA infrastructure. This request includes increases to Operations of Facilities to provide for transitioning new facilities to operations, lease payments for the Administrative Support Complex at Pantex, and programmatic tempo increases. The request also includes increases to Maintenance to continue the stabilization of deferred maintenance and improve the condition of NNSA infrastructure. The request supports increases in funding for UPF and CMRR per the respective project execution plans and efforts to phase out mission dependency in the existing aged facilities. Funding is also provided for the U1a Complex Enhancements Project, Lithium Production Capability, Tritium Production Capability, and general purpose construction projects including the construction of the Albuquerque

Complex Project to replace the current aging and degrading federal facilities in Albuquerque and the 138kV Power Transmission System Replacement project to replace and upgrade the current power transmission system for the Mission Corridor at NNSS.

Infrastructure Modernization Initiative

The FY 2018 National Defense Authorization Act (NDAA) directed the creation of the Infrastructure Modernization Initiative (IMI) program, which the NNSA Administrator created in December 2017. The goal of the IMI is to reduce deferred maintenance (DM) and repair needs (RN) by not less than 30 percent by 2025. The IMI will be carried out under the current budget structure via the Recapitalization: Infrastructure and Safety and Maintenance and Repair of Facilities programs. The initial plan is currently under development and will be transmitted to Congress once completed.

Major Outyear Priorities and Assumptions

Outyear funding levels for Infrastructure and Operations total $13,374,869,000 for FY 2020 through FY 2023. Outyear priorities will focus on the IMI goal of reducing DM and RN and continuing to modernize NNSA's infrastructure to reduce mission and safety risks through the application of an enterprise risk management methodology, with line item construction investments largely directed to uranium and plutonium infrastructure. NNSA will seek operational efficiencies by deactivating and dispositioning facilities that are no longer needed, thereby reducing operations, maintenance, and recapitalization requirements.

In response to GAO recommendations, the following information is provided to improve transparency in the budget. Table 1 below lists total DM at NNSA sites as well as the subset of DM on excess facilities and facilities to be excessed in 10 years.

Table 1

NNSA Deferred Maintenance (DM) as of FY 2017 (dollars in thousands)	
Total DM	2,514,987
DM on excess facilities	24,627
DM on facilities to be excessed in 10 years	159,564

Approximately 7 percent of NNSA DM is associated with facilities that are or will be excess in the next 10 years. As part of a prudent investment strategy, NNSA will intentionally not perform some of the maintenance and repair on facilities that are or soon will become excess. In addition, NNSA will eliminate DM on excess facilities via disposition.

NNSA annually screens excess facilities to identify the highest risks to mission, workers, the public, and the environment to support risk-informed decision making. Table 2 lists the highest-risk facilities.

Table 2

NNSA's Top Ten High-Risk Excess Facilities			
Site	**Facility**	**Year Built**	**Year Shut Down**
Y-12	Alpha 5, Building 9201-05	1944	1983
Y-12	Beta 4, Building 9204-04	1945	2007
Y-12	Building 9206	1944	1993
LLNL	Heavy Elements Facility, Building 251	1956	1995
LLNL	Livermore Pool-Type Reactor, Building 280	1956	1980
LLNL	MARS-E Beam, Building 175	1980	1999
LLNL	Rotating Target Neutron Source Facility, Building 292	1979	1987
LANL	Ion Beam Facility, Building TA-3-0016	1953	1999
LANL	HE Pressing Complex, Building TA-16-0430	1953	2007
LLNL	Pluto Project Testing and Fabrication Facility, Building 241	1960	2008

Infrastructure and Operations
Funding

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Infrastructure and Operations				
Operating				
Operations of Facilities	824,000	818,404	891,000	+67,000
Safety and Environmental Operations	110,000	109,253	115,000	+5,000
Maintenance and Repair of Facilities	324,000	321,800	365,000	+41,000
Recapitalization				
Infrastructure and Safety	430,509	427,585	431,631	+1,122
Capability Based Investments	112,639	111,874	109,057	-3,582
Bannister Federal Complex Disposition	200,000	198,642	0	-200,000
Subtotal, Recapitalization	**743,148**	**738,101**	**540,688**	**-202,460**
Total, Operating	**2,001,148**	**1,987,558**	**1,911,688**	**-89,460**
Construction	807,215	801,732	1,091,048	+283,833
Total, Infrastructure and Operations	**2,808,363**	**2,789,290**	**3,002,736**	**+194,373**

Outyears for Infrastructure and Operations
Funding

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Infrastructure and Operations				
Operating				
Operations of Facilities	925,000	945,000	971,000	986,000
Safety and Environmental Operations	119,000	120,000	122,000	122,000
Maintenance and Repair of Facilities	390,000	407,000	419,000	432,000
Recapitalization				
Infrastructure and Safety	474,642	477,245	504,926	508,160
Capability Based Investments	121,341	123,679	126,066	128,504
Subtotal, Recapitalization	**595,983**	**600,924**	**630,992**	**636,664**
Total, Operating	**2,029,983**	**2,072,924**	**2,142,992**	**2,176,664**
Construction	1,203,600	1,270,106	1,214,600	1,264,000
Total, Infrastructure and Operations	**3,233,583**	**3,343,030**	**3,357,592**	**3,440,664**

Infrastructure and Operations
Explanation of Major Changes
(Dollars in Thousands)

	FY 2019 Request vs FY 2017 Enacted
Infrastructure and Operations	
Operations of Facilities: The overall increase supports: transitioning new facilities at LANL to operations, including concurrent operations; lease payments for the Administrative Support Complex at Pantex; programmatic tempo increases; and inflation. These increases are partially offset by reductions resulting from the transfer of the Bannister Federal Complex in Kansas City to a private developer for redevelopment; the transfer of scope at Y-12 to the Long Term Stewardship program within Safety and Environmental Operations; and anticipated efficiencies gained via increased investments in Maintenance and Repair of Facilities and Recapitalization.	+67,000
Safety and Environmental Operations: The increase reflects the transfer of scope from Y-12 Operations of Facilities for five facilities that treat waste streams normally associated with the Long Term Stewardship program.	+5,000
Maintenance and Repair of Facilities: The increase provides additional funding to support the Infrastructure Modernization Initiative (IMI) to reduce Deferred Maintenance and improve the working condition of NNSA facilities and equipment, and expand the Roof Asset Management Program and the Cooling and Heating Asset Management Program.	+41,000
Recapitalization:	
• **Infrastructure and Safety:** No significant changes.	+1,122
• **Capability Based Investments (CBI)**: OPCs for Lithium Production Capability move to Lithium Sustainment in FY 2019, and OPC requirements for two LANL construction projects end in FY 2018.	-3,582
• **Bannister Federal Complex Disposition:** The decrease reflects full funding for the transfer and disposition of the Bannister Federal Complex in FY 2017.	-200,000
Construction: The increase primarily reflects funding for construction of the UPF, CMRR project, Albuquerque Complex Project, U1a Complex Enhancements Project, Tritium Production Capability at SRS, and new starts for the 138kV Power Transmission System Replacement at NNSS and the Lithium Production Capability at Y-12.	+283,833
Total, Infrastructure and Operations	**+194,373**

Infrastructure and Operations
Operations of Facilities

Description

The Operations of Facilities program provides the funding required to operate NNSA facilities in a safe manner. Operations of Facilities is fundamental to achieving NNSA's plutonium, uranium, tritium, lithium, high explosives, and other mission objectives. It includes essential support such as water and electrical utilities, safety systems, lease agreements for facilities and land, emergency response services, and other critical systems. This program also provides resources for environment, safety, health, and quality (ESH&Q) costs associated with ensuring compliance with Federal; state; and local environmental, worker safety, and health regulations as well as applicable DOE Orders and Directives.

The Operations of Facilities program also funds waste management activities, including treatment, storage, and waste disposition of both hazardous and newly generated radiological wastes. It provides for the daily operations and staffing to ensure facilities, systems, equipment, and capabilities are available to meet mission requirements. FY 2017-FY 2023 site allocations for the Operations of Facilities program are provided in Table 3 below.

Table 3

National Nuclear Security Administration Operations of Facilities Allocations by Site (Dollars in Thousands)							
Site	**FY 2017 Enacted**	**FY 2018 Request**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**
Kansas City National Security Campus	101,000	90,000	91,000	91,000	95,000	97,000	98,000
Lawrence Livermore National Laboratory	70,500	92,000	80,000	82,000	84,000	86,000	87,000
Los Alamos National Laboratory	196,500	207,000	231,000	234,000	236,000	238,000	240,000
Nevada National Security Site	92,500	93,000	100,000	102,000	104,000	106,000	108,000
Pantex Plant	55,000	59,000	69,000	69,000	69,000	70,000	71,000
Sandia National Laboratories	118,000	118,000	123,000	128,000	133,000	135,000	138,000
Savannah River Site	83,500	105,000	93,000	114,000	118,000	132,000	135,000
Y-12 National Security Complex	107,000	104,000	104,000	105,000	106,000	107,000	109,000
TOTAL	**824,000**	**868,000**	**891,000**	**925,000**	**945,000**	**971,000**	**986,000**

Operations of Facilities

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Operations of Facilities $824,000,000	**Operations of Facilities $891,000,000**	**Operations of Facilities +$67,000,000**
• Funding supported base facility operations at: ○ KC in support of non-nuclear production. ○ LLNL to support plutonium, tritium and high explosive nuclear security enterprise missions. Includes funds to certify TRU waste in preparation for shipment to WIPP. ○ LANL in support of plutonium production, research, and development; chemistry and metallurgy research; weapons engineering and tritium capability; and beryllium operations. ○ NNSS, including experimental capabilities. ○ Pantex, including industrial and high explosives to support weapon assembly, disassembly, and surveillance in support of the LEPs. ○ SNL, including environmental testing and microelectronics technologies facilities. ○ SRS, including tritium capabilities. ○ Y-12 for enriched and depleted uranium, lithium, and other special material operations.	• Funding supports base facility operations at: ○ KC in support of non-nuclear production. ○ LLNL to support plutonium, tritium and high explosive nuclear security enterprise missions. ○ LANL in support of plutonium production, research, and development; chemistry and metallurgy research; weapons engineering and tritium capability; and beryllium operations. ○ NNSS, including experimental capabilities. ○ Pantex, including industrial and high explosives to support weapon assembly, disassembly, and surveillance in support of the LEPs. ○ SNL, including environmental testing and microelectronics technologies facilities. ○ SRS, including tritium capabilities. ○ Y-12 for enriched and depleted uranium, lithium, and other special material operations.	• The overall increase supports transitioning new facilities at LANL to operations, including concurrent operations; lease payments for the Administrative Support Complex at Pantex; programmatic tempo increases; and inflation. These increases are partially offset by reductions resulting from the transfer of the Bannister Federal Complex in Kansas City to a private developer for redevelopment; the transfer of scope at Y-12 to the Long Term Stewardship program within Safety and Environmental Operations; and anticipated efficiencies gained via increased investments in Maintenance and Repair of Facilities and Recapitalization.

Infrastructure and Operations
Safety and Environmental Operations

Description

The Safety and Environmental Operations program provides for the NNSA's Nuclear Safety Research and Development (NSR&D) subprogram, Packaging subprogram, Long Term Stewardship (LTS) subprogram, and the Department's Nuclear Criticality Safety Program (NCSP). Table 4 provides the funding breakout for these subprograms.

NCSP develops, maintains and disseminates the essential technical tools, training and data required to support safe, efficient fissionable material operations within DOE. This includes maintaining and operating the National Criticality Experiments Research Center (NCERC) at NNSS where critical and sub-critical experiments are conducted to provide tests of nuclear data, analytical codes, and to develop new measurement methods.

The NSR&D subprogram provides the technical foundation for safety analyses and controls as well as authorization basis decision making for DOE/NNSA nuclear facilities and associated operations. The NCSP and NSR&D subprograms are vital to ensuring nuclear safety is achieved across the NNSA enterprise.

The Packaging subprogram ensures safe transport of nuclear and radiological materials by providing off-site shipping container research and development, design, certification, recertification, test and evaluation, production and procurement, fielding and maintenance, decontamination, and disposal. It also provides off-site transportation authorization of shipping containers for nuclear materials and components supporting both the nuclear weapons program and nuclear nonproliferation and other mission objectives.

The LTS subprogram ensures environmental safety at remediated sites with residual contamination by conducting activities necessary to meet Federal and state environmental regulatory requirements identified in legally enforceable records of decision, cleanup agreements, and consent orders. The LTS subprogram operates and maintains remediation systems and monitoring of contaminant levels in the soil and groundwater. LTS is required to meet environmental requirements associated with corrective actions at sites that are subject to the Resource Conservation and Recovery Act (RCRA) or cleanup requirements under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

Table 4

National Nuclear Security Administration
Safety and Environmental Operations Subprograms
(Dollars in Thousands)

Subprogram	FY 2017 Enacted	FY 2018 Request	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Nuclear Criticality Safety Program	27,298	27,623	26,887	28,472	28,561	28,767	29,314
Nuclear Safety Research and Development	3,837	3,838	6,003	3,704	4,408	4,013	5,281
Packaging	28,804	28,690	26,857	29,144	29,802	29,802	30,398
Long Term Stewardship	50,061	55,849	55,253	57,680	57,229	59,418	57,007
TOTAL	**110,000**	**116,000**	**115,000**	**119,000**	**120,000**	**122,000**	**122,000**

Safety and Environmental Operations

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Safety and Environmental Operations $110,000,000	**Safety and Environmental Operations $115,000,000**	**Safety and Environmental Operations +$5,000,000**
Nuclear Criticality Safety Program $27,298,000	**Nuclear Criticality Safety Program $26,887,000**	**Nuclear Criticality Safety Program -$411,000**
• Provided technical infrastructure, expertise, and experimentation capabilities for the DOE encompassing the following technical elements: Nuclear Data, Analytical Methods, Training & Education, Information Preservation and Dissemination, and Integral Experiments. Integral Experiments includes the NCSP's NCERC to ensure criticality safety capabilities are adequate for the DOE mission.	• Provides technical infrastructure, expertise, and experimentation capabilities for the DOE encompassing the following technical elements: Nuclear Data, Analytical Methods, Training & Education, Information Preservation and Dissemination, and Integral Experiments. Integral Experiments includes the NCSP's NCERC to ensure criticality safety capabilities are adequate for the DOE mission.	• No significant changes.
Nuclear Safety Research and Development $3,837,000	**Nuclear Safety Research and Development $6,003,000**	**Nuclear Safety Research and Development +$2,166,000**
• Conducted projects to provide the technical foundation for safety analyses and controls as well as authorization basis decision making for DOE/NNSA nuclear facilities and associated operations.	• Conducts projects to provide the technical foundation for safety analyses and controls as well as authorization basis decision making for DOE/NNSA nuclear facilities and associated operations.	• Provides funding for additional projects.
Packaging $28,804,000	**Packaging $26,857,000**	**Packaging -$1,947,000**
• Refurbished, reconditioned, maintained, and certified containers to ensure availability to support the nuclear weapons mission.	• Refurbish, recondition, maintain, and certify containers to ensure availability to support the nuclear weapons mission.	• No significant changes. Reduction will be covered by using uncosted carryover.
Long Term Stewardship $50,061,000	**Long Term Stewardship $55,253,000**	**Long Term Stewardship +$5,192,000**
• Supported LTS regulatory required activities at the KC National Security Campus, LLNL (Main Site and Site 300), Pantex Plant, SNL, and Y-12. • LTS required activities included: treating contaminated ground water; monitoring surface/ground water and soils; maintaining landfill remedies; performed CERCLA and RCRA	• Supports LTS regulatory required activities at the KC National Security Campus, LLNL (Main Site and Site 300), Pantex Plant, SNL, and Y-12. • LTS required activities include: treating contaminated ground water; monitoring surface/ground water and soils; maintaining landfill remedies; performing CERCLA and RCRA	• The increase reflects the transfer of scope from Operations of Facilities for five facilities that treat waste streams normally associated with the Long Term Stewardship program.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
5-year remedy reviews of selected cleanup remedies; worked with the Environmental Protection Agency regions and various states to meet post-completion regulatory cleanup and reporting requirements; and worked in concert with other federal agencies, states, and affected stakeholders to execute LTS activities in a cost effective, compliant, and safe manner consistent with end states.	5-year remedy reviews of selected cleanup remedies; working with the Environmental Protection Agency regions and various states to meet post-completion regulatory cleanup and reporting requirements; and working in concert with other federal agencies, states, and affected stakeholders to execute LTS activities in a cost effective, compliant, and safe manner consistent with end states.	

Infrastructure and Operations
Maintenance and Repair of Facilities

Description

The Maintenance and Repair of Facilities program provides direct-funded maintenance activities across the NNSA enterprise for the recurring day-to-day work required to sustain and preserve NNSA facilities and equipment in a condition suitable for their designated purpose. These efforts include predictive, preventive, and corrective maintenance activities to maintain facilities, property, assets, systems, roads, equipment, and vital safety systems. This program also funds maintenance of excess facilities (including high-risk excess facilities) necessary to minimize the risk posed by those facilities prior to disposition.

Maintenance and Repair of Facilities is prioritized within an enterprise risk management framework based on mission needs; probability of failure of a system or a component; and risk determination with regard to safety, security, and environmental requirements. Investments focus on those structures, systems, and components that are considered essential to the national security mission. FY 2017-FY 2023 Infrastructure and Operations site allocations for direct-funded maintenance are provided in Table 5 below.

This program also funds the Roof Asset Management Program (RAMP) and the Cooling and Heating Asset Management Program (CHAMP). RAMP provides a dedicated approach to managing roofing assets through a single prioritized list of roofing needs across the nuclear security enterprise. The benefits of this approach enable the implementation of standard industry processes and best practices in the management of the roofing portfolio at a corporate level. Efficiencies are achieved by centralized procurement through leveraged buying power and long-term solutions instead of short-term repairs. The successful RAMP methodology has been expanded to other common components/systems under the Asset Management Program (AMP). NNSA implemented CHAMP pilots in FY 2016, with full implementation of the program in FY 2017. Other systems will be analyzed as possible AMPs to achieve additional efficiencies.

Table 5

National Nuclear Security Administration
Infrastructure and Operations Direct Funded Maintenance and Repair of Facilities Allocations by Site
(Dollars in Thousands)

Site	FY 2017 Enacted	FY 2018 Request	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Kansas City National Security Campus	24,000	23,000	23,000	24,000	25,000	26,000	27,000
Lawrence Livermore National Laboratory	13,000	13,500	14,000	15,000	16,000	17,000	18,000
Los Alamos National Laboratory	60,000	62,000	63,000	64,000	66,000	68,000	70,000
Nevada National Security Site	25,000	25,000	32,000	32,000	33,000	33,000	33,000
Pantex Plant	59,000	63,500	66,000	67,000	68,000	70,000	72,000
Sandia National Laboratories	5,000	5,000	6,000	9,000	10,000	11,000	12,000
Savannah River Site	23,000	24,000	26,500	29,000	30,000	32,000	34,000
Y-12 National Security Complex	60,000	65,000	67,000	68,000	69,000	70,000	71,000
Enterprise Acquisitions*	55,000	79,000	67,500	82,000	90,000	92,000	95,000
TOTAL	**324,000**	**360,000**	**365,000**	**390,000**	**407,000**	**419,000**	**432,000**

* The Maintenance and Repair of Facilities allocation under "Enterprise Acquisitions" includes funding for Asset Management Programs, which achieve economies of scale and maintenance standardization for critical building systems that are common across the enterprise (e.g. roofs, HVAC) and to quickly respond to emergent unforeseeable issues. Funding is distributed to the sites during execution, which is consistent with industry best practices.

Maintenance and Repair of Facilities

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Maintenance and Repair of Facilities $324,000,000	**Maintenance and Repair of Facilities $365,000,000**	**Maintenance and Repair of Facilities +$41,000,000**
• Specifically, ○ At KC, funded maintenance of equipment and tenant improvement equipment. ○ At LLNL, funded maintenance activities at Contained Firing Facility, Superblock, HEAF, machine shops, and waste management facilities. ○ At LANL, funded maintenance activities at PF-4, CMR, DARHT, LANSCE, Beryllium, waste management, radiological laboratory, and tritium facilities. ○ At NNSS, funded maintenance of JASPER, BEEF, DAF, and U1a. ○ At Pantex, funded Bays and Cell maintenance, emerging requirements, and support for high explosives activities. ○ At SNL, funded maintenance activities at MESA, METF, and Tonopah. ○ At SRS, funded maintenance on tritium facilities and equipment and activities associated with gas transfer systems. ○ At Y-12, funded maintenance for uranium and lithium operations. ○ Enterprise-wide, funded RAMP and CHAMP centralized procurement activities to increase buying power and accelerate repairs of systems/components that are common across the NNSA enterprise. ○ Provided for enterprise-wide activities to stabilize the condition of excess facilities to minimize risk to mission prior to disposition.	• Specifically, ○ At KC, funds maintenance of equipment and tenant improvement equipment. ○ At LLNL, funds maintenance activities at Contained Firing Facility, Superblock, HEAF, machine shops, and waste management facilities. ○ At LANL, funds maintenance activities at PF-4, CMR, DARHT, LANSCE, Beryllium, waste management, radiological laboratory, and tritium facilities. ○ At NNSS, funds maintenance of JASPER, BEEF, DAF, and U1a. ○ At Pantex, funds Bays and Cell maintenance, emerging requirements, and support for high explosives activities. ○ At SNL, funds maintenance activities at MESA, METF, and Tonopah. ○ At SRS, funds maintenance on tritium facilities and equipment and activities associated with gas transfer systems. ○ At Y-12, funds maintenance for uranium and lithium operations. ○ Enterprise-wide, funds RAMP and CHAMP centralized procurement activities to increase buying power and accelerate repairs of systems/components that are common across the NNSA enterprise. ○ Provides for enterprise-wide activities to stabilize the condition of excess facilities to minimize risk to mission prior to disposition.	• The increase provides additional funding to support the Infrastructure Modernization Initiative (IMI) to reduce Deferred Maintenance and improve the working condition of NNSA facilities and equipment, and expand the Roof Asset Management Program and the Cooling and Heating Asset Management Program.

Infrastructure and Operations
Recapitalization

Description

The Recapitalization program, the key to arresting the declining state of NNSA infrastructure, prioritizes investments to improve the condition and extend the design life of the structures, capabilities, and/or systems. The Infrastructure and Safety (I&S) subprogram improves the reliability, sustainability, productivity, and efficiency of NNSA's infrastructure to reduce overall operating costs. It also reduces safety, environmental, and program risk associated with facilities and systems that are often well beyond their design life. The Capability Based Investments (CBI) subprogram is an investment strategy for managing risks in existing capabilities by prioritizing investments to upgrade and improve the reliability, efficiency, and capability of programmatic equipment and associated infrastructure to meet Defense Programs (DP) requirements.

The I&S subprogram includes costs for minor construction projects, capital equipment, projects that are expensed, and Other Project Costs (OPC) for general purpose infrastructure line item construction projects. I&S also funds deactivation and disposal of excess infrastructure, including stabilization and risk reduction activities at high-risk excess facilities, resulting in surveillance and maintenance cost avoidance and reduced risk to workers, the public, the environment, and programs. Recapitalization projects incorporate energy conservation measures to the greatest extent practicable in support of sustainability and energy performance improvements.

The CBI subprogram implements multi-year projects and strategies to sustain, enhance, or replace DP capabilities through focused investments supporting core programmatic requirements across the enterprise. These investments address needs beyond any single facility, campaign, or weapon system and are essential to achieving program mission objectives. Over the years, DP's science and manufacturing capabilities have been lost or degraded due to aging, broken, or outdated equipment and supporting systems. To support ongoing and future DP weapons activities, CBI invests in projects to reduce risk to the mission and ensure needed capabilities are available for LEPs and other mission work.

CBI projects include minor construction projects, capital equipment projects, and some operating funded projects that are expensed. The CBI subprogram also funds OPCs for several DP-specific infrastructure line item construction projects. For major system acquisition projects (TEC > $750M), OPCs are funded within the line item. Also, OPCs for the U1a Complex Enhancements Project are requested within Enhanced Capabilities for Subcritical Experiments (ECSE) subprogram under the Science Program, and OPCs for Lithium Production Capability are requested within the new Lithium Sustainment subprogram under Strategic Materials.

Tables 6 and 7 show the plans for Recapitalization projects to be executed with FY 2019 funding based on the status of enterprise infrastructure as of February 2018. This plan may need to be updated before the FY 2019 execution year to respond to changing infrastructure conditions and requirements.

Table 6

National Nuclear Security Administration Infrastructure and Safety Planned FY 2019 Recapitalization Projects - As of February 2018		
Site	**Project Name**	**FY 2019 Allocation ($K)**
KC	Bldgs 2&3 Environmental Testing & Controls Equipment Replacement & Upgrade	2,800
	Bldgs 2&3 Special Materials Production & Rubber & Plastics Equipment Replacement & Upgrade	3,000
	Bldgs 2&3 Infrastructure Alterations for Precision Milling Equipment Replacement & Upgrades	1,700
	Building and Infrastructure Alterations for Rubber and Plastics Equipment Upgrade Efforts	1,800
	Bldgs 2&3 Specialty Machining Applications and Welding Capital Equipment Upgrades	3,000
	Bldgs 2&3 Paint & Heat Treat & Rubber & Plastics Area Refurbishments	1,700
	Bldgs 2&3 Rubber & Plastics Manufacturing & Applications Equipment Upgrades	2,900
	Bldgs 2&3 Specialty Fabrication & Assembly Applications Equipment Upgrades	2,500
	Bldgs 2&3 Specialty Chemical Processing & Applications Capital Equipment Modernization	2,600
Subtotal, Kansas City National Security Campus		**22,000**
LLNL	B131 High Bay HVAC Replacement	5,900
	B235 Ancillary Synthesis Chemistry Laboratories Refurbishment with Fume Hood Upgrades	5,400
	B322 Plating Shop Utility & Safety Systems Refurbishment	3,400
	B332 iCAM Alarm System Upgrade	1,000
	B391 Sustainable Chilled Water & Heating Hot Water System Replacement	3,900
	Site 200 & SNL CA Campus Domestic Water System Disinfection Plant & SCADA System Installation	3,700
	B341 AME Mechanical Test Capability Consolidation Refurbishment	12,500
	B805 Classified Machine Shop Refurbishment	3,900
	New Site 300 Remote Firing Facilities Office	1,000
	B332 Ventilation Control System Upgrade for Fume Hood Exhaust (FHE) System	5,100
	Site 200 Security Perimeter Primary Entrances Presence Strengthening Installation	2,200
	Design – B151 High Level Radiochemistry Laboratories 5 thru 8 Refurbishment	700
	Design – New AME Joining Capabilities and Vapor Disposition Facility	1,800
Subtotal, Lawrence Livermore National Laboratory		**50,500**
LANL	TA-16-0303 Refurbishment for Crystal Lab Relocation	9,200
	CMR Decontamination and Remediation of Components in Wing Basements	2,800
	TA-53-0003 (LANSCE) Sector H Fire Protection System Installation	1,800
	RLWTF Tank Removal and Ground Water Monitoring Well Replacement	6,600
	TA-22-093-C123 & C125 HVAC Installation	2,300
	RLWTF Clarifier Number 1 Stabilization	5,500
	TA 16-0202 RM 114 Refurbishment	4,400
	DARHT Weather Enclosure Addition	11,800
	CMR Final Transition Requirements for Enduring Surveillance	2,400
	TA-46-0001 Disposition	13,000
	Design – TA-11-30 (K-Site) Environmental and Vibration Test Facility Fire Suppression Upgrade	1,000
	Design – TA-8-23 Radiography Facility Fire Protection System Installation	1,100
	Design – TA-16-260 Pressing, Machining and Testing Facility UPS Replacement	1,100
	Design – TA-16 Fire Suppression Upgrades	1,400
	Design – TA-40-23 Electrical, Mechanical Refurbishment	1,100
	Design – HE Magazine Refurbishment – 12 Magazines located at TA-9, TA-14, and TA-15	1,800
Subtotal, Los Alamos National Laboratory		**67,300**

National Nuclear Security Administration Infrastructure and Safety Planned FY 2019 Recapitalization Projects - As of February 2018		
Site	**Project Name**	**FY 2019 Allocation ($K)**
NNSS	Frenchman Flat Substation Transformer Replacement	4,000
	Mercury Modernization Utility Upgrades - Campus	7,000
	NNSS Building 06-904 Refurbishment	2,500
	DAF UPS400-3 Replacement	3,800
	U1a New Underground Access Control System	2,000
	U1a Shaft Station New Fire Barrier	1,000
	Mission Corridor Water Supply Line Upgrade	5,000
	Mercury Buildings 23-425 and 23-152 Disposition	2,000
	Design - Mercury Modernization New Building 23-461	3,000
Subtotal, Nevada National Security Site		**30,300**
PX	Bays & Cells Safety Improvements	25,800
	Bldg 12-130 Generator & UPS Replacement	2,000
	Bldg 12-37 Secondary Electrical Feed Installation	9,200
	Bldg 12-24E Chiller Replacement	4,500
	West Interconnect Replacement	9,600
	Bldg 11-029 Disposition	2,600
	Design - New Gas Analysis Laboratory	1,200
Subtotal, Pantex Plant		**54,900**
SNL	New Data Center Replacement Facility	14,700
	Bldg 888 Process Oil Storage Tanks Replacement	600
	Building C914 High Bay Seismic Upgrades	9,800
	Bldg 6639 Site Erosion Protection Replacement	800
	NM TA-I Roads Installation – K Ave Extension from Gate 17 to 9th St	700
	NM Water System Secondary Feed to 700K Tank Installation	2,900
	New Z & TA-IV Missions Support Building	9,700
	20th St. & G Ave Intersection Relocation	6,500
	Design – NM High Voltage Power System Meter Installation and Switch Replacement	100
	Design – Bldg 894 – Thermal Battery Lab 132 Exhaust Ventilation System Upgrades	100
Subtotal, Sandia National Laboratories		**45,900**
SRS	HANM Oxygen Monitor Replacements	3,400
	SRS 234-H 480 Volt Cable Replacement	5,000
	SRS-HANM Distributed Control System I/O Replacements	6,700
	Building 238-H/237-H shutdown	2,925
Subtotal, Savannah River Site		**18,025**

National Nuclear Security Administration Infrastructure and Safety Planned FY 2019 Recapitalization Projects - As of February 2018		
Site	**Project Name**	**FY 2019 Allocation ($K)**
Y-12	50 Year Sprinkler head Replacements	8,800
	Bldg 9204-4 Concrete Replacements	3,000
	Nuclear Facility Electrical Modernization	17,000
	Criticality Accident Alarm System (CAAS) Replacement Portfolio	7,100
	Bldg 9201-5W AJ-91 HVAC Refurbishment	4,700
	Bldg 9204-2 Kathabar #1 Sump Replacement	2,000
	Bldg 9995 Supply Fan #13 Refurbishment	400
	Fire Water Laterals Replacement Portfolio (Bldg 9998 N/S & 9212 N Z-2)	3,300
	Bldg 9201-05 Utility Isolations and Reroutes Portfolio	9,000
	Bldg 9204-04 Utility Isolations and Reroutes Portfolio	2,700
	Bldg 9206 Equipment/Material De-Inventory	1,200
	Bldg 9206 Exterior Tank & Dikes De-Inventory	1,200
Subtotal, Y-12 National Security Complex		**60,400**
	Planning, Assessments, & Infrastructure Management Tools	54,979
	Construction Other Project Costs (OPC)	4,327
	NNSA Albuquerque Complex Project Furniture, Fixtures & Equipment (FF&E)	23,000
Grand Total, Infrastructure and Safety		**431,631**

Table 7

Capabilities Based Investments Planned FY 2019 Recapitalization Projects - As of February 2018		
Site	**Project Name**	**FY 2019 Allocation ($K)**
KC	Development Laboratory Modernization	250
	Special Application Machining Modernization	600
	Gas Transfer Systems Production Modernization	1,700
	Rubber & Plastics Production Modernization	1,650
	Analytical Laboratory Modernization	800
Subtotal, Kansas City National Security Campus		**5,000**
LLNL	LEP and Warhead Assessment Investments	2,500
	Insensitive High Explosives Qualification Capabilities Recapitalization	2,850
	Applied Material Engineering Consolidation	3,150
	Site 300 OFF Firing & Control System Modernization	1,200
	Multiplex Optical Ranging System (MIE)	2,300
	Static and Dynamic Enhanced Radiography (MIE)	1,000
	Neutron Imaging Deployment	1,000
Subtotal, Lawrence Livermore National Laboratory		**14,000**
LANL	DARHT Reliability/Capability Upgrades	2,430
	DARHT Vessel Support	2,870
	Replace Lujan Target (MIE)	4,200
	PF-4 Area 300 Trolley Revitalization	2,600
	Uranium Foundry Modernization	1,000
Subtotal, Los Alamos National Laboratory		**13,100**
NNSS	Area 6 ATLAS Transition (6-922)	1,500
	Forward Area Classified Network Upgrade	1,500
	Mission Facility Equipment	1,500
	Big Sur Modifications Support	2,500
Subtotal, Nevada National Security Site		**7,000**
PX	Mass Properties Measurement Machine	530
	Replacement of Machine Tools for Special Tooling	4,020
	High Explosives Development Machining Center	8,050
	Replace Two 300' Environmental Chambers	1,400
Subtotal, Pantex Plant		**14,000**
SNL	Sandia Silicon Fabrication Revitalization (SSiFR)	16,600
	Wafer Bonding System (MIE)	5,900
Subtotal, Sandia National Laboratories		**22,500**
SRS	Load Line 6 Upgrades to support loading LEPs and new Major ALTs	3,500
	Function Test Station (FTS) Laser Replacement	1,380
	FTS Programmable Controller System Upgrade	920
Subtotal, Savannah River Site		**5,800**
Y-12	Deploy Wet Chemistry Process Capability	1,300
	High Energy Digital Radiography System (HEDR)	250
	2 MeV Part Positioners	300
	Mid Energy Panels	250
	Retrofit AG Davis Controller	1,300
	New Casting Capability	1,900
Subtotal, Y-12 National Security Complex		**5,300**

Capabilities Based Investments Planned FY 2019 Recapitalization Projects - As of February 2018		
Site	**Project Name**	**FY 2019 Allocation ($K)**
	DP Line Item Other Project Costs (OPCs)	7,000
	Corporate Taxes and Assessments	2,726
	CBI Planning, Design, Program Management	12,631
Grand Total, Capabilities Based Investments		**109,057**

Recapitalization

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Infrastructure and Safety $430,509,000	**Infrastructure and Safety $431,631,000**	**Infrastructure and Safety +$1,122,000**
• Provided funds for needed investments in obsolete/aging facilities and infrastructure to improve safety, reliability, and working conditions.	• Table 6 contains the current FY 2019 project plan as of February 2018. The table includes advanced funding for design of several complex, high priority projects for future year execution. Recapitalization funds are allocated in accordance with planned priorities but retain the flexibility to adjust efforts to address emerging changes in priorities and unplanned failures.	• No significant changes.
Capability Based Investments $112,639,000	**Capability Based Investments $109,057,000**	**Capability Based Investments -$3,582,000**
• CBI provided targeted, strategic investments for life-extension and modernization of enduring requirements needed to sustain Defense Program's capabilities. • CBI provided funding to implement projects across the nuclear security enterprise including continued investments to: support LEP assessments and Insensitive High Explosives (IHE) capabilities at LLNL, upgrade surveillance capabilities at LANL's DARHT facility, replace production and diagnostic equipment to support B61 LEP activities at Pantex and Y-12, revitalize silicon fabrication capabilities at SNL, provide lithium manufacturing capabilities at Y-12, and support DP's mission across the nuclear security enterprise. Additional FY 2017 projects included: o At KCNSC, modernization of equipment and capabilities on production lines supporting the W88 Alteration Program. o At LANL, upgraded a detonator test fire facility.	• CBI will continue to provide targeted, strategic investments for life-extension and modernization of enduring requirements needed to sustain Defense Program's capabilities. • Table 7 contains the current FY 2019 CBI project plan as of February 2018. Recapitalization funds are allocated in accordance with planned priorities but retain the flexibility to adjust efforts to address emerging changes in priorities. • CBI will continue funding OPCs for several DP line item construction projects.	• OPCs for Lithium Production Capability move to Lithium Sustainment in FY 2019, and OPC requirements for two LANL construction projects end in FY 2018.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
○ At NNSS, increased investment in capabilities supporting subcritical experiments at U1a and DAF. ○ At Pantex, restored HE machining capabilities and replaced machine tools and equipment. ○ At SRS, GTS load line upgrades to support the B61-12 LEP. • CBI continued funding OPCs for several DP line item construction projects.		
Bannister Federal Complex Disposition $200,000,000	**Bannister Federal Complex Disposition $0**	**Bannister Federal Complex Disposition -$200,000,000**
• Disposition of the Bannister Federal Complex by transfer to a private developer for remediation and redevelopment.	• The disposition was fully funded in FY 2017.	• The decrease reflects full funding for the transfer and disposition of the Bannister Federal Complex in FY 2017.

Infrastructure and Operations
Construction

Description

The Construction subprogram plays a critical role in revitalizing the nuclear security enterprise including the nuclear weapons manufacturing and research and development infrastructure. Investments from this subprogram will improve the responsiveness and utility of the infrastructure and its technology base. The subprogram is focused on two primary objectives: (1) identification, planning, and prioritization of the projects supporting national security objectives, particularly the weapons programs, and (2) development and execution of these projects within approved cost and schedule baselines. Table 8 shows the breakout of funding by line item.

The UPF at Y-12 consists of processing capabilities for enriched uranium casting, oxide production, and salvage and accountability operations. The UPF project includes a Main Process Building (MPB), a Salvage and Accountability Building (SAB), a Mechanical Electrical Building (MEB), a Process Support Facility (PSF), and various other support facilities. Constructing multiple facilities allows each facility to be designed and constructed with a level of safety and security appropriate for the hazards of each operation. FY 2019 funding will be used for construction/long-lead procurement for the MPB, MEB, SAB, and PSF subprojects. The Department is committed to complete UPF by 2025 for no more than $6,500,000,000. This commitment is predicated on receiving consistent and stable funding as requested to support the approved project baseline.

Under the CMRR project, FY 2019 construction funding supports the RLUOB Equipment Installation Phase 2 (REI2) and PF-4 Equipment Installation Phase 1 (PEI1) subprojects, which both received baseline approval in FY 2017. Funding also supports design activities for the other two subprojects: PF-4 Equipment Installation, Phase 2 (PEI2) and the Re-categorization of RLUOB to Hazard Category 3 (RC3).

FY 2019 funding will be used to continue the design and prepare the safety basis documents for the Tritium Production Capability (TPC) Project at the Savannah River Site. The TPC project is planned to relocate critical processes and operations currently performed in the 60-year old H-Area Old Manufacturing (HAOM) facility to new facilities that will be built to new and more stringent safety standards currently in effect throughout the DOE and NNSA complex. The infrastructure of the building has deteriorated and is well beyond expected end-of-life. Critical capabilities are now housed in areas that create a substantial risk to the enduring Tritium Mission. Infrastructure failures have increased the frequency of production delays and led to increased safety, security, maintenance and operating costs.

FY 2019 funding is requested for the Lithium Production Capability (LPC) Project at the Y-12 National Security Complex to start the design. The LPC Project is planned to relocate lithium operations currently conducted in Building 9204-2 which was built in 1943. The facility, at approximately 325,000 square feet, is oversized for today's mission, was not built in accordance with the current codes and standards, is costly to operate, has many operating issues, and has exceeded its expected life. This facility has concrete deterioration, both internal and external, in areas where the roofs, walls, and ceilings have been exposed to decades of corrosive liquids and processing fumes, requiring restricted access and protective equipment (e.g., hard hats) in some processing areas.

FY 2019 funding will also be used to continue the design and construction of the U1a Complex Enhancements Project (UCEP) at NNSS. This project will deliver a new underground laboratory that will enable new experimental and diagnostic capabilities and an increased operational cadence of subcritical weapons experiments using plutonium.

FY 2019 funding supports the 138kV Power Transmission System Replacement project at NNSS. The existing 138kV Power Transmission System was originally constructed in 1963 of wooden creosote poles and cross members and aerial conductors in a loop configuration, which is approximately 100 miles in length. The power transmission system is well beyond the useful design life. The impact of the high desert environment has severely degraded the reliability of the system. As a result, the system will continue to be a liability to mission focus due to continued deterioration and unscheduled outages. This project replaces and upgrades the highest risk 23-mile segment of the system from Mercury to near U1a to provide the NNSS with highly reliable power and communications to the mission corridor.

Requested FY 2019 funding also supports the construction of the Albuquerque Complex Project, which will replace the current inadequate Albuquerque Complex facilities with the construction of a new facility on DOE property adjacent to the Kirtland Air Force Base.

50 US Code 2746 requires that if the estimated cost of completing a conceptual design for a construction project exceeds $5,000,000, the Secretary shall submit to Congress a request for funds for the conceptual design before submitting a request for funds for the construction project. NNSA anticipates that the estimated cost to complete the conceptual design of the following project will exceed the $5,000,000 threshold:

- Material Staging Facility at Pantex

The rough-order of magnitude cost estimate to complete the conceptual design is between $7,000,000 and $10,000,000 for the project. NNSA plans to request design funding in FY 2020 for the Material Staging Facility.

Table 8

National Nuclear Security Administration Infrastructure and Operations Construction by Line-item (dollars in thousands)							
Project	**FY 2017 Enacted**	**FY 2018 Request**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**
22-D-xxx, DUE Capability	0	0	0	0	0	12,700	27,400
21-D-xxx, Utility Distribution System, LLNL	0	0	0	0	20,000	0	0
21-D-xxx, Electrical Transmission & Distribution Capacity Upgrade, LANL	0	0	0	0	15,000	0	25,000
19-D-670, 138kV Power Transmission System Replacement, NNSS	0	0	6,000	54,000	0	0	0
19-D-660, Lithium Production Capability, Y-12	0	0	19,000	32,000	26,200	125,900	201,600
18-D-680, Material Staging Facility, PX	0	0	0	3,000	25,000	51,000	351,000
18-D-660, Fire Station, Y-12	0	28,000	0	0	0	0	0
18-D-650, Tritium Production Capability, SRS	0	6,800	27,000	27,000	13,000	30,000	45,000
17-D-640, U1a Complex Enhancements Project, NNSS	11,500	22,100	53,000	35,000	29,900	0	0
17-D-630, Expand Electrical Distribution System, LLNL	25,000	6,000	0	0	0	0	0
17-D-125, RLUOB Reconfiguration Project, LANL	1,000	0	0	0	0	0	0
17-D-126, PF-4 Reconfiguration Project, LANL	8,000	0	0	0	0	0	0
16-D-515, Albuquerque Complex Project	15,047	98,000	47,953	0	0	0	0
15-D-613, Emergency Operations Center, Y-12	2,000	7,000	0	0	0	0	0
15-D-612, Emergency Operations Center, LLNL	0	0	0	5,000	27,000	0	0
15-D-611, Emergency Operations Center, SNL	0	0	0	3,000	0	37,000	0
15-D-302, TA-55 Reinvestment Project, Phase 3, LANL	2,000	0	0	30,000	50,000	30,000	0
15-D-301, HE Science & Engineering Facility, PX	0	0	0	30,000	40,000	23,000	30,000
07-D-220, Radioactive Liquid Waste Treatment Facility Upgrade Project, LANL	0	2,100	0	0	0	0	0
07-D-220-04, Transuranic Liquid Waste Facility, LANL	17,053	17,895	0	0	0	0	0
06-D-141, Uranium Processing Facility, Y-12	575,000	663,000	703,000	745,000	750,000	620,000	300,000
Chemistry and Metallurgy Replacement (CMRR)							
04-D-125, Chemistry and Metallurgy Research Replacement Project, LANL	0	180,900	235,095	239,600	274,006	285,000	284,000
04-D-125-04, RLUOB Equipment Installation, Phase 2	75,000	0	0	0	0	0	0
04-D-125-05, PF-4 Equipment Installation	75,615	0	0	0	0	0	0
Subtotal, 04-D-125, CMRR Project, LANL	150,615	180,900	235,095	239,600	274,006	285,000	284,000
Total, Infrastructure and Operations: Construction	**807,215**	**1,031,795**	**1,091,048**	**1,203,600**	**1,270,106**	**1,214,600**	**1,264,000**

Construction

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Construction $807,215,000	**Construction $1,091,048,000**	**Construction +$283,833,000**
• Continued execution of CMRR subprojects (REI2, PEI1, and PEI2) and commenced Re-categorization to Hazard Category 3 (RC3) subproject. • Started conceptual design of the TA-55 Reinvestment Project Phase 3 at LANL. • Continued construction of the TLW Facility at LANL. • Continued design activities and construction of approved subprojects for UPF at Y-12. • Continued design and construction of the U1a Complex Enhancements Project at NNSS. • Initiated design and construction of the Expand Electrical Distribution System Project at LLNL and continue the EOC at Y-12. • Continued design of the Albuquerque Complex Project.	• Continue execution of CMRR subprojects (REI2, PEI1), as well as the design and other activities for the remaining two subprojects: PF-4 Equipment Installation, Phase 2 (PEI2) and the Re-categorization of RLUOB to Hazard Category 3 (RC3). • Continue long lead procurement and construction of approved subprojects for UPF at Y-12. • Continue construction of the Albuquerque Complex Project. • Continue design activities for the Tritium Production Capability project at SRS. • Continue design and construction of the U1a Complex Enhancements Project at NNSS. • Initiate design of the 138K Power Transmission System Replacement project at NNSS and the Lithium Production Capability at Y-12.	• The increase primarily reflects funding for construction of the UPF, CMRR project, Albuquerque Complex Project, U1a Complex Enhancements Project, Tritium Production Capability at SRS, and new starts for the 138kV Power Transmission System Replacement at NNSS and the Lithium Production Capability at Y-12.

Infrastructure and Operations
Performance Measures

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Operations of Facilities – Enable NNSA missions by providing operational facilities to support nuclear weapon dismantlement, life extension, surveillance, and research and development activities, as measured by percent of scheduled versus planned days mission-critical and mission-dependent facilities are available without missing key deliverables.							
Target	85% of availability	85% of availability	85% of availability	85% of availability	85% of availability	85% of availability	85% of availability
Result	**Exceeded** – 97.6						
Endpoint Target	Mission critical facilities are available at least 85% of scheduled days annually.						
Maintenance – Percentage of preventive maintenance (PM) spending vs total maintenance (TM).							
Target	35% PM conducted	36% PM conducted	36.5% PM conducted	37% PM conducted	37.5% PM conducted	38% PM conducted	38.5% PM conducted
Result	**Met** - 35						
Endpoint Target	PM to TM ratio target is 50%.						
Recapitalization – Percentage of NNSA assets rated adequate (by Replacement Plant Value).							
Target	37% of assets	35.5 % of assets	36 % of assets	36.5% of assets	37% of assets	37.5% of assets	38% of assets
Result	**Not Met** - 35						
Endpoint Target	44% of NNSA assets rated as adequate.						

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Environmental Monitoring and Remediation - Annual percentage of environmental monitoring and remediation deliverables that are required by regulatory agreements to be conducted at NNSA sites under Long Term Stewardship (LTS) that are executed on schedule and in compliance with all acceptance criteria.							
Target	95% of deliverables	95% of deliverables	95% of deliverables	95% of deliverables	95% of deliverables	95% of deliverables	95% of deliverables
Result	**Exceeded** - 100						
Endpoint Target	Annually, submit on schedule and receive regulatory approval of at least 95% of all environmental monitoring and remediation deliverables that are required at NNSA sites under LTS by regulatory agreements.						
Construction Projects (formerly Major Construction Projects) - Execute construction projects within approved costs and schedules, as measured by the total percentage of projects with total estimated cost (TEC) greater than $20 million with a schedule performance index (ratio of budgeted cost of work performed to budgeted cost of work scheduled) and a cost performance index (ratio of budgeted cost of work performed to actual cost of work performed) between 0.9-1.15.							
Target	90% of projects	90% of projects	N/A	N/A	N/A	N/A	N/A
Result	**Not Met** - 89						
Endpoint Target	Annually achieve 90% of baselined construction projects with TEC greater than $20M with actual SPI and CPI of 0.9-1.15 as measured against approved baseline definitions.						
FY 2019 Note:	This Performance Measure is being replaced with the new Major Systems Construction Projects Performance Measure.						
Major System Construction Projects - Execute Major System Projects within approved costs and schedules, as measured by the total percentage of sub-projects that are part of projects with a total project cost (TPC) greater than $750 million with a cost performance index (ratio of budgeted cost of work performed to actual cost of work performed) between 0.9 and 1.15. Cost performance is measured against the original approved performance baseline (approved at Critical Decision 2).							
Target	N/A	N/A	90% of projects	90% of projects	90% of projects	90% of projects	90% of projects
Result	N/A	N/A					
Endpoint Target	Annually achieve 90% of baselined construction projects with TPC greater than $750M with actual CPI of 0.9-1.15 as measured against approved baseline definitions.						
FY 2019 Note:	This Construction Project Measure replaces the Construction Measure that ends in FY 2018. The previous measure included all projects measured by the total percentage of projects with total estimated cost (TEC) greater than $20 million. This new measure focuses on projects that have a total approved TPC of $750 million or greater but are reported at the subproject level.						

Infrastructure and Operations
Capital Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2017 Current	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Capital Operating Expenses Summary (including (Major Items of Equipment (MIE))							
Capital Equipment >$500K (including MIE)	N/A	N/A	59,821	56,105	42,399	60,700	+4,595
Plant Projects (GPP)	N/A	N/A	128,164	124,943	140,370	171,620	+46,677
Total, Capital Operating Expenses	**N/A**	**N/A**	**187,985**	**181,048**	**182,769**	**232,320**	**+51,272**
Capital Equipment > $500K (including MIE)							
Total Non-MIE Capital Equipment (>$500K)	N/A	N/A	37,481	40,181	36,069	47,300	+7,119
HE Synthesis Pilot Plant, LLNL	10,100	4,326	5,500	5,774	0	0	-5,774
Parts Cleaning for Direct Lithium Material Manufacturing, Y-12[a]	10,300	2,000	8,300	500	0	0	-500
Single Ion Implanter, SNL	5,000	0	5,000	5,000	0	0	-5,000
Reestablish HE Development Machining Capabilities, PX	6,780	0	3,540	3,150	3,630	0	-3,150
Replace Lujan Target, LANL	8,000	0	0	1,500	400	4,200	+2,700
Lithium Salt Crusher/Grinder, Y-12[b]	8,860	0	0	0	400	0	0
Multiplex Optical Ranging System, LLNL	5,000	0	0	0	1,900	2,300	+2,300
Static and Dynamic Enhanced Radiography, LLNL	8,000	0	0	0	0	1,000	+1,000
Wafer Bonding System, SNL	5,900	0	0	0	0	5,900	+5,900
Total, Capital Equipment (including MIE)	**N/A**	**N/A**	**59,821**	**56,105**	**42,399**	**60,700**	**+4,595**

[a] CBI funded $500 to complete design revision in FY 2017. Re-scoped project is funded by Weapons Dismantlement & Disposition.
[b] CBI requested funding for planning in FY 2018. Scope moved to new Lithium Sustainment program in FY 2019.

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2017 Current	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Plant Projects (GPP) (Total Estimated Cost (TEC)							
Total Plant Projects (GPP) (TEC <$5M)	N/A	N/A	43,260	42,970	50,120	61,100	+18,130
New SNL/CA Data Center Replacement Facility	14,700	0	0	0	0	14,700	+14,700
B341 AME Mechanical Test Capability Consolidation Refurbishment, LLNL	12,500	0	0	0	0	12,500	+12,500
New AME Joining Capabilities and Vapor Deposition Facility, LLNL	18,000	0	0	0	0	1,800	+1,800
B151 High Level Radiochemistry Laboratories Refurbishment, LLNL	14,600	0	0	0	0	700	+700
B235 and Ancillary Synthesis Chemistry Laboratories Refurbishment with Fume Hood Upgrades, LLNL	11,400	0	0	0	0	5,400	+5,400
Mercury Modernization New Building 23-461, NNSS	15,000	0	0	0	0	3,000	+3,000
Building 12-37 Secondary Electrical Feed Installation	16,300	0	0	0	0	9,200	+9,200
Mercury Modernization Utility Upgrades - Campus, NNSS	7,000	0	0	0	0	7,000	+7,000
20th Street & G Avenue Intersection Relocation, SNL	7,250	0	0	750	0	6,500	+5,750
New Z & TA-IV Missions Support Facility, SNL	9,700	0	0	0	0	9,700	+9,700
Building C914 High Bay Seismic Upgrades, SNL	9,800	0	0	0	0	9,800	+9,800
New Gas Analysis Laboratory, PX	15,000	40	4,989	0	0	1,200	+1,200
Weather Enclosure Addition at DARHT, LANL[a]	13,113	1,000	3,445	313	0	11,800	+11,487

[a] This project was initiated in FY 2016 under the Recapitalization/Capabilities Based Investments (CBI) program and $1.313 million was spent under that program before the project was placed on hold due to the risk of Total Project Cost exceeding the $10 million minor construction threshold. The project will resume under the Recapitalization/Infrastructure & Safety program starting in FY 2019.

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2017 Current	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Plant Projects (GPP)							
TA-16-0303 Refurbishment for Crystal Lab Relocation, LANL	12,200	0	0	0	3,000	9,200	+9,200
Building 9212 50-Year Sprinkler Head Replacement (Wet Pipe System 007), Y-12	5,200	0	0	0	3,800	1,400	+1,400
PF-4 Fire Wall Upgrades, LANL	7,000	0	0	0	7,000	0	0
Site 300 SCADA Upgrade, LLNL	3,250	0	0	0	3,250	0	0
DAF Electrical Substations Upgrade, NNSS	5,500	0	0	0	5,500	0	0
New Mercury Consolidated Operations Complex Building 1 (23-460), NNSS	9,000	0	0	0	9,000	0	0
Building 12-44 Equipment Room Expansion, PX	9,200	0	0	0	9,200	0	0
B878 (Process Development Lab) Renovation, SNL	9,200	0	0	0	9,200	0	0
SNL/CA Sanitary Sewer Replacements	7,000	0	0	0	7,000	0	0
Bear Creek Road 13.8kV Electrical Power Distribution Installation, Y-12	8,600	0	0	0	8,600	0	0
New AME Polymers and Engineering Facility, LLNL	14,500	0	0	0	14,500	0	0
Modify Unloading Station B, SRS	6,650	5,500	0	0	1,150	0	0
Site 300 Firing Site Support Systems Upgrade, LLNL	5,000	0	5,000	5,000	0	0	-5,000
RANT Seismic Upgrades, LANL	9,990	1,500	6,340	8,490	0	0	-8,490
DAF Electrical and Backup Power Replacement, NNSS	9,200	7,200	2,000	2,000	0	0	-2,000
Mission Corridor Consolidation, NNSS	8,000	0	6,300	8,000	0	0	-8,000
Water/Wastewater Systems - CP Hill Water Line Replacement, NNSS	7,000	0	7,000	7,000	0	0	-7,000
B6588 (Annular Core Research Reactor) Facility Renovation, SNL	5,600	600	5,000	5,000	0	0	-5,000
B827 (Primary Standards Laboratory) Renovation, SNL	7,500	740	5,760	6,760	0	0	-6,760

	(Dollars in Thousands)						
	Total	Prior Years	FY 2017 Enacted	FY 2017 Current	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Plant Projects (GPP)							
B862 (Standby Power Plant) Upgrades, SNL	8,500	2,760	5,740	5,740	0	0	-5,740
234-7H Air Handler Units Replacement, SRS	7,360	4,245	1,595	3,115	0	0	-3,115
Building 9204-2 Kathabar Replacement, Y-12	8,600	7,300	1,300	1,300	0	0	-1,300
Criticality Accident Alarm System Replacement, Y-12	6,700	0	6,700	6,700	0	0	-6,700
3rd St 13.8kV Electrical Power Distribution Installation, Y-12	6,225	0	5,425	6,225	0	0	-6,225
Battery Test Facility, SNL	7,600	0	7,600	7,600	0	0	-7,600
Environmental Testing Capability Investments for B61 and other LEPs (ARMAG), LANL	9,209	8,129	530	1,080	0	0	-1,080
Reconfigure Production Bay for Non-Destructive Laser Gas Sampling (CSA Certification), PX	5,210	1,610	3,600	3,600	0	0	-3,600
Detonator Test Fire Upgrades (Indoor Firing Site TA-40-0015), LANL	7,500	1,000	2,300	2,300	4,200	0	-2,300
Load Line 6 Upgrades, SRS	9,603	1,153	4,280	1,000	3,950	3,500	+2,500
Site 300 OFF Firing & Control System Modernization, LLNL	6,000	0	0	0	900	1,200	+1,200
Uranium Foundry Modernization, LANL	9,300	0	0	0	0	1,000	+1,000
Function Test Station (FTS) Programmable Controller System Upgrade, SRS	5,730	0	0	0	0	920	+920
Total, Plant Projects (GPP)	**N/A**	**N/A**	**128,164**	**124,943**	**140,370**	**171,620**	**+46,677**
Total, Capital Summary	**N/A**	**N/A**	**187,985**	**181,048**	**182,769**	**232,320**	**+51,272**

	(Dollars in Thousands)			
	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Capital Operating Expenses Summary (including MIE)				
Capital Equipment >$500K (including MIE)	36,900	35,450	36,000	36,600
Plant Projects (GPP)	90,120	16,184	10,042	9,878
Total, Capital Operating Expenses	**127,020**	**51,634**	**46,042**	**46,478**
Capital Equipment > $500K (including MIE)				
Total Non-MIE Capital Equipment (>$500K)	20,800	27,100	34,100	35,500
Replace Lujan Target, LANL	1,900	0	0	0
Multiplex Optical Ranging System, LLNL	800	0	0	0
Static and Dynamic Enhanced Radiography, LLNL	2,000	2,000	1,900	1,100
Molecular Beam Epitaxy Tool, SNL	6,500	5,250	0	0
Microfab Photolithography Tool MESA Microfab, SNL	4,900	1,100	0	0
Total, Capital Equipment (including MIE)	**36,900**	**35,450**	**36,000**	**36,600**

	(Dollars in Thousands)			
	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Plant Projects (GPP)				
Total Plant Projects (GPP) (Total Estimated Cost (TEC) <$5M)	6,500	6,600	7,000	8,000
New AME Joining Capabilities and Vapor Deposition Facility, LLNL	16,200	0	0	0
B151 High Level Radiochemistry Laboratories Refurbishment, LLNL	13,900	0	0	0
B235 and Ancillary Synthesis Chemistry Laboratories Refurbishment with Fume Hood	6,000	0	0	0
Mercury Modernization New Building 23-461, NNSS	12,000	0	0	0
Building 12-37 Secondary Electrical Feed Installation	7,100	0	0	0
New Gas Analysis Laboratory, PX	13,760	0	0	0
Site 300 OFF Firing & Control System Modernization, LLNL	1,900	2,000	0	0
Uranium Foundry Modernization, LANL	3,400	4,000	900	0
Function Test Station Programmable Controller System Upgrade, SRS	2,820	1,990	0	0
Detonator/ Booster Fabrication, Formulation Upgrades, LANL	6,000	0	0	0
Replace Film Radiography in Finishing Gloveboxes, FL 4/5 Glovebox, SRS	500	1,594	3,042	1,878
Total, Plant Projects (GPP) (TEC <$20M)	**90,080**	**16,184**	**10,942**	**9,878**
Total, Capital Summary	**126,980**	**51,634**	**46,942**	**46,478**

Minor Construction Projects over $10 million

As directed in the FY 2018 National Defense Authorization Act, this section provides the requested project information for projects with a total project cost (TPC) over $10 million.

Project	Location/ Site	Project Description	TPC ($k)	Project Milestones		
				Project Start	Design Complete	Construction Complete
DARHT Weather Enclosure Addition	LANL	This project will erect a Weather Enclosure (WE) covering the confinement systems and target of hydrodynamic experiments at the Dual Axis Radiographic Hydrodynamic Test (DARHT) firing point. The WE provides the required protection for the experiment vessels and other confinement systems to ensure they perform as designed to contain the high explosive blast pressure, debris, gases and collection of valuable radiographic data. The new WE facility, adjacent to the DARHT facility, will be an insulated steel frame structure with metal panel exterior walls and roof. Basic support systems include crane, power, lighting (both interior and exterior), lightning protection and HVAC. The WE will include wall penetrations to accommodate existing equipment located adjacent to the vessel (i.e., beam transport, protective envelopes, and camera shielding structures). The WE provides a safe productive environment for workers. Without a WE, set up of the vessel system and associated shot diagnostic hardware must proceed out in the weather that may include temperature extremes, wind, snow, and rain. Furthermore, the enclosure provides environmental protection allowing workers to minimize personal protective equipment, reducing cold and heat stress, and eliminating wind and moisture, all of which makes workers more productive and allows operations proceed more safely with better control of schedule fluctuations due to weather. This project was initiated in FY 2016 under the Recapitalization/Capabilities Based Investments (CBI) program and $1.313 million (included in the TPC) was spent under that program before the project was placed on hold due to the risk of Total Project Cost exceeding the $10 million minor construction threshold. The project will resume under the Recapitalization/Infrastructure & Safety program starting in FY 2019.	13,113	FY 2016	FY 2019	FY 2020
New AME Polymers and Engineering Facility	LLNL	This 13,000 sq ft new construction facility will house Polymers capabilities as they must relocate from a 60-year old Building 231 that is beryllium contaminated and seismically deficient at LLNL. Three fourths of the building will be laboratory space, some of it very high ceiling and VTR space, and the rest will be technician cubicles and meeting spaces. Processing polymer material requires various fume hoods and the associated ventilation distribution systems. One lab area will have LEP advanced manufacturing R&D equipment, which is sensitive to vibration, requires the VTR, and must be as clean as possible. The LEED Gold facility will also have a distributed utility buildout and staging space for immediate program equipment acceptance. It is necessary to get the equipment back online as soon as possible, as the equipment is required to meet W80-4 LEP Phase 6.3 milestones.	14,500	FY 2018	FY 2018	FY 2020
New SNL/CA Data Center Replacement Facility	SNL	The current SNL/CA Data Center, originally constructed in the late 1960's, is antiquated and poses numerous operational risks due to potential failures of the electrical and mechanical cooling systems, seismic vulnerabilities, and fire-safety issues. This project will replace the current facility with a modern data center to effectively support SNL's missions. The project will provide a high-capacity, resilient, enduring, and purposely built facility with an enhanced level of redundancy that enables near-term mission growth and flexibility to support the advancement in IT and High-Performance Computing technology. The new facility will be approximately 9,500 total gross square foot (GSF), single story data center building at the Sandia California site. Major features will include: secure data server room of approximately 8,000 GSF to house approximately 200 existing and future data racks at 1000 KW IT load, including associated; site work, site utilities connections, primary and back-up mechanical and electrical equipment / systems serving the building, restrooms, and a systems operations center.	14,700	FY 2019	FY 2019	FY 2021

Project	Location/ Site	Project Description	TPC ($k)	Project Milestones		
				Project Start	Design Complete	Construction Complete
New Gas Analysis Laboratory	PX	Gas analysis is a key capability required to support component testing and nuclear weapon stockpile evaluation. The Gas Lab at the Pantex Plant is currently housed in Building 12-021. This building was constructed in 1944 for the production of conventional munitions. The 14,000 sf ft2 was re-purposed to house the Gas Lab and Non-Destructive Testing Laboratory. Building 12-021 is deteriorating and in poor condition. It also has numerous operational deficiencies. This project will construct a new gas analysis laboratory in a high security area at Pantex Plant that will be an 11,000 square foot concrete slab on grade steel frame masonry structure with a design life of at least 50 years. The facility will contain a temperature controlled laboratory with supporting offices, breakroom, restrooms, and storage area. Special features will include a backup power supply and redundant heating, ventilation, and air conditioning (HVAC) system. This project will substantially reduce the risk to upcoming Life Extension Programs. This project was initiated in FY 2016 and $40 thousand (included in the TPC) was spent before the project was placed on hold in FY 2017 due to the risk of TPC exceeding the $10 million minor construction threshold. The project will resume in FY 2019.	15,000	FY 2019	FY 2019	FY 2021
B341 AME Mechanical Test Capability Consolidation Refurbishment	LLNL	B341 has over 12,000 sq ft of available, empty high bay space. This project relocates the Mechanical Test capabilities from B231, 60-year old building that is beryllium contaminated and seismically deficient, to B341 which will allow leverage of existing related capabilities in the B341 facility. The vacant space was a gas gun facility, so it is a major effort to renovate the interior as there are many concrete, feet thick, shielded walls that must be removed or modified. Over 80% of this space will be laboratory space, most of it high bay. This project will have intensive mechanical, electrical and plumbing work, because this capability uses a lot of hydraulics and draws a lot of power. B341 will also have a distributed utility buildout and staging space for immediate program equipment acceptance. It is necessary to get the equipment back online as soon as possible, as the equipment is required to meet W80-4 LEP Phase 6.4 milestones.	12,500	FY 2019	FY 2019	FY 2020
New AME Joining Capabilities and Vapor Deposition Facility	LLNL	This approximately 18,000 sq ft new construction facility will house joining (welding, brazing) and vapor deposition capabilities as they must relocate from a 60-year old Building 231 that is beryllium contaminated and seismically deficient at LLNL. Three fourths of the building will be laboratory space, some of it high bay space, and the rest will be technician cubicles and meeting spaces. The LEED Gold facility must have various fume hoods and the associated ventilation distribution systems to support handling radiological materials. It will also have a distributed utility buildout and staging space for immediate program equipment acceptance. It is necessary to get the equipment back online as soon as possible, as the equipment is required to meet W80-4 LEP Phase 6.3 milestones. The capabilities require hi-bay cranes, and since these will have large lift loads, the facility walls must be very robust.	18,000	FY 2019	FY 2019	FY 2021
B151 High Level Radiochemistry Laboratories Refurbishment	LLNL	The refurbishment of radiochemistry laboratories and adjacent anterooms built in 1967 will include the disposal of contaminated materials and hardware, the replacement of radiological fume hoods, and the addition of new fume hoods. The project will provide bench and storage space for chemicals, radiological materials and equipment, and afford engineering controls adapted to state of the art radiochemistry activities. This project will modernize existing unsafe and obsolete Type II fume hoods and associated ventilation in approximately six laboratories by replacing over fifteen radiological fume hoods, adding two new hoods, and replacing over 20 gloveboxes. One specific lab ('The Elephant Trunk lab') has over a dozen gloveboxes and requires complex designs to accommodate seismically secured gloveboxes and their associated rigid ventilation distribution system in a small space. Individual gloveboxes per hazardous element are required to prevent cross contamination in the data for the Weapons Program. The first activities in these lab rooms and their anterooms is the disposal of contaminated materials and hardware. The laboratories will be designed to be versatile and optimized to support multiple program mission space.	14,600	FY 2019	FY 2019	FY 2022

Project	Location/ Site	Project Description	TPC ($k)	Project Milestones		
				Project Start	Design Complete	Construction Complete
B235 and Ancillary Synthesis Chemistry Laboratories Refurbishment with Fume Hood Upgrades	LLNL	The project will provide bench and storage space for chemicals, radiological materials and equipment in the labs. Obsolete material characterization labs handling hazardous materials such as nanomaterials and beryllium will be modernized, repaired or replaced, as applicable. The modernized labs will include the replacement of controls and fume hoods, benches and storage spaces for the noted labs. The project will renovate labs built in 1987, repair approximately 15 existing fume hoods and add over half a dozen fume hoods. This scope also addresses Category A seismic deficiencies, recently evaluated under LLNL's seismic program per Executive Order. There are over 350 staff who reside or work this facility daily, and will continue their work here during the refurbishment.	11,400	FY 2019	FY 2019	FY 2020
Mercury Modernization New Building 23-461	NNSS	This project provides a new building to replace aging and failing infrastructure in support of the Modernized Mercury Campus. Building 23-461 will support relocation of the NNSS Emergency Operations Center and Operations Control Center functions into a new building on the remote test site. These activities are currently conducted in an oversized 50 year old facility that has experienced significant building systems failures that have shut down operations. This project is the second building in a long-term strategy to consoldiate the Mercury complex into a smaller footprint of modern, energy efficient facilities to meet the enduring mission need. Mercury serves as the "base camp" for the NNSS, housing the Operations Command Center, a fuel station, office buildings, a fire station, dormitories, a cafeteria, and other facilities. The modernization effort is aimed at supporting current and future missions at the NNSS, consolidating facilities into a smaller footprint, reducing energy costs, and providing a modern, sustainable infrastructure. Integration of sustainability design elements will be included through planning outreach and partnering with the NNSA Program for High Performance Sustainable Buildings and NREL.	15,000	FY 2019	FY 2020	FY 2022
Building 12-37 Secondary Electrical Feed Installation	PX	This project will eliminate potential single points of failure that could affect data processing operations at Pantex Plant and Y-12 by providing a fully redundant electrical supply to the data center at Pantex. A second electrical feed will be installed between the main electrical distribution system circuit and the building for this purpose. The scope of work includes replacement of the transformer supplying power to the building, installation of a backup generator and uninterruptible power supply, installation of automatic transfer switches and panel boards, and reconfiguration of the circuitry. An additional Heating, Ventilation, and Air Conditioning (HVAC) unit will be installed to provide redundancy in the building cooling system. All work will be performed while the facility continues to operate in a high security area.	16,300	FY 2019	FY 2020	FY 2022
TA-16-0303 Crystal Lab Refurbishment Portfolio	LANL	The current high explosive (HE) crystal growth lab resides at TA-40-12 and at another remote location in TA-9 due to space constraints and HE facility load limits. These facilities do not meet HE mission environmental control requirements and don't operate reliably, experiencing sudden facility failure of building systems. This project will consolidate HE crystal growth operations into Building 16-303 through refurbishments that include installation of a prefabricated modular laboratory w/ fume hoods and associated new light lab support systems (e.g., HVAC, electrical infrastructure) to meet NFPA-70 and HE safety compliance. The project will also convert the facility into a Vault Type Room (VTR) with associated security related infrastructure systems. TA-16-303, a mission critical building that is slated for long-term use, was constructed in the 1950s before fire suppression was a code requirement. With the increase in the minor construction threshold, the $2.3 million scope associated with building 16-303 fire protection is being added to the existing Crystal Lab Refurbishment to enable integrated design and construction of the project which increases the initial $9.9 million TPC to $12.2 million.	12,200	FY 2018	FY 2019	FY 2021

Construction Projects Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2017 Current	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
19-D-670, 138K Power Transmission System Replacement, NNSS							
TEC	65,000	0	0	0	0	6,000	+6,000
OPC	10,000	0	500	500	900	500	0
TPC, 19-D-670, 138K Power Transmission System Replacement, NNSS	**75,000**	**0**	**500**	**500**	**900**	**6,500**	**+6,000**
19-D-660, Lithium Production Capability, Y-12							
TEC	650,000	0	0	0	0	19,000	+19,000
OPC[a]	70,000	1,654	1,600	1,600	3,865	3,250	+1,650
TPC, 19-D-660, Lithium Production Capability, Y-12	**720,000**	**1,654**	**1,600**	**1,600**	**3,865**	**22,250**	**+20,650**
18-D-660, Fire Station, Y-12							
TEC	28,000	0	0	0	28,000	0	0
OPC	5,830	1,618	2,000	2,000	1,000	400	-1,600
TPC, 18-D-660, Fire Station, Y-12	**33,830**	**1,618**	**2,000**	**2,000**	**29,000**	**400**	**-1,600**
18-D-650, Tritium Production Capability, SRS							
TEC	501,042	0	0	0	6,800	27,000	+27,000
OPC	74,000	4,100	3,000	3,000	3,000	3,000	0
TPC, 18-D-650, Tritium Production Capability, SRS	**575,042**	**4,100**	**3,000**	**3,000**	**9,800**	**30,000**	**+27,000**
17-D-640, U1a Complex Enhancements Project, NNSS							
TEC	151,500	0	11,500	11,500	22,100	53,000	+41,500
OPC[b]	7,109	3,609	1,700	1,700	1,000	800	-900
TPC, 17-D-640, U1a Complex Enhancements Project, NNSS	**158,609**	**3,609**	**13,200**	**13,200**	**23,100**	**53,800**	**+40,600**

[a] Lithium Production Capability Project OPCs are funded under Lithium Sustainment within the DSW Program.
[b] U1a Complex Enhancements Project OPCs are funded under Enhanced Capabilities for Subcritical Experiments within the Science Program.

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2017 Current	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
17-D-630, Expand Electrical Distribution System, LLNL							
TEC	31,000	0	25,000	25,000	6,000	0	-25,000
OPC	2,800	1,400	200	200	400	200	0
TPC, 17-D-630, Expand Electrical Distribution System, LLNL	**33,800**	**1,400**	**25,200**	**25,200**	**6,400**	**200**	**-25,000**
17-D-125, RLUOB Reconfiguration Project, LANL							
TEC	0	0	0	0	0	0	0
OPC	1,000	0	1,000	1,000	0	0	-1,000
TPC, 17-D-125, RLUOB Reconfiguration Project, LANL	**1,000**	**0**	**1,000**	**1,000**	**0**	**0**	**-1,000**
17-D-126, PF-4 Reconfiguration Project, LANL							
TEC	8,000	0	8,000	8,000	0	0	-8,000
OPC	0	0	0	0	0	0	0
TPC, 17-D-126, PF-4 Reconfiguration Project, LANL	**8,000**	**0**	**8,000**	**8,000**	**0**	**0**	**-8,000**
16-D-515, Albuquerque Complex Project							
TEC	169,000	8,000	15,047	15,047	98,000	47,953	+32,906
OPC[a]	33,000	2,706	0	0	550	600	+600
TPC, 16-D-515, Albuquerque Complex Project	**202,000**	**10,706**	**15,047**	**15,047**	**98,550**	**48,553**	**+33,506**
15-D-613, Emergency Operations Center, Y-12							
TEC	28,919	19,919	2,000	2,000	7,000	0	-2,000
OPC	5,482	2,750	500	500	750	1,000	+500
TPC, 15-D-613, Emergency Operations Center, Y-12	**34,401**	**22,669**	**2,500**	**2,500**	**7,750**	**1,000**	**-1,500**

[a] In FY 2015, $190,000 in OPCs for the Albuquerque Complex Project were funded within the NNSA Federal Salaries and Expenses appropriation.

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2017 Current	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
15-D-612, Emergency Operations Center, LLNL							
TEC	32,000	0	0	0	0	0	0
OPC	3,592	892	600	600	600	0	-600
TPC, 15-D-612, Emergency Operations Center, LLNL	**35,592**	**892**	**600**	**600**	**600**	**0**	**-600**
15-D-611, Emergency Operations Center, SNL							
TEC	40,000	0	0	0	0	0	0
OPC	2,100	700	200	200	200	500	+300
TPC, 15-D-611, Emergency Operations Center, SNL	**42,100**	**700**	**200**	**200**	**200**	**500**	**+300**
15-D-302, TA-55 Reinvestment Project Phase III, LANL							
TEC	146,257	34,257	2,000	2,000	0	0	-2,000
OPC	31,500	10,500	3,000	3,000	2,000	2,000	-1,000
TPC, 15-D-302, TA-55 Reinvestment Project Phase III, LANL	**177,757**	**44,757**	**5,000**	**5,000**	**2,000**	**2,000**	**-3,000**
15-D-301, HE Science & Engineering Facility, PX							
TEC	134,772	11,772	0	0	0	0	0
OPC	21,290	2,640	0	0	6,000	8,650	+8,650
TPC, 15-D-301, HE Science & Engineering Facility, PX	**156,062**	**14,412**	**0**	**0**	**6,000**	**8,650**	**+8,650**
11-D-801, TA-55 Reinvestment Project, Phase II, LANL							
TEC[a]	103,693	97,464	0	6,229	0	0	0
OPC	14,462	13,437	1,025	1,025	0	0	-1,025
TPC, 11-D-801, TA-55 Reinvestment Project, Phase II, LANL	**118,155**	**110,901**	**1,025**	**7,254**	**0**	**0**	**-1,025**

[a] In FY 2017, $6,228,800 of prior year funding was reprogrammed into TA-55 Reinvestment Project, Phase II at LANL.

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2017 Current	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
07-D-220, Radioactive Liquid Waste Treatment Facility Upgrade, LANL							
TEC[a]	106,306	101,537	0	2,669	2,100	0	0
OPC	19,945	16,686	259	259	2,700	300	+41
TPC, 07-D-220, Radioactive Liquid Waste Treatment Facility Upgrade, LANL	**126,251**	**118,223**	**259**	**2,928**	**4,800**	**300**	**+41**
07-D-220-04, Transuranic Liquid Waste Facility, LANL							
TEC[b]	92,849	57,901	17,053	17,053	17,895	0	-17,053
OPC	12,940	2,718	1,500	1,500	1,500	2,000	+500
TPC, 07-D-220-04, Transuranic Liquid Waste Facility, LANL	**105,789**	**60,619**	**18,553**	**18,553**	**19,395**	**2,000**	**-16,553**
06-D-141, Uranium Processing Facility, Y-12							
TEC	6,319,533	1,884,283	574,500	574,500	662,500	702,417	+127,917
OPC	180,467	95,128	500	500	500	583	+83
TPC, 06-D-141, Uranium Processing Facility, Y-12	**6,500,000**	**1,979,411**	**575,000**	**575,000**	**663,000**	**703,000**	**+128,000**
04-D-125, Chemistry and Metallurgy Research Replacement, LANL							
TEC	2,264,642	1,023,677	126,597	126,597	142,908	160,095	+33,498
OPC	603,588	115,343	24,018	24,018	37,992	75,000	+50,982
TPC, 04-D-125, Chemistry and Metallurgy Research Replacement, LANL	**2,868,230**	**1,139,020**	**150,615**	**150,615**	**180,900**	**235,095**	**+84,480**
Total All Construction Projects							
TEC	10,872,513	3,238,810	781,697	790,595	993,303	1,015,465	233,768
OPC	1,099,105	275,881	41,602	41,602	62,957	98,783	57,181
TPC All Construction Projects	**11,971,618**	**3,514,691**	**823,299**	**832,197**	**1,056,260**	**1,114,248**	**+290,949**

[a] In FY 2017, $2,669,265.19 of prior year funding was reprogrammed into Radioactive Liquid Waste Treatment Facility to support the Low Level Liquid Waste Facility subproject.

[b] In FY 2017, prior year funding of $1,153,300 was reprogrammed from Transuranic Liquid Waste Facility project into Radioactive Liquid Waste Treatment Facility to support the Low Level Liquid Waste Facility subproject.

Outyears to Completion for Infrastructure and Operations Construction

	(Dollars in Thousands)				
	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request	Outyears to Completion
22-D-xxx, DUE Capability					
Total Estimated Cost (TEC)	0	0	12,700	27,400	TBD
Other Project Cost (OPC)	0	0	0	0	TBD
TPC, 22-D-xxx, DUE Capability	**0**	**0**	**12,700**	**27,400**	**TBD**
21-D-xxx, Utility Distribution System, LLNL					
TEC	0	20,000	0	0	TBD
OPC	0	0	0	0	TBD
TPC, 21-D-xxx, Utility Distribution System, LLNL	**0**	**20,000**	**0**	**0**	**TBD**
21-D-xxx, Electrical Transmission & Distribution Capacity Upgrade, LANL					
TEC	0	15,000	0	25,000	TBD
OPC	700	500	0	0	TBD
	700	**15,500**	**0**	**25,000**	**TBD**
21-D-xxx, Electrical Transmission & Distribution Capacity Upgrade, LANL					
19-D-670, 138K Power Transmission System Replacement, NNSS					
TEC	54,000	0	0	0	0
OPC	500	500	7,100	0	0
TPC, 19-D-670, 138K Power Transmission System Replacement, NNSS	**54,500**	**500**	**7,100**	**0**	**0**
19-D-660, Lithium Production Capability, Y-12					
TEC	32,000	26,200	125,900	201,600	245,300
OPC	1,000	1,000	1,000	1,000	55,631
TPC, 19-D-660, Lithium Production Capability, Y-12	**33,000**	**27,200**	**126,900**	**202,600**	**300,931**

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request	Outyears to Completion
18-D-680, Material Staging Facility, PX					
TEC	3,000	25,000	51,000	351,000	TBD
OPC	0	0	0	0	TBD
TPC, 18-D-680, Material Staging Facility, PX	**3,000**	**25,000**	**51,000**	**351,000**	**TBD**
18-D-660, Fire Station, Y-12					
TEC	0	0	0	0	0
OPC	812	0	0	0	0
TPC, 18-D-660, Fire Station, Y-12	**812**	**0**	**0**	**0**	**0**
18-D-650, Tritium Production Capability, SRS					
TEC	27,000	13,000	30,000	45,000	352,242
OPC	3,000	3,000	3,000	3,000	48,900
TPC, 18-D-650, Tritium Production Capability, SRS	**30,000**	**16,000**	**33,000**	**48,000**	**401,142**
17-D-640, U1a Complex Enhancements Project, NNSS					
TEC	35,000	29,900	0	0	0
OPC	0	0	0	0	0
TPC, 17-D-640, U1a Complex Enhancements Project, NNSS	**35,000**	**29,900**	**0**	**0**	**0**
17-D-630, Expand Electrical Distribution System, LLNL					
TEC	0	0	0	0	0
OPC	200	400	0	0	0
TPC, 17-D-630, Expand Electrical Distribution System, LLNL	**200**	**400**	**0**	**0**	**0**
16-D-515, Albuquerque Complex Project, ABQ					
TEC	0	0	0	0	0
OPC	3,100	3,300	22,744	0	0
TPC, 16-D-515, Albuquerque Complex Project, ABQ	**3,100**	**3,300**	**22,744**	**0**	**0**

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request	Outyears to Completion
15-D-613, Emergency Operations Center, Y-12					
TEC	0	0	0	0	0
OPC	482	0	0	0	0
TPC, 15-D-613, Emergency Operations Center, Y-12	**482**	**0**	**0**	**0**	**0**
15-D-612, Emergency Operations Center, LLNL					
TEC	5,000	27,000	0	0	0
OPC	500	1,000	0	0	0
TPC, 15-D-612, Emergency Operations Center, LLNL	**5,500**	**28,000**	**0**	**0**	**0**
15-D-611, Emergency Operations Center, SNL					
TEC	3,000	0	37,000	0	0
OPC	500	0	0	0	0
TPC, 15-D-611, Emergency Operations Center, SNL	**3,500**	**0**	**37,000**	**0**	**0**
15-D-302, TA-55 Reinvestment Project Phase III, LANL					
TEC	30,000	50,000	30,000	0	0
OPC	3,000	3,000	3,000	5,000	0
TPC, 15-D-302, TA-55 Reinvestment Project Phase III, LANL	**33,000**	**53,000**	**33,000**	**5,000**	**0**
15-D-301, HE Science & Engineering Facility, PX					
TEC	30,000	40,000	23,000	30,000	0
OPC	1,000	1,000	1,000	1,000	0
TPC, 15-D-301, HE Science & Engineering Facility, PX	**31,000**	**41,000**	**24,000**	**31,000**	**0**
07-D-220-04, Transuranic Liquid Waste Facility, LANL					
TEC	0	0	0	0	0
OPC	1,710	1,000	2,000	512	0
TPC, 07-D-220-04, Transuranic Liquid Waste Facility, LANL	**1,710**	**1,000**	**2,000**	**512**	**0**

	(Dollars in Thousands)				
	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request	Outyears to Completion
06-D-141, Uranium Processing Facility, Y-12					
TEC	744,500	748,500	616,000	253,876	132,957
OPC	500	1,500	4,000	46,124	31,632
TPC, 06-D-141, Uranium Processing Facility, Y-12	**745,000**	**750,000**	**620,000**	**300,000**	**164,589**
04-D-125, Chemistry and Metallurgy Research Replacement, LANL					
TEC	186,000	218,340	212,011	190,401	4,613
OPC	53,600	55,666	72,989	93,599	75,381
TPC, 04-D-125, Chemistry and Metallurgy Research Replacement, LANL	**239,600**	**274,006**	**285,000**	**284,000**	**79,994**
Total All Construction Projects					
TEC	1,149,500	1,212,940	1,137,611	1,124,277	735,112
OPC	70,604	71,866	116,833	150,235	211,544
TPC All Construction Projects	**1,220,104**	**1,284,806**	**1,254,444**	**1,274,512**	**946,656**

19-D-670, 138kV Power Transmission System Replacement
Nevada National Security Site (NNSS), Nevada
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary: The FY 2019 Request for the 19-D-670, 138kV Power Transmission System Replacement project is $6,000K. The current Total Project Cost (TPC) range is $30,000K to $75,000K. The project is currently funded less than the high-end range of the Critical Decision-0 (CD-0) estimate based on the initial review of the conceptual design. Outyear funding amounts may be revised in future budget requests as NNSA baselines the project in accordance with DOE Order 413.3B.

Significant Changes:
This project is a new start in FY 2019.

The most recent DOE Order 413.3B approved critical decision (CD) is CD-0, Approve Mission Need, approved on January 18, 2017, with a preliminary cost range of $30,000K to $75,000K and a projected CD-4 of 2Q FY 2022.

A Federal Project Director will be appointed for this project prior to CD-1 approval. An individual has been identified to lead the project and has approved this CPDS.

The project will design and construct a 138 kV Power Transmission System (PTS) in the NNSS Mission Corridor, Mercury, Nevada. The PTS will replace and upgrade approximately 23 miles of the degraded existing PTS and upgrade the co-located fiber optic lines to meet the mission requirements for reliable power and communications distribution in the NNSS Mission Corridor. The proposed PTS project will be executed to allow continued operations of current mission critical facilities, accepting the risk of operating in a very confined security/hazards zone.

Critical Milestone History[a]

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	Final Design Complete	CD-2/3	D&D Complete	CD-4
FY 2019	1/18/2017	12/21/2017	4Q FY2018	4Q FY2019	1Q FY2020	4Q FY2022	4Q FY2022

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete(d)
CD-3 – Approve Start of Construction
D&D Complete – Completion of D&D work
CD-4 – Approve Start of Operations or Project Closeout

[a]The schedules are only estimates and consistent with the high end of the schedule ranges.

Project Cost History[a][b]

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2019	6,000	59,000	65,000	4,000	6,000	10,000	75,000

2. Project Scope and Justification

Scope

The project scope is to design and build a new PTS for the Mission Corridor at the NNSS. This segment of the system traverses approximately 23 miles between the Mercury Switching Center and the Tweezer Substation. The project scope includes replacement of the existing power transmission line, installation of a new higher-capacity fiber optic cable, new taller support poles, and the demolition of the existing power line and poles. The final scope, schedule, and estimate will be established at the time the project CD-2/3 is approved.

Justification

Replacement of the 138kV Power Transmission System will provide the NNSS with highly reliable power and communications to the mission critical facilities. The existing system was originally constructed in 1963 (54 years of age) and is well beyond its useful design life. The reliability of the system will continue to be a risk to mission as system components continue to deteriorate, resulting in unscheduled outages that will impact the mission of Stockpile Stewardship operations. The system carries the site's fiber optic backbone, which enables vital communications and data transmission across the NNSS. Therefore, replacement of the system will provide the NNSS with highly reliable power and communications, enabling continued success at executing the site's vital national security mission.

This project provides the following benefits:

- Mitigates the risk of losing mission critical data from Stockpile Stewardship experiments; this data represents significant federal investment of dollars, man-hours, and special nuclear material
- Improves the reliability and capability of security, safety, and emergency management/response systems
- Provides uninterrupted communications and data transmission in support of normal site operations

An Independent Analysis of Alternatives was conducted after CD-0 in accordance with the requirements of Office of Management and Budget (OMB) Circular A-11. Multiple alternatives were analyzed; the highest ranked alternative was to construct a new 138 kV Power Transmission System.

The project is being conducted in accordance with the project management requirements in DOE O 413.3B, Program and Project Management for the Acquisition of Capital Assets.

Funds appropriated under this data sheet may be used for contracted support services to the Federal Project Director and to conduct reviews of design and construction.

[a] No construction will be performed until the project performance baseline has been validated and CD-3 has been approved.
[b] The FY 2019 numbers are only estimates and consistent with the high end values of the cost ranges.

Key Performance Parameters (KPPs)
The Threshold KPPs represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion. The Objective KPPs represent the desired project performance.

In accordance with DOE Order 413.3B, KPPs will be finalized at approval of CD-2, *Approve Performance Baseline*.

Performance Measure	Threshold	Objective
Component Service Life	New components shall have the following minimum service life: Conductors - 35 years, Insulators - 50 years, Poles - 60 years	N/A
Prevent Single Failure	The new Power Transmission System will maintain the current loop configuration that incorporates three interconnection points from the off-site utility grid. The NNSS Power Transmission System will be sectionalized such that no single failure of the system will result in a loss of load	N/A
Natural Phenomenon	In accordance ASCE/SEI 7-10, the design will meet the following design categories for essential structures: Seismic Design Category 2; Extreme Wind Design Category 2; Flood Design Category 2; Extreme Precipitation (includes ice) Design Category 2	N/A
Electrical	The Power Transmission System configuration will support: Voltage - 138 kV, Power - Specific parameters shall be optimized during conceptual design to establish load capacity	N/A
Fiber Optic Cabling - communications requirements	The fiber optic system co-located with the Power Transmission System conductor shall provide single mode 144 strand fiber optic cable compatible with all 1510 nm wave length equipment to meet current and projected NNSS communications requirements and provide capacity for emerging communication requirements	N/A

3. Project Cost and Schedule

Financial Schedule[a]

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2019	6,000	6,000	5,000
FY 2020	0	0	1,000
Total Design	6,000	6,000	6,000
Construction			
FY 2020	54,000	54,000	26,000

[a] The project has not yet been approved for CD-2, and therefore has not been baselined. Outyear funding amounts may be revised in future budget requests as NNSA baselines the project in accordance with DOE Order 413.3B.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2021	0	0	26,000
FY 2022	0	0	2,000
Total Construction	54,000	54,000	54,000
Total Estimated Costs (TEC)			
FY 2019	6,000	6,000	5,000
FY 2020	54,000	54,000	27,000
FY 2021	0	0	26,000
FY 2022	0	0	2,000
Total TEC	60,000	60,000	60,000
Other Project Costs			
FY 2017	500	175	175
FY 2018	900	1,225	1,225
FY 2019	500	500	500
FY 2020	500	500	500
FY 2021	500	500	500
FY 2022	1,100	1,100	1,100
Total OPC, except D&D	4,000	4,000	4,000
OPC D&D			
FY 2022	6,000	6,000	6,000
Total, OPC	10,000	10,000	10,000
Total Project Costs (TPC)			
FY 2017	500	175	175
FY 2018	900	1,225	1,225
FY 2019	6,500	6,500	5,500
FY 2020	54,500	54,500	27,500
FY 2021	500	500	26,500
FY 2022	7,100	7,100	9,100
Grand Total	70,000	70,000	70,000

Details of Project Cost Estimate

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	4,800	N/A	N/A
Contingency	1,200	N/A	N/A
Total, Design	6,000	N/A	N/A
Construction			
Site Work	0	N/A	N/A
Equipment	0	N/A	N/A
Construction	48,425	N/A	N/A
Federal Support	1,000	N/A	N/A
Contingency	9,575	N/A	N/A
Total, Construction	59,000	N/A	N/A
Total Estimated Cost	65,000	N/A	N/A
Contingency, TEC	10,775	N/A	N/A
Other Project Cost (OPC)			
OPC except D&D			
Analysis of Alternatives	175	N/A	N/A
Conceptual Design	265	N/A	N/A
Start-up	1,100	N/A	N/A
Contingency	2,460	N/A	N/A
Total, OPC except D&D	4,000	N/A	N/A
Demolition	4,800	N/A	N/A
Contingency	1,200	N/A	N/A
Total, OPC D&D	6,000	N/A	N/A
Total OPC	10,000	N/A	N/A
Contingency, OPC	3,660	N/A	N/A
Total Project Cost	75,000	N/A	N/A
Total Contingency (TEC+OPC)	14,435	N/A	N/A

Schedule of Appropriations Requests[a]

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	Total
FY 2019	TEC	0	0	6,000	54,000	0	0	60,000
	OPC	500	900	500	500	500	7,100	10,000
	TPC	500	900	6,500	54,500	500	7,100	70,000

4. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	1QFY 2023
Expected Useful Life	50
Expected Future Start of D&D of this capital asset	TBD

Related Funding Requirements

(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	N/A	4,479	N/A	180,900

5. D&D Information

Portions of the existing 23 mile PTS section will be demolished after the replacement power line is energized and accepted. Some poles will remain in place for environmental reasons as indigenous animals have nested on these structures.

6. Acquisition Approach

The design of the PTS will be led by the M&O contractor utilizing a subcontracted Specialty Architectural and Engineering Firm to be determined. The Specialty System Design will be contracted to a specialty design engineering firm using a firm fixed price contract.

Construction execution is to be executed by an M&O led subcontractor Specialty System construction installation using a firm fixed price contract.

[a] The project has not yet been approved for CD-2, and therefore has not been baselined. Outyear funding amounts may be revised in future budget requests as NNSA baselines the project in accordance with DOE Order 413.3B.

19-D-660, Lithium Production Capability
Y-12 National Security Complex, Oak Ridge, Tennessee
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary: The FY 2019 Request for the Lithium Production Capability project is $19,000K. The current Total Estimated Cost (TEC) range is $230,000K to $650,000K.

Significant Changes:
This project is a new start in FY 2019.

- The most recent CD is CD-0, Approve Mission Need.
- The project completed the conceptual design in 2Q FY 2018. The project continues developing all other documents needed for CD-1 approval to complete the definition phase as defined by DOE Order 413.3B, Change 4.
- A Federal Project Director will be assigned prior to CD-1 approval.

The FY 2019 funding will be used to acquire design services.

Critical Milestone History

Fiscal Quarter or Date[a]

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2019	06/10/2015	01/19/2018	2Q FY 2019	1Q FY 2021	2Q FY 2022	1Q FY 2021	N/A	2Q FY 2027

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – The conceptual design was completed
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete/d
CD-3 – Approve Start of Construction
D&D Complete –Completion of D&D work (see Section 9)
CD-4 – Approve Start of Operations or Project Complete
CD-3A – Long Lead for equipment. N/A

[a] The schedules are only estimates until the project baseline is approved.

Project Cost History[a]

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC Except D&D	OPC, D&D	OPC, Total	TPC
FY 2019	120,000	530,000	650,000	70,000	0	70,000	720,000

No construction, excluding long-lead procurement, if deemed necessary, will be performed until the project baseline (CD-2) and CD-3 are approved.

2. Project Scope and Justification

Scope

The Project will construct a new facility to relocate lithium operations and processes currently in Y-12's Building 9204-2 into a safe, reliable, modern building. The new Lithium Production Capability (LPC) will be 90,000 to 110,000 square feet in size. It will be designed with space for lithium process equipment, shipping and receiving areas, a storage area, and technical and administrative support areas. The LPC will be supported by new electrical substations and three underground containment tanks as necessary.

Justification

Lithium is an essential element for the refurbishment and modernization of the nuclear weapons stockpile. To support Directed Stockpile Work (DSW) missions, Y-12 maintains capabilities and facilities for the production of lithium components. In addition to supporting DSW, lithium capabilities support international agreements, the Defense Nuclear Nonproliferation Nuclear Smuggling Detection and Deterrence Office, the Department of Homeland Security Domestic Nuclear Detection Office, and the Department of Energy (DOE) Office of Science Isotope Business Office.

Production work for lithium and related nonnuclear special materials vital to canned subassemblies is performed in Building 9204-2, which was built in 1943. The facility is oversized for today's mission, is costly to operate, has many operating issues, and has exceeded its expected life. Conditions in Building 9204-2 continue to degrade caused in part by a significant amount of deferred maintenance. In addition, the Senate Armed Service Committee in the National Defense Authorization Act of Fiscal Year 2015, acknowledged that: "Portions of the concrete ceiling above equipment that supplies components to the stockpile are spalling as the rebar inside the 60-plus-year-old concrete has corroded due to a desiccant used in the air handling system. Such working conditions are unacceptable if not dangerous." In order to ensure continuity of lithium capabilities, reduce annual operating costs, and increase process efficiencies using safer, more modern, agile, and responsive processes, a new facility must be built.

The project funding profile may be revised in future budget requests prior to CD-2 to account for improved definition of the design, schedule, and risks.

The project is being conducted in accordance with the project management requirements in DOE O 413.3B, Program and Project Management for the Acquisition of Capital Assets.

Funds appropriated under this data sheet may be used to provide independent assessments of the planning and execution of this project and for contracted support services to the federal project team for oversight and support. Funding specifically appropriated for this project will be used only for Total Estimated Cost (TEC) work.

[a] The costs are estimates only until approval of the project baseline.

Key Performance Parameters (KPPs)
The Threshold KPPs, represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion. The Objective KPPs represent the desired project performance.

Performance Measure[a]	Threshold	Objective
N/A	N/A	N/A

3. Project Cost and Schedule

Financial Schedule

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2019	19,000	19,000	10,000
FY 2020	32,000	32,000	41,000
FY 2021	26,200	26,200	26,000
FY 2022	42,800	42,800	43,000
Total Design	120,000	120,000	120,000
Construction			
FY 2021	0	0	0
FY 2022	83,100	83,100	76,000
FY 2023	201,600	201,600	201,600
FY 2024	200,000	200,000	150,000
FY 2025	45,300	45,300	80,000
FY 2026	0	0	22,400
Total Construction	530,000	530,000	530,000
Total Estimated Costs (TEC)			
FY 2019	19,000	19,000	10,000
FY 2020	32,000	32,000	41,000
FY 2021	26,200	26,200	26,000
FY 2022	125,900	125,900	119,000
FY 2023	201,600	201,600	201,600
FY 2024	200,000	200,000	150,000
FY 2025	45,300	45,300	80,000
FY 2026	0	0	22,400
Total TEC	**650,000**	**650,000**	**650,000**

[a] Key performance Parameters will be approved upon approval of the project baseline.

	Budget Authority (Appropriations)	Obligations	Costs
Other Project Costs			
FY 2016	1,654	1,654	1,654
FY 2017	1,600	1,600	1,600
FY 2018	3,865	3,865	3,865
FY 2019	3,250	3,250	3,250
FY 2020	1,000	1,000	1,000
FY 2021	1,000	1,000	1,000
FY 2022	1,000	1,000	1,000
FY 2023	1,000	1,000	1,000
FY 2024	11,936	11,936	11,936
FY 2025	13,663	13,663	13,663
FY 2026	17,032	17,032	17,032
FY 2027	13,000	13,000	13,000
Total OPC	70,000	70,000	70,000
Total Project Costs (TPC)			
FY 2016	1,654	1,654	1,654
FY 2017	1,600	1,600	1,600
FY 2018	3,865	3,865	3,865
FY 2019	22,250	22,250	13,250
FY 2020	33,000	33,000	42,000
FY 2021	27,200	27,200	27,000
FY 2022	126,900	126,900	120,000
FY 2023	202,600	202,600	202,600
FY 2024	211,936	211,936	161,936
FY 2025	58,963	58,963	93,663
FY 2026	17,032	17,032	39,432
FY 2027	13,000	13,000	13,000
Grand Total	**720,000**	**720,000**	**720,000**

Details of Project Cost Estimate

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	97,085	0	0
Federal Support	5,000	0	0
Other Costs	11,203	0	0
Contingency	6,712	0	0
Total, Design	120,000	0	0
Construction			
Site Work	10,300	0	0
Equipment	200,000	0	0
Construction	270,560	0	0
Federal Support	10,000	0	0
Project Management	20,000	0	0
Contingency	19,140	0	0
Total, Construction	530,000	0	0
Other TEC (if any)			
Cold Startup	0	0	0
Contingency	0	0	0
Total, Other TEC	0	0	0
Total Estimated Cost	650,000	0	0
Contingency, TEC	25,852	0	0
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Planning	7,774	0	0
Conceptual Design	4,119	0	0
Federal Support	5,000	0	0
Other OPC Costs (Startup, ES&H, etc)	42,500	0	0
Contingency	10,607	0	0
Total, OPC	**70,000**	0	0
Contingency, OPC	10,607	0	0
Total Project Cost	720,000	0	0
Total Contingency (TEC+OPC)	36,459	0	0

Schedule of Appropriations Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	Future Year	Total
FY 2019	TEC	0	0	19,000	32,000	26,200	125,900	201,600	245,300	650,000
	OPC	3,254	3,865	3,250	1,000	1,000	1,000	1,000	55,631	70,000
	TPC	3,254	3,865	22,250	33,000	27,200	126,900	202,600	300,931	720,000

4. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	FY 2031
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	FY 2080

Related Funding requirements

(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	0	37	0	1,855

5. Required D&D Information

The new area being constructed in this project is replacing existing facilities; however, the costs of D&D of the facilities that are being replaced are not included in the costs of this construction project. Building 9204-2 houses operations in addition to lithium production, and the plan for the continued operation and follow-on capability for those operations is yet to be decided. Once all capabilities have been moved out of Building 9204-2, the facility will be demolished.

	Square Feet
New area being constructed by this project at Y-12	106,000
Area of D&D in this project at Y-12	0
Area at Y-12 to be transferred, sold, and/or D&D outside the project, including area previously "banked"	0
Area of D&D in this project at other sites	0
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	0
Total area eliminated	0

6. Acquisition Approach

The design and construction management contract could be awarded by the site Management and Operating contractor or directly by a Federal entity upon approval of the Acquisition Strategy by the Deputy Administrator for Defense Programs. Design and construction may be acquired through a design-build firm-fixed price contract. As allowed by Order 413.3B, Change 4, the project scope may be phased into smaller usable projects with phased CD-2/3 approvals after approval of CD-1.

18-D-650, Tritium Production Capability
Savannah River Site, Aiken, South Carolina
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary: The FY 2019 Request for the Tritium Production Capability Project is $27,000K. The current Total Estimated Cost (TEC) range is $239,503K to $501,042K.

Significant Changes:
Initial funding for this project was requested in FY 2018.

- The most recent CD is CD-0, Approve Mission Need.
- In FY 2017, the project developed all documents required for CD-1 approval, and went through an Independent Project Review (IPR) and Independent Cost Review (ICR) required by the Department of Energy Order 413.3B, Change 4. The Department of Energy (DOE) Office of Project Management Oversight and Assessment conducted the ICR and recommended to increase the high end of the cost range to $575,042K to account for the potential labor and materials cost increases in the future. CD-2/3 preliminary dates have been delayed to address comments from the IPR, ICR, and other project reviews. In addition, the CD-4 date has been extended by two years to account for potential risks identified in the ICR and the project basis of estimate.
- A Federal Project Director has been appointed.

Critical Milestone History

Fiscal Quarter or Date[a]

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2018	06/10/2015	01/28/2017	2Q FY 2018	4Q FY 2022	2Q FY 2022	4Q FY 2022	N/A	4Q FY 2027
FY 2019	06/10/2015	01/28/2017	3Q FY 2018	2Q FY 2023	2Q FY 2022	2Q FY 2023	N/A	4Q FY 2029

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete (d)
CD-3 – Approve Start of Construction
D&D Complete – Completion of D&D work
CD-4 – Approve Start of Operations or Project Complete

Fiscal Quarter or Date

Fiscal Year	Performance Baseline Validation	CD-3A
FY 2018	N/A	1Q FY 2020
FY 2019	N/A	1Q FY 2020

CD-3A – Site Preparation – demolishing existing structures, relocating fence, access roads, warehouse space, and utilities to clear and prepare the site for new construction or refurbishment of existing buildings and procuring critical equipment.

[a] The schedules are only estimates until the project baseline is approved.

Project Cost History

(Dollars in Thousands)[b]

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2018	76,000	349,000	425,000	74,000	0	74,000	499,000
FY 2019	76,000	425,042	501,042	74,000	0	74,000	575,042

With the exception of CD-3A, no construction of process facilities will be performed until the project performance baseline has been validated and CD-3 has been approved. A CD-3A request will be made for long-lead procurement, dismantlement and removal of structures, systems and components, re-establishing warehouse space and site preparation to reduce project schedule and subsequent cost.

2. Project Scope and Justification

Scope

The Tritium Production Capability Project will construct two new facilities to relocate tritium and deuterium processes currently in H-Area Old Manufacturing into safe, reliable, modern buildings. The first, hardened facility (estimated at 15,000 +/-10% square feet) will house nuclear equipment processes, and the second (estimated at 5,000 +/-10% square feet) will house non-nuclear process equipment. To make room for the new buildings, existing warehouses will be demolished and replaced. Additional scope for the project includes project design, safety basis development, and relocation of utilities, fences, and an access road.

Justification

The NNSA Stockpile Stewardship mission and the Tritium-related missions require the specific capability of providing tritium and deuterium-filled reservoirs to the Department of Defense, a capability that must be ensured well into the foreseeable future. Some of the critical capabilities required to produce the filled reservoirs are currently housed in a 60-year-old building, H Area Old Manufacturing. The infrastructure of the building has deteriorated and is well beyond expected end-of-life. Critical capabilities are now housed in areas that create a substantial risk to the enduring Tritium Mission. Infrastructure failures have increased the frequency of production, delays and led to increased, safety, security, maintenance and operating costs.

The project is being conducted in accordance with the project management requirements in DOE O 413.3B Program and Project Management for the Acquisition of Capital Assets, and all appropriate project management requirements for CD-1 will be met before authorizing use of appropriated funds. The project funding profile may be revised in future budget requests prior to CD-2 to account for improved definition of the design, schedule, and risks.

Funds appropriated under this data sheet may be used to provide independent assessments of the planning and execution of this project and for contracted support services to the federal project team for oversight and support. Funding specifically appropriated for this project will be used only for Total Estimated Cost (TEC) work.

Key Performance Parameters (KPPs)

The Threshold KPPs, represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion. The Objective KPPs represent the desired project performance.

[b] The costs are only estimates until the project performance baseline is approved

Performance Measure[c]	Threshold	Objective
N/A	N/A	N/A

3. Project Cost and Schedule

Financial Schedule

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2018	6,800	6,800	3,800
FY 2019	27,000	27,000	15,000
FY 2020	22,000	22,000	27,000
FY 2021	3,000	3,000	12,000
FY 2022	15,000	15,000	11,000
FY 2023	2,200	2,200	7,200
Total Design	76,000	76,000	76,000
Construction			
FY 2020	5,000	5,000	5,000
FY 2021	10,000	10,000	10,000
FY 2022	15,000	15,000	15,000
FY 2023	42,800	42,800	42,800
FY 2024	200,000	200,000	91,800
FY 2025	152,242	152,242	123,800
FY 2026	0	0	120,000
FY 2027	0	0	16,642
Total Construction	425,042	425,042	425,042
Total Estimated Costs (TEC)			
FY 2018	6,800	6,800	3,800
FY 2019	27,000	27,000	15,000
FY 2020	27,000	27,000	32,000
FY 2021	13,000	13,000	22,000
FY 2022	30,000	30,000	26,000
FY 2023	45,000	45,000	50,000
FY 2024	200,000	200,000	91,800

[c] Key Performance Parameters will be approved upon approval of the project baseline.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2025	152,242	152,242	123,800
FY 2026	0	0	120,000
FY 2027	0	0	16,642
FY 2028	0	0	0
FY 2029	0	0	0
Total TEC	**501,042**	**501,042**	**501,042**
Other Project Costs			
FY 2015	2,000	2,000	2,000
FY 2016	2,100	2,100	2,100
FY 2017	3,000	3,000	3,000
FY 2018	3,000	3,000	3,000
FY 2019	3,000	3,000	3,000
FY 2020	3,000	3,000	3,000
FY 2021	3,000	3,000	3,000
FY 2022	3,000	3,000	3,000
FY 2023	3,000	3,000	3,000
FY 2024	3,000	3,000	3,000
FY 2025	3,000	3,000	3,000
FY 2026	10,000	10,000	10,000
FY 2027	10,000	10,000	10,000
FY 2028	15,000	15,000	15,000
FY 2029	7,900	7,900	7,900
Total OPC	74,000	74,000	74,000
Total Project Costs (TPC)			
FY 2015	2,000	2,000	2,000
FY 2016	2,100	2,100	2,100
FY 2017	3,000	3,000	3,000
FY 2018	9,800	9,800	6,800
FY 2019	30,000	30,000	18,000
FY 2020	30,000	30,000	35,000
FY 2021	16,000	16,000	25,000
FY 2022	33,000	33,000	29,000
FY 2023	48,000	48,000	53,000
FY 2024	203,000	203,000	94,800

	Budget Authority (Appropriations)	Obligations	Costs
FY 2025	155,242	155,242	126,800
FY 2026	10,000	10,000	130,000
FY 2027	10,000	10,000	26,642
FY 2028	15,000	15,000	15,000
FY 2029	7,900	7,900	7,900
Grand Total	**575,042**	**575,042**	**575,042**

Details of Project Cost Estimate

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	50,000	50,000	0
Safety Basis	4,000	4,000	0
Federal Support	3,000	3,000	0
Project and Design Management	9,500	9,500	0
Contingency	9,500	9,500	0
Total, Design	76,000	76,000	0
Construction			
Site Work	8,500	8,500	0
Facility Demolition	2,000	2,000	0
Construction	345,000	270,000	0
Safety Basis Documents	6,000	6,000	0
Federal Support	8,000	8,000	0
M&O Support	5,000	5,000	0
Contingency	50,542	49,500	0
Total, Construction	425,042	349,000	0
Other TEC (if any)			
Cold Startup	0	0	0
Contingency	0	0	0
Total, Other TEC	0	0	0
Total Estimated Cost	501,042	425,000	0
Contingency, TEC	60,042	59,000	0
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	0
Conceptual Planning	4,900	4,900	0
Analysis of Alternative	832	832	0
Conceptual Design	3,200	3,200	0
NEPA & Permit	500	500	0
Federal Support	3,000	3,000	0
Safeguard & Security	1,000	1,000	0
ES&H	12,500	12,500	0
Contractor Support	3,000	3,000	0
Startup	36,500	36,500	0
Contingency	8,568	8,568	0

Total, OPC except D&D	74,000	74,000	0
Contingency, OPC	8,568	8,568	0
Total Project Cost	575,042	499,000	0
Total Contingency (TEC +OPC)	68,610	67,568	0

Schedule of Appropriations Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	Outyears	Total
FY 2018	TEC	0	6,800	25,505	49,500	13,000	22,000	0	308,195	425,000
	OPC	7,100	3,000	3,000	3,000	3,000	3,000	0	51,900	74,000
	TPC	7,100	9,800	28,505	52,500	16,000	25,000	0	360,095	499,000
FY 2019	TEC	0	6,800	27,000	27,000	13,000	30,000	45,000	352,242	501,042
	OPC	7,100	3,000	3,000	3,000	3,000	3,000	3,000	48,900	74,000
	TPC	7,100	9,800	30,000	30,000	16,000	33,000	48,000	401,142	575,042

4. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2029
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	1Q FY 2078

Related Funding Requirements

(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	4.9	4.9	2,478	2,478

5. D&D Information

Because the existing facility contains tritium, the facility cannot be decommissioned and demolished for another 70 years. The approximate area of warehouses to be demolished to clear the site for the new building is listed here.

D&D Description	Square Feet
1. New area being constructed by this project on the Savannah River Site	20,000 – 30,000
2. Area on the Savannah River Site to be D&D by this project	10,000
3. Area on the Savannah River Site to be transferred, sold, and/or D&D outside the project including area previously "banked"	0
4. Area on other sites to be D&D by this project	0
5. Area on other sites to be transferred, sold, and/or D&D outside the project including area previously "banked"	0
6. Total area eliminated (add boxes 2, 3, 4, and 5)	10,000

6. Acquisition Approach

The design and construction, including developing the safety basis documents, could be awarded by the site Management & Operating contractor or directly by Federal Government upon approval of the Acquisition Strategy by the Deputy Administrator for Defense Programs.

17-D-640, U1a Complex Enhancements Project (UCEP)
Nevada National Security Site (NNSS), Mercury, Nevada
Construction Project Data Sheet

1. Summary, Significant Changes, and Schedule and Cost History

<u>Summary</u>: The FY 2019 Request for the U1a Complex Enhancements Project (UCEP) is $53,000K. DOE Order 413.3B Critical Decision (CD), *CD-0 Approve Mission Need* was approved on September 25, 2014, for the "Enhanced Capabilities for Subcritical Experiments (ECSE) at the Nevada National Security Site, U1a Complex." On November 4, 2015, the U1a 100 and U1a 104 drifts within the U1a Complex at the Nevada National Security Complex were determined to be the only viable location for ECSE. UCEP has a Total Project Cost (TPC) of $158,609K, and a CD-4 *Approve Start of Operations or Project Completion* scheduled for 2QFY 2023. This estimate has not changed since the original estimate, however, it is subject to change when the project obtains CD-2 approval and as design is completed for each of the subprojects.

In 2014, the national security laboratories LANL, LLNL, SNL, and the NNSS jointly identified a significant gap in the capabilities available to meet the responsibilities of the science-based Stockpile Stewardship Program. As part of the ECSE portfolio, UCEP delivers a new underground laboratory that enables new experimental and diagnostic capabilities and an increased operational cadence of subcritical weapons experiments using plutonium. The project provides both mining operations and installation of the necessary supporting structures, systems, and components. Existing U1a Complex orthogonal U1a 100 and U1a 104 drifts will be used to minimize the need for new mining. Other major efforts under the ECSE portfolio include the advanced multi-pulse radiography machine funded as a Major Item of Equipment (MIE), denoted as Advanced Sources and Detectors (ASD), as well as a research and development of a future diagnostic called Neutron Diagnosed Subcritical Experiments (NDSE). ASD and NDSE are both funded in the ECSE subprogram.

<u>Significant Changes</u>:

This Construction Project Data Sheet (CPDS) is an update of the Fiscal Year (FY) 2018 CPDS and does not include a new start for the budget year. Following are the changes from the previous version:

1. CD-1 was approved August 9, 2017.
2. The projected CD-2/3 for the Access and Life Safety Infrastructure subproject slipped from 2Q FY 2018 to 2Q FY 2019.
3. Subproject titles changed to reflect subproject scope.
4. Mining scope and funds shifted from subproject 020 to subproject 010 to improve access for installing and assembling programmatic equipment.

17-D-640-010: ECSE Access and Life Safety Infrastructure (formally Refuge Station Drift)

Constructs the U1a ECSE Access and Life Safety Infrastructure drifts (crosscut to the 104 drift and repurposes the 102D drift into a refuge station) and installs the ventilation upgrades and temporary construction power needed for the Subproject 17-D-640-020 mining activities.

17-D-640-020: ECSE Laboratory and Support Infrastructure (formally Mining and Infrastructure)

Constructs the ECSE drifts (U1a 100, 102, 102B, 102D, 104, 106, and 107 Drifts) and installs the ventilation, mechanical, electrical, fire protection and life safety, control and diagnostics, and containment plug structures, systems, and components.

A Federal Project Director at the appropriate level has been assigned to this project and has approved the CPDS.

Critical Milestone History

17-D-640: Total Project

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2017	9/25/2014	8/13/2015	1Q FY 2017	1Q FY 2019	2Q FY 2019	3Q FY 2019	N/A	3Q FY 2022
FY 2018	9/25/2014	8/13/2015	3Q FY 2017	4Q FY 2019	2Q FY 2019	4Q FY 2019	N/A	2Q FY 2023
FY 2019	9/25/2014	8/13/2015	08/09/2017	4Q FY 2019	2Q FY 2019	4Q FY 2019	N/A	2Q FY 2023

17-D-640-010: ECSE Access and Life Safety Infrastructure

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2017	9/25/2014	8/13/2015	1Q FY 2017	3Q FY 2017	4Q FY 2017	4Q FY 2017	N/A	2Q FY 2019
FY 2018	9/25/2014	8/13/2015	3Q FY 2017	2Q FY 2018	1Q FY 2018	2Q FY 2018	N/A	3Q FY 2020
FY 2019	9/25/2014	8/13/2015	08/09/2017	2Q FY 2019	3Q FY 2018	2Q FY 2019	N/A	2Q FY 2021

17-D-640-020: ECSE Laboratory and Support Infrastructure

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2017	9/25/2014	8/13/2015	1Q FY 2017	1Q FY 2019	2Q FY 2019	3Q FY 2019	N/A	3Q FY 2022
FY 2018	9/25/2014	8/13/2015	3Q FY 2017	4Q FY 2019	2Q FY 2019	4Q FY 2019	N/A	2Q FY 2023
FY 2019	9/25/2014	8/13/2015	08/09/2017	4Q FY 2019	2Q FY 2019	4Q FY 2019	N/A	2Q FY 2023

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete (d)
CD-3 – Approve Start of Construction
D&D Complete – Completion of D&D work
CD-4 – Approve Start of Operations or Project Closeout

Separate documentation will be submitted for combined CD-2/3 for each subproject. The dates listed above do not include schedule contingency.

Project Cost History

17-D-640: Total Project

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2017	14,200	137,300	151,500	7,109	N/A	7,109	158,609
FY 2018	14,200	137,300	151,500	7,109	N/A	7,109	158,609
FY 2019	19,900	131,600	151,500	7,109	N/A	7,109	158,609

17-D-640-010: ECSE Access and Life Safety Infrastructure

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2017	2,700	23,940	26,640	981	N/A	981	27,621
FY 2018	2,700	23,940	26,640	981	N/A	981	27,621
FY 2019	8,400	38,240	46,640	981	N/A	981	47,621

17-D-640-020: ECSE Laboratory and Support Infrastructure

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2017	11,500	113,360	124,860	6,128	N/A	6,128	130,988
FY 2018	11,500	113,360	124,860	6,128	N/A	6,128	130,988
FY 2019	11,500	93,360	104,860	6,128	N/A	6,128	110,988

2. Project Scope and Justification

Scope

UCEP will perform mining and provide the supporting structures, systems and components necessary to deploy the large MIE diagnostic systems and experiments. Existing U1a Complex orthogonal U1a.100 and U1a.104 drifts will be used to minimize the need for new mining.

17-D-640-010 includes the design, fabrication, construction, installation and commissioning of the underground areas and systems in the U1a Complex to provide a refuge station, adequate ventilation, and construction power for the ensuing subproject 17-D-640-020. This subproject is required to support any significant construction activity in the eastern portion of the U1a Complex. It is a project that can be designed and completed separately from the other subproject.

17-D-640-020 includes the design, fabrication, construction, installation and commissioning of the ECSE Area and systems to provide MIE diagnostic/detector alcove drifts and mechanical equipment drifts. The project underground scope includes an experimental room with containment plugs for experiment execution, process control system, safety interlock system, diagnostic clean rooms and diagnostic infrastructure, and ancillary systems (overhead handling systems, power, cooling, ventilation, process water and oil, instrument air, spill mitigation, and shielding).

Justification

The enhancements to the U1a Complex included in this Line Item will provide the drifts and the supporting structures, systems, and components necessary for the deployment of the MIEs to diagnose the subcritical hydrodynamic integrated weapons experiments using plutonium.

NNSA plans long-term investments supporting plutonium science at the NNSS. NNSS is the only site in the United States for experiments combining high explosives and plutonium, a core capability for NNSA's Stockpile Stewardship Program.

Funds appropriated under this data sheet may be used for contracted support services to the Federal Program Manager and the Federal Project Director to conduct independent assessments of the planning and execution of this project required by DOE O 413.3B and to conduct technical reviews of design and construction documents.

The project is being conducted in accordance with the project management requirements in DOE O 413.3B, Program and Project Management for the Acquisition of Capital Assets. As allowed by DOE O 413.3B, work will be phased to improve overall efficiency.

OPCs are funded out of the Enhanced Capabilities for Subcritical Experiments subprogram within Research Development Test & Evaluation (RDT&E), Science program.

Key Performance Parameters (KPPs)

The Threshold KPPs, represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion. The Objective KPPs represent the desired project performance.

Performance Measure	Threshold	Objective
Refuge Station Occupancy	100 Person Capacity	160 Person Capacity
Electrical Power Capacity	3600 kVA	6000 kVA
ECSE Area Ventilation Flow Rate	Sufficient for 100 people + diesel equipment	Sufficient for 160 people + diesel equipment
Heat Removal Capacity	3.0e6 BTU/hr	5.0e6 BTU/hr
Containment Barrier Design Pressure	5 psig	5 psig
ECSE Area Equipment/Work Space	800 Linear Feet Mining	1200 Linear Feet Mining

3. Project Cost and Schedule

Financial Schedule

17-D-640-010: ECSE Access and Life Safety Infrastructure

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2017	2,700	2,700	500
FY 2018	5,700	5,700	7,900
Total, Design	8,400	8,400	8,400
Construction			
FY 2017	8,800	8,800	0
FY 2018	9,440	9,440	0
FY 2019	20,000	20,000	23,000
FY 2020	0	0	8,500
FY 2021	0	0	6,740
Total, Construction	38,240	38,240	38,240
Total Estimated Costs (TEC)			
FY 2017	11,500	11,500	500
FY 2018	15,140	15,140	7,900
FY 2019	20,000	20,000	23,000
FY 2020	0	0	8,500
FY 2021	0	0	6,740
Total TEC	**46,640**	**46,640**	**46,640**
Other Project Costs			
FY 2015	281	281	281
FY 2016	700	700	700
FY 2017	0	0	0
FY 2018	0	0	0
FY 2019	0	0	0
Total OPC	**981**	**981**	**981**
Total Project Costs (TPC)			

	Budget Authority (Appropriations)	Obligations	Costs
FY 2015	281	281	281
FY 2016	700	700	700
FY 2017	11,500	11,500	500
FY 2018	15,140	15,140	7,900
FY 2019	20,000	20,000	23,000
FY 2020	0	0	8,500
FY 2021	0	0	6,740
Grand Total	**47,621**	**47,621**	**47,621**

17-D-640-020: ECSE Laboratory and Support Infrastructure

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2017	0	0	0
FY 2018	6,960	6,960	6,100
FY 2019	4,540	4,540	5,400
Total, Design	11,500	11,500	11,500
Construction			
FY 2019	28,460	28,460	3,360
FY 2020	35,000	35,000	28,000
FY 2021	29,900	29,900	28,000
FY 2022	0	0	28,000
FY 2023	0	0	6,000
Total, Construction	93,360	93,360	93,360
Total Estimated Costs (TEC)			
FY 2017	0	0	0
FY 2018	6,960	6,960	6,100
FY 2019	33,000	33,000	8,760
FY 2020	35,000	35,000	28,000
FY 2021	29,900	29,900	28,000

	Budget Authority (Appropriations)	Obligations	Costs
FY 2022	0	0	28,000
FY 2023	0	0	6,000
Total TEC	**104,860**	**104,860**	**104,860**
Other Project Costs			
FY 2016	2,628	2,628	2,128
FY 2017	1,700	1,700	1,700
FY 2018	1,000	1,000	1,000
FY 2019	800	800	1,300
FY 2020	0	0	0
Total OPC	**6,128**	**6,128**	**6,128**
Total Project Costs (TPC)			
FY 2016	2,628	2,628	2,128
FY 2017	1,700	1,700	1,700
FY 2018	7,960	7,960	7,100
FY 2019	33,800	33,800	10,060
FY 2020	35,000	35,000	28,000
FY 2021	29,900	29,900	28,000
FY 2022	0	0	28,000
FY 2023	0	0	6,000
Grand Total	**110,988**	**110,988**	**110,988**

17-D-640: Total Project

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2017	2,700	2,700	500
FY 2018	12,660	12,660	14,000
FY 2019	4,540	4,540	5,400
Total, Design	19,900	19,900	19,900
Construction			

	Budget Authority (Appropriations)	Obligations	Costs
FY 2017	8,800	8,800	0
FY 2018	9,440	9,440	0
FY 2019	48,460	48,460	26,360
FY 2020	35,000	35,000	36,500
FY 2021	29,900	29,900	34,740
FY 2022	0	0	28,000
FY 2023	0	0	6,000
Total, Construction	131,600	131,600	131,600
Total Estimated Costs (TEC)			
FY 2017	11,500	11,500	500
FY 2018	22,100	22,100	14,000
FY 2019	53,000	53,000	31,760
FY 2020	35,000	35,000	36,500
FY 2021	29,900	29,900	34,740
FY 2022	0	0	28,000
FY 2023	0	0	6,000
Total TEC	**151,500**	**151,500**	**151,500**
Other Project Costs			
FY 2015	281	281	281
FY 2016	3,328	3,328	2,828
FY 2017	1,700	1,700	1,700
FY 2018	1,000	1,000	1,000
FY 2019	800	800	1,300
FY 2020	0	0	0
Total OPC	**7,109**	**7,109**	**7,109**
Total Project Costs (TPC)			
FY 2015	281	281	281
FY 2016	3,328	3,328	2,828
FY 2017	13,200	13,200	2,200
FY 2018	23,100	23,100	15,000
FY 2019	53,800	53,800	33,060
FY 2020	35,000	35,000	36,500
FY 2021	29,900	29,900	34,740

	Budget Authority (Appropriations)	Obligations	Costs
FY 2022	0	0	28,000
FY 2023	0	0	6,000
Grand Total	**158,609**	**158,609**	**158,609**

Details of Project Cost Estimate

17-D-640-010: ECSE Access and Life Safety Infrastructure

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	5,600	1,800	0
Project Management	1,600	500	0
Contingency	1,200	400	0
Total, Design	8,400	2,700	0
Construction			
Site Work	0	0	0
Equipment	0	0	0
Construction	29,240	18,340	0
Construction Management	1,500	900	0
Contingency	7,500	4,700	0
Total, Construction	38,240	23,940	0
Other TEC (if any)			
Cold Startup	0	0	0
Contingency	0	0	0
Total, Other TEC	0	0	0
Total Estimated Cost	**46,640**	**26,640**	0
Contingency, TEC	8,700	5,100	0
Other Project Cost (OPC)			
OPC except D&D			
R&D			
Conceptual Planning	200	200	0
Conceptual Design	281	281	0
Other OPC Costs	500	400	0
Contingency	0	100	0
Total, OPC	981	981	0
Contingency, OPC	0	100	0
Total Project Cost	**47,621**	**27,621**	**0**
Total Contingency (TEC+OPC)	8,700	5,200	0

17-D-640-020: ECSE Laboratory and Support Infrastructure

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	7,800	7,800	0
Project Management	1,900	1,900	0
Contingency	1,800	1,800	0
Total, Design	11,500	11,500	0
Construction			
Site Work	0	0	0
Equipment	0	0	0
Construction	69,560	84,500	0
Construction Management	4,500	5,440	0
Contingency	19,300	23,420	0
Total, Construction	93,360	113,360	0
Other TEC (if any)			
Cold Startup	0	0	0
Contingency	0	0	0
Total, Other TEC	0	0	0
Total Estimated Cost	**104,860**	**124,860**	0
Contingency, TEC	21,100	25,220	0
Other Project Cost (OPC)			
OPC except D&D			
R&D			
Conceptual Planning	300	300	0
Conceptual Design	728	728	0
Other OPC Costs	4,800	4,800	0
Contingency	300	300	0
Total, OPC	6,128	6,128	0
Contingency, OPC	300	300	0
Total Project Cost	**110,988**	**130,998**	**0**
Total Contingency (TEC+OPC)	21,400	25,520	0

17-D-640: Total Project

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	13,400	9,600	0
Project Management	3,500	2,400	0
Contingency	3,000	2,200	0
Total, Design	19,900	14,200	0
Construction			
Site Work	0	0	0
Equipment	0	0	0
Construction	98,800	102,840	0
Construction Management	6,000	6,340	0
Contingency	26,800	28,120	0
Total, Construction	131,600	137,300	0
Other TEC (if any)			
Cold Startup	0	0	0
Contingency	0	0	0
Total, Other TEC	0	0	0
Total Estimated Cost	**151,500**	**151,500**	0
Contingency, TEC	*29,800*	*30,320*	0
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	0
Conceptual Planning	500	500	0
Conceptual Design	1,009	1,009	0
Other OPC Costs	5,300	5,200	0
Contingency	300	400	0
Total, OPC	7,109	7,109	0
Contingency, OPC	300	400	0
Total Project Cost	**158,609**	**158,609**	**0**
Total Contingency (TEC+OPC)	30,100	30,720	0

Schedule of Appropriations Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	Outyears	Total
FY 2017	TEC	11,500	22,100	63,000	35,000	19,900	0	0	0	151,500
	OPC	5,309	1,000	800	0	0	0	0	0	7,109
	TPC	16,809	23,100	63,800	35,000	19,900	0	0	0	158,609
FY 2018	TEC	11,500	22,100	63,000	35,000	19,900	0	0	0	151,500
	OPC	5,309	1,000	800	0	0	0	0	0	7,109
	TPC	16,809	23,100	63,800	35,000	19,900	0	0	0	158,609
FY 2019	TEC	11,500	22,100	53,000	35,000	29,900	0	0	0	151,500
	OPC	5,309	1,000	800	0	0	0	0	0	7,109
	TPC	16,809	23,100	53,800	35,000	29,900	0	0	0	158,609

3. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	3Q FY 2021
Expected Useful Life	30
Expected Future Start of D&D of this capital asset	3Q FY 2054

Related Funding Requirements

(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	36	36	1,075	1,075

4. D&D Information

The new area being constructed in this project is not replacing existing facilities.

5. Acquisition Approach

The project is being managed by the NNSS Management and Operating (M&O) contractor because of operations within the U1a Complex, which is an underground facility with limited access. Design and construction of the underground modifications will be performed by the NNSS M&O contractor.

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16-D-515, Albuquerque Complex Project
NNSA Albuquerque Complex, Albuquerque, New Mexico
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary: The FY 2019 Request for the 16-D-515, Albuquerque Complex Project is $47,953K. The current estimated Total Project Cost (TPC) is $202,000K.

Significant Changes:

This project was initiated in FY 2016. The Project plans to request a combined Critical Decision (CD)-2/3 in the second quarter of FY 2018 for the New Facility Subproject. Construction is scheduled to start in FY 2018. The FY 2018 CPDS is consistent with 90% design estimates. Design increased by $1,000K to account for radio-frequency shielding for an Office of Emergency Operations high-frequency automatic link establishment antenna and to incorporate information technology into the design. The project has not established a Performance Baseline and will do so after the United States Army Corps of Engineers (USACE) receives all the bids for construction. The change in Critical Decision (CD) 2 for the D&D subproject was done to better align the baselining effort closer to the start of the D&D effort.

The most recent DOE Order 413.3B approved Critical Decision (CD) is CD-1 and was approved on February 3, 2016 with an estimated CD-4 of FY 2021.

A Federal Project Director has been assigned to this project.

Critical Milestone History[a]

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2017	09/22/2011	12/18/2015	02/03/2016	2Q FY 2017	4Q FY 2017	2Q FY 2017	1Q FY 2021	2Q FY 2021
FY 2018	09/22/2011	12/18/2015	02/03/2016	1Q FY 2020	1Q FY 2018	2Q FY 2022	2Q FY 2023	3Q FY 2023
FY 2019	09/22/2011	12/18/2015	02/03/2016	3Q FY 2021	2Q FY 2018	2Q FY 2022	2Q FY 2023	3Q FY 2023

[a] The schedules are only estimates and consistent with the high end of the schedule ranges.

New Facility Subproject (16-D-515-01)

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2018	09/22/2011	12/18/2015	02/03/2016	2Q FY 2018	1Q FY 2018	2Q FY 2018	N/A	1Q FY 2022
FY 2019	09/22/2011	12/18/2015	02/03/2016	2Q FY 2018	2Q FY 2018	2Q FY 2018	N/A	1Q FY 2022

D&D Subproject (16-D-515-02)

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2018	09/22/2011	12/18/2015	02/03/2016	1Q FY 2020	N/A	2Q FY 2022	2Q FY 2023	3Q FY 2023
FY 2019	09/22/2011	12/18/2015	02/03/2016	3Q FY 2021	N/A	2Q FY 2022	2Q FY 2023	3Q FY 2023

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete(d)
CD-3 – Approve Start of Construction
D&D Complete – Completion of D&D work
CD-4 – Approve Start of Operations or Project Closeout

Project Cost History[a]

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2017	14,700	153,900	168,600	3,690	24,210	27,900	196,500
FY 2018	11,000	158,000	169,000	5,700	27,300	33,000	202,000
FY 2019	12,000	157,000	169,000	5,700	27,300	33,000	202,000

New Facility Subproject (16-D-515-01)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2018	11,000	158,000	169,000	5,700	N/A	5,700	174,700
FY 2019	12,000	157,000	169,000	5,700	N/A	5,700	174,700

D&D Subproject (16-D-515-02)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2018	N/A	N/A	N/A	N/A	27,300	27,300	27,300
FY 2019	N/A	N/A	N/A	N/A	27,300	27,300	27,300

[a] No construction will be performed until the project performance baseline has been validated and CD-3 has been approved.

2. Project Scope and Justification

Scope

This project will design and construct approximately 333,000 square feet (SF) of office space for approximately 1,200 employees. The project will include approximately 22,000 square feet of vault type rooms and/or Sensitive Compartmented Information Facility (SCIF) space. The project will include an access road to the site on leased land from Kirtland Air Force Base. The building will be constructed on DOE property in Albuquerque, New Mexico adjacent to the Kirtland Air Force Base east perimeter fence on Eubank Avenue. Upon completion of the building, the perimeter fence will be relocated to encompass the new building and parking lot. The project includes the cost for moves, decommissioning, abatement and demolition of approximately 312,000 GSF of existing buildings. Two buildings (15,499 GSF) which are leased from the Air Force will be returned. The new building will be designed to LEED Gold Standards.

The Albuquerque Complex Project consists of the following subprojects:

New Facility Subproject (16-D-515-01): The New Facility subproject covers all scope of the project, with the exception of the D&D of the current Albuquerque Complex. This includes planning, design and construction of the new building, access road and perimeter.

D&D Subproject (16-D-515-02): The D&D subproject will decommission, abate, and demolish approximately 312,000 GSF of existing buildings. Two buildings (15,499 GSF) leased from the Air Force will be prepared for return to the Air Force.

Justification

The NNSA Albuquerque Complex provides vital services to the agency. The Albuquerque Complex houses multiple organizations that fulfill unique and essential roles within the nuclear weapons enterprise by providing programmatic, technical support, legal, security, procurement, human resources, business and administrative functions that directly support the NNSA national security mission. The proximity of the Albuquerque Complex to two NNSA national laboratories and the Air Force Nuclear Weapons Center on Kirtland Air Force Base makes it an ideal location for an NNSA field installation. The Albuquerque Complex has supported the DOE/NNSA from this location for over 50 years, and there are no plans to eliminate or reduce the size or function of this office in the near future. NNSA has a long-term commitment at this installation, and it will remain the primary field support office for NNSA.

The NNSA Albuquerque Office currently occupies 327,428 GSF in 25 buildings. The main office buildings were originally constructed in 1951 as enlisted barracks. The existing complex is beyond its designed life and does not meet NNSA's needs. The four-story barracks facilities are 64-year-old, unreinforced concrete block buildings and do not meet requirements under Executive Order 12941, *Seismic Safety of Existing Federally Owned or leased Buildings*. In 2005, a building assessment stated, "The building structure has violated the Uniform Building Code for the last 15 years. The structure type is prohibited in nearly all seismic zones."[a] The Albuquerque Complex has a deferred maintenance backlog of $39 million, not including necessary seismic upgrades.

The project is being conducted in accordance with the project management requirements in DOE O 413.3B, Program and Project Management for the Acquisition of Capital Assets.

Funds appropriated under this data sheet may be used for contracted support services to the Federal Project Director and to conduct reviews of design and construction.

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[a] Infrastructure Condition Assessment Survey and Analysis, National Nuclear Security Administration Service Center and Energy Training Center, Albuquerque, NM, Lopez Engineering, Inc., November 2005.

Key Performance Parameters (KPPs)

The Threshold KPPs represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion. The Objective KPPs represent the desired project performance. Per DOE O 413.3B, final KPPs will be approved at CD-2.

Performance Measure	Threshold	Objective
Operational Capability – number of occupants, size	Administration Building that will provide modern working space for approximately 1,200 employees at the Eubank Tract. The proposed facility will be constructed as a new three story building, approximately 333,000 gross square foot administrative building (including classified and unclassified areas).	N/A
Operational Capability – power for critical functions	Backup power for critical functions within the building including the Data Center, Transportation Emergency Command Center and Emergency Operations Center which are capable of 24/7 operations during power outages.	N/A
Operational Capability - sustainability	Designed and constructed to LEED Gold standards	N/A

3. Project Cost and Schedule

Financial Schedule

New Facility Subproject (16-D-515-01)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2016	8,000	8,000	3,247
FY 2017	4,000	3,000	6,276
FY 2018	0	1,000	2,477
Total Design	12,000	12,000	12,000
Construction			
FY 2017	11,047	0	0
FY 2018	98,000	109,047	25,630
FY 2019	47,953	47,953	97,340
FY 2020	0	0	34,030
Total Construction	157,000	157,000	157,000
Total Estimated Costs (TEC)			
FY 2016	8,000	8,000	3,247
FY 2017	15,047	3,000	6,276
FY 2018	98,000	110,047	28,107

	Budget Authority (Appropriations)	Obligations	Costs
FY 2019	47,953	47,953	97,340
FY 2020	0	0	34,030
Total TEC	**169,000**	**169,000**	**169,000**
Other Project Costs			
FY 2015[a]	250	250	223
FY 2016	2,456	2,456	994
FY 2017	0	0	900
FY 2018	550	550	1,100
FY 2019	600	600	520
FY 2020	600	600	480
FY 2021	700	700	900
FY 2022	544	544	400
FY 2023	0	0	183
Total OPC	5,700	5,700	5,700
Total Project Costs (TPC)			
FY 2015[a]	250	250	223
FY 2016	10,456	10,456	4,241
FY 2017	15,047	3,000	7,176
FY 2018	98,550	110,597	29,207
FY 2019	48,553	48,553	97,860
FY 2020	600	600	34,510
FY 2021	700	700	900
FY 2022	544	544	400
FY 2023	0	0	183
Grand Total	174,700	174,700	174,700

[a] OPCs in FY 2015 were funded from the NNSA Federal Salaries and Expenses appropriation. FY 2015 costs in the FY 2017 CPDS were incorrect and have been revised.

D&D Subproject (16-D-515-02)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Total Estimated Costs (TEC)			
FY 2020	0	0	0
FY 2021	0	0	0
Total TEC	**0**	**0**	**0**
OPC except D&D	**0**	**0**	**0**
OPC D&D			
FY 2020	2,500	2,500	2,400
FY 2021	2,600	2,600	2,500
FY 2022	22,200	22,200	21,700
FY 2023	0	0	700
Total OPC D&D	27,300	27,300	27,300
Total Project Costs (TPC)			
FY 2020	2,500	2,500	2,400
FY 2021	2,600	2,600	2,500
FY 2022	22,200	22,200	21,700
FY 2023	0	0	700
Grand Total	**27,300**	**27,300**	**27,300**

Total Project

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2016	8,000	8,000	3,247
FY 2017	4,000	3,000	6,276
FY 2018	0	1,000	2,477
Total Design	12,000	12,000	12,000
Construction			
FY 2017	11,047	0	0
FY 2018	98,000	109,047	25,630
FY 2019	47,953	47,953	97,340
FY 2020	0	0	34,030
Total Construction	157,000	157,000	157,000
Total Estimated Costs (TEC)			
FY 2016	8,000	8,000	3,247
FY 2017	15,047	3,000	6,276
FY 2018	98,000	110,047	28,107
FY 2019	47,953	47,953	97,340
FY 2020	0	0	34,030
Total TEC	**169,000**	**169,000**	**169,000**
Other Project Costs, except D&D			
FY 2015[a]	250	250	223
FY 2016	2,456	2,456	994
FY 2017	0	0	900
FY 2018	550	550	1,100
FY 2019	600	600	520
FY 2020	600	600	480
FY 2021	700	700	900
FY 2022	544	544	400
FY 2023	0	0	183

[a] OPCs in FY 2015 were funded from the NNSA Federal Salaries and Expenses appropriation. FY 2015 costs in the FY 2017 CPDS were incorrect and have been revised.

	Budget Authority (Appropriations)	Obligations	Costs
Total OPC, except D&D	5,700	5,700	5,700
OPC D&D			
FY 2020	2,500	2,500	2,400
FY 2021	2,600	2,600	2,500
FY 2022	22,200	22,200	21,700
FY 2023	0	0	700
Total OPC D&D	27,300	27,300	27,300
OPC			
FY 2015	250	250	223
FY 2016	2,456	2,456	994
FY 2017	0	0	900
FY 2018	550	550	1,100
FY 2019	600	600	520
FY 2020	3,100	3,100	2,880
FY 2021	3,300	3,300	3,400
FY 2022	22,744	22,744	22,100
FY 2023	0	0	883
Total OPC	33,000	33,000	33,000
Total Project Costs (TPC)			
FY 2015	250	250	223
FY 2016	10,456	10,456	4,241
FY 2017	15,047	3,000	7,176
FY 2018	98,550	110,597	29,207
FY 2019	48,553	48,553	97,860
FY 2020	3,100	3,100	36,910
FY 2021	3,300	3,300	3,400
FY 2022	22,744	22,744	22,100
FY 2023	0	0	883
Grand Total	**202,000**	**202,000**	**202,000**

Details of Project Cost Estimate

New Facility Subproject (16-D-515-01)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	12,000	10,571	N/A
Contingency	0	429	N/A
Total, Design	12,000	11,000	N/A
Construction			N/A
Site Work	0	3,500	N/A
Construction	129,500	126,500	N/A
FPD Support	12,500	12,500	N/A
Contingency	15,000	15,500	N/A
Total, Construction	157,000	158,000	N/A
Total Estimated Cost	169,000	169,000	N/A
Contingency, TEC	15,000	15,929	N/A
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Planning	223	223	N/A
Conceptual Design	375	375	N/A
FPD Support and Review	3,602	3,102	N/A
Startup	1,000	1,000	N/A
Contingency	500	1,000	N/A
Total, OPC	5,700	5,700	N/A
Contingency, OPC	500	1,000	N/A
Total Project Cost	174,700	174,700	N/A
Total Contingency (TEC+OPC)	15,500	16,929	N/A

D&D Subproject (16-D-515-02)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	N/A	N/A	N/A
Contingency	N/A	N/A	N/A
Total, Design	N/A	N/A	N/A
Construction	N/A	N/A	N/A
Site Work	N/A	N/A	N/A
Construction	N/A	N/A	N/A
FPD Support	N/A	N/A	N/A
Contingency	N/A	N/A	N/A
Total, Construction	N/A	N/A	N/A
Total Estimated Cost	N/A	N/A	N/A
Contingency, TEC	N/A	N/A	N/A
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Planning	N/A	N/A	N/A
Conceptual Design	N/A	N/A	N/A
FPD Support and Review	N/A	N/A	N/A
Startup	N/A	N/A	N/A
Contingency	N/A	N/A	N/A
Total OPC except D&D	N/A	N/A	N/A
D&D			
D&D	26,000	26,000	N/A
Contingency	1,300	1,300	N/A
Total, OPC	27,300	27,300	N/A
Contingency, OPC	1,300	1,300	N/A
Total Project Cost	27,300	27,300	N/A
Total Contingency (TEC+OPC)	1,300	1,300	N/A

Total Project

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	12,000	10,571	N/A
Contingency	0	429	N/A
Total, Design	12,000	11,000	N/A
Construction			N/A
Site Work	0	3,500	N/A
Construction	129,500	126,500	N/A
FPD Support	12,500	12,500	N/A
Contingency	15,000	15,500	N/A
Total, Construction	157,000	158,000	N/A
Total Estimated Cost	169,000	169,000	N/A
Contingency, TEC	15,000	15,929	N/A
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Planning	223	223	N/A
Conceptual Design	375	375	N/A
FPD Support and Review	3,602	3,102	N/A
Startup	1,000	1,000	N/A
Contingency	500	1,000	N/A
Total OPC except D&D	5,700	5,700	N/A
D&D			
D&D	26,000	26,000	N/A
Contingency	1,300	1,300	N/A
Total, OPC	27,300	33,000	N/A
Contingency, OPC	1,800	2,300	N/A
Total Project Cost	202,000	202,000	N/A
Total Contingency (TEC+OPC)	16,800	18,229	N/A

Schedule of Appropriations Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	Total
FY 2017	TEC	23,047	50,000	0	0	0	0	0	73,047
	OPC	2,690	0	0	0	0	0	0	2,690
	TPC	25,737	50,000	0	0	0	0	0	75,737
FY 2018	TEC	23,047	98,000	47,953	0	0	0	0	169,000
	OPC	2,706	550	600	3,100	3,300	22,744	0	33,000
	TPC	25,737	98,550	48,553	3,100	3,300	22,744	0	202,000
FY 2019	TEC	23,047	98,000	47,953	0	0	0	0	169,000
	OPC	2,706	550	600	3,100	3,300	22,744	0	33,000
	TPC	25,753	98,550	48,553	3,100	3,300	22,744	0	202,000

4. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4QFY 2021
Expected Useful Life	40 years
Expected Future Start of D&D of this capital asset	4QFY 2061

Related Funding Requirements

(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	7,826	7,826	313,040	313,040

5. D&D Information

The new area being constructed in this project is replacing existing facilities.

	Square Feet
New area being constructed by this project at the Albuquerque Complex	333,000
Area of D&D in this project at the Albuquerque Complex	311,929
Area at the Albuquerque Complex to be transferred, sold, and/or D&D outside the project including area previously “banked”	15,499
Area of D&D in this project at other sites	0
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously “banked”	5,572
Total area eliminated	333,000

Characterization will be initiated in FY 2021 with abatement/D&D commencing once personnel are moved into the new facility. Completion of D&D is expected 3Q FY 2023.

Names and site locations of existing facilities to be D&D by this project:

Albuquerque	Bldg. 20380	2,634 sq ft
Albuquerque	Bldg. 20381	34,058 sq ft
Albuquerque	Bldg. 20381-A	14,284 sq ft
Albuquerque	Bldg. 20382	34,874 sq ft
Albuquerque	Bldg. 20383	36,351 sq ft
Albuquerque	Bldg. 20384	33,270 sq ft
Albuquerque	Bldg. 20385	40,525 sq ft
Albuquerque	Bldg. 20387	9,954 sq ft
Albuquerque	Bldg. 20388	16,093 sq ft
Albuquerque	Bldg. 20390	5,513 sq ft
Albuquerque	Bldg. 20391	14,939 sq ft
Albuquerque	Bldg. 20392	17,286 sq ft
Albuquerque	Bldg. 20393	12,209 sq ft
Albuquerque	Bldg. 20397	8,690 sq ft
Albuquerque	Bldg. 20398	287 sq ft
Albuquerque	Bldg. 20401	8,537 sq ft
Albuquerque	Bldg. Mod 12	2,227 sq ft
Albuquerque	Bldg. SC 1	5,770 sq ft
Albuquerque	Bldg. SC 2	1,448 sq ft
Albuquerque	Bldg. SC 3	4,348 sq ft
Albuquerque	Bldg. SC 4	4,312 sq ft
Albuquerque	Bldg. SC 5	2,880 sq ft
Albuquerque	Bldg. SC 6	1,440 sq ft

6. Acquisition Approach

The construction contract will be acquired through full and open competition executed by USACE; selection will be based on best value to the government and award will be on firm-fixed price delivery. D&D will be a best value, unit-price contract.

This project is being executed by the USACE under a Firm Fixed Price contract that will be incrementally funded by the Department of Energy.

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06-D-141, Uranium Processing Facility (UPF)
Y-12 National Security Complex, Oak Ridge, Tennessee
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary: The FY 2019 Request for the Uranium Processing Facility (UPF) project is $703,000K. The current Total Project Cost (TPC) is $6,500,000K.

The most recent DOE Order 413.3B approved Critical Decision (CD) for the overall project is CD-1 reaffirmation that was approved on June 8, 2012 with an upper end cost range of $6,500,000K and CD-4 of fourth quarter of FY 2025. The cost tables on the following pages provide numbers at the upper end of the range for subprojects without a CD-2/3 approval.

The UPF consists of processing capabilities for enriched uranium casting, oxide production, and salvage and accountability operations. The UPF project includes a Main Process Building (MPB), a Salvage and Accountability Building (SAB), a Mechanical Electrical Building (MEB), and various support facilities. Constructing multiple facilities allows each facility to be designed and constructed with a level of safety and security appropriate for the hazards of each operation. The UPF project will be considered complete upon successful completion of the described subset of Building 9212 capabilities.

Significant Changes:
The Critical Decision (CD) 2/3 approvals for the Main Process Building Subproject (MPB) (-04), Salvage and Accountability Building (SAB) Subproject (-09) and the Process Support Facilities (PSF) Subproject (-08) are scheduled for the second quarter of FY 2018. The established definitive scope, schedule, and cost baselines as part of the CD-2/3 submission and approval will be included in the FY 2020 CPDS.

The MPB, SAB, and PSF subprojects achieved 90% design in FY 2017. Estimates for these Subprojects have been updated to reflect the final design, and are subject to change based on negotiations with the Management and Operating contractor to establish target prices and fee annexes until the performance measurement baselines for the subprojects are established in FY 2018. The updated project costs reflect the Management and Operating contractor's cost estimates following completion of 90% design. The increase in the construction estimate is a result of better project definition and a reduction in overall estimate uncertainty and project contingency. The reduction in the Other Project Cost (OPC) estimate reflects a correction of indirect cost allocation from UPF to other programs at Y-12.

FY 2019 funds will be used for construction for the MPB, SAB, MEB, PSF, and Substation subprojects. Subproject descriptions are included in Section 2.

Consistent with NNSA's increased emphasis on project management rigor and Department policy, subproject Total Project Costs (TPCs) and baseline schedules are based upon 90% design completion. An independent cost estimate (ICE) and external independent review (EIR) were performed prior to CD-2/3 approval.

Site Readiness Subproject (06-D-141-01): Site Readiness Subproject received CD-4 on February 27, 2015. The project was completed under budget and CD-4 was achieved on schedule on February 27, 2015.

Site Infrastructure and Services (SIS) Subproject (06-D-141-05): The SIS Subproject CD-2/3 was approved on March 12, 2015, at a cost of $78.5 million with a CD-4 date of April 2018.

Substation Subproject (06-D-141-07): The Substation Subproject CD-2/3 was approved on September 14, 2016, at a cost of $60 million with a CD-4 date of June 2020.

Mechanical Electrical Building (MEB) Subproject (06-D-141-06): The MEB Subproject CD-2/3 was approved on December 13, 2016 at a cost of $284 million with a CD-4 date of January 2022.

Process Support Facilities Subproject (PSF) (06-D-141-08): The PSF Subproject CD-2/3 approval is scheduled for the second quarter of FY 2018, and the top end of the cost range is estimated at $121 million. The projected CD-4 date is the fourth quarter of FY 2025.

Salvage and Accountability Building Subproject (SAB) (06-D-141-09): The SAB Subproject CD-2/3 approval is scheduled for the second quarter of FY 2018, and the top end of the cost range is estimated at $1.030 billion. The projected CD-4 date is the fourth quarter of FY 2025. The long lead equipment authorized as part of CD-3B for the SAB are included in the SAB TPC.

Main Process Building Subproject (MPB) (06-D-141-04): The MPB subproject CD-2/3 approval is scheduled for the second quarter of FY 2018, and the top end of the cost range is estimated at $4.9 billion which includes UPF design, site preparation, and long lead procurements as well as construction of the MPB nuclear facility. The projected CD-4 date is the fourth quarter of FY 2025. The CD-3A for Long Lead Procurement and Site Preparation was approved on March 30, 2016. The long lead equipment authorized as part of CD-3B for the MPB are included in the MPB TPC.

A Level 4 PMCDP qualified Federal Project Director has been assigned to this project and has approved this CPDS. A Federal Project Director at the appropriate level has been assigned to each subproject. Project funds may be used by the Federal Project Director for contracted support services for the federal project team.

As represented since the FY 2012 request, design, construction and Other Project Costs (OPC) will continue to be executed through the line item funding. After October 1, 2011, OPC work has been and will only be performed using funding specifically appropriated by Congress for the project.

<u>Critical Milestone History</u>

Overall Project (06-D-141)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2011	12/17/2004		7/25/2007	TBD	2QFY2014	TBD	TBD	TBD
FY 2012	12/17/2004		7/25/2007	4QFY2013	2QFY2014	4QFY2013	TBD	TBD
FY 2013	12/17/2004		7/25/2007	4QFY2013	2QFY2014	4QFY2013	N/A	
FY 2104	12/17/2004		6/8/2012	3QFY2014	4QFY2015	3QFY2015	N/A	TBD
FY 2015	12/17/2004		6/8/2012	TBD	TBD	TBD	N/A	TBD
FY 2016	12/17/2004	2/9/2006	6/8/2012	TBD	TBD	TBD	N/A	TBD
FY 2017	12/17/2004	6/24/2015	6/8/2012	4QFY2017	4QFY2017	4QFY2017	N/A	4QFY2025
FY 2018	12/17/2004	6/24/2015	6/8/2012	2QFY2018	4QFY2017	2QFY2018	N/A	4QFY2025
FY 2019	12/17/2004	6/24/2015	6/8/2012	2QFY2018	8/25/2017	2QFY2018	N/A	4QFY2025

Site Readiness Subproject (06-D-141-01)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2014 PB	12/17/2004		6/8/2012	1/29/2013	1/29/2013	1/29/2013	N/A	2QFY2015
FY 2015	12/17/2004		6/8/2012	1/29/2013	1/29/2013	1/29/2013	N/A	2QFY2015
FY 2016	12/17/2004	2/9/2006	6/8/2012	1/29/2013	1/29/2013	1/29/2013	N/A	2QFY2015
FY 2017	12/17/2004	2/9/2006	6/8/2012	1/29/2013	1/29/2013	1/29/2013	N/A	2/27/2015
FY 2018	12/17/2004	2/9/2006	6/8/2012	1/29/2013	1/29/2013	1/29/2013	N/A	2/27/2015
FY 2019	12/17/2004	2/9/2006	6/8/2012	1/29/2013	1/29/2013	1/29/2013	N/A	2/27/2015

Site Infrastructure and Services Subproject (06-D-141-05)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2015	12/17/2004		7/25/2007	4QFY2014	4QFY2013	4QFY2014	N/A	4QFY2016
FY 2016	12/17/2004	2/9/2006	6/8/2012	2QFY2015	3QFY2015	2QFY2015	N/A	4QFY2016
FY 2017 PB	12/17/2004	2/9/2006	6/8/2012	3/12/2015	3/12/2015	3/12/2015	N/A	4/28/2018
FY 2018	12/17/2004	2/9/2006	6/8/2012	3/12/2015	3/12/2015	3/12/2015	N/A	4/28/2018
FY 2019	12/17/2004	2/9/2006	6/8/2012	3/12/2015	3/12/2015	3/12/2015	N/A	4/28/2018

Substation Subproject (06-D-141-07)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2017	12/17/2004	6/24/2015	6/8/2012	4QFY2016	4QFY2016	4QFY2016	N/A	1QFY2019
FY 2018 PB	12/17/2004	6/24/2015	6/8/2012	9/14/2016	9/30/2017	9/14/2016	N/A	6/30/2020
FY 2019	12/17/2004	6/24/2015	6/8/2012	9/14/2016	12/22/2017	9/14/2016	N/A	6/30/2020

Mechanical Electrical Building (MEB) Subproject (06-D-141-06)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2017	12/17/2004	6/24/2015	6/8/2012	2QFY2017	4QFY2017	2QFY2017	N/A	4QFY2021
FY 2018 PB	12/17/2004	6/24/2015	6/8/2012	12/13/2016	4QFY2017	12/13/2016	N/A	1/31/2022
FY 2019	12/17/2004	6/24/2015	6/8/2012	12/13/2016	9/30/2017	12/13/2016	N/A	1/30/2022

Process Support Facilities Subproject (06-D-141-08) [a]

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2017	12/17/2004	6/24/2015	6/8/2012	3QFY2017	3QFY2017	3QFY2017	N/A	4QFY2021
FY 2018	12/17/2004	6/24/2015	6/8/2012	2QFY2018	4QFY2017	2QFY2018	N/A	4QFY2025
FY 2019	12/17/2004	6/24/2015	6/8/2012	2QFY2018	9/30/2017	2QFY2018	N/A	4QFY2025

Salvage and Accountability Building Subproject (06-D-141-09) [a]

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2017	12/17/2004	6/24/2015	6/8/2012	4QFY2017	4QFY2017	4QFY2017	N/A	4QFY2025
FY 2018	12/17/2004	6/24/2015	6/8/2012	2QFY2018	4QFY2017	2QFY2018	N/A	4QFY2025
FY 2019	12/17/2004	6/24/2015	6/8/2012	2QFY2018	8/25/2017	2QFY2018	N/A	4QFY2025

Main Process Building Subproject (06-D-141-04) [a]

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2104	12/17/2004		6/8/2012	3QFY2014	4QFY2015	3QFY2015	N/A	TBD
FY 2015	12/17/2004		6/8/2012	TBD	TBD	TBD	N/A	TBD
FY 2016	12/17/2004	2/9/2006	6/8/2012	TBD	TBD	TBD	N/A	TBD
FY 2017	12/17/2004	6/24/2015	6/8/2012	4QFY2017	4QFY2017	4QFY2017	N/A	4QFY2025
FY 2018	12/17/2004	6/24/2015	6/8/2012	2QFY2018	4QFY2017	2QFY2018	N/A	4QFY2025
FY 2019	12/17/2004	6/24/2015	6/8/2012	2QFY2018	8/25/2017	2QFY2018	N/A	4QFY2025

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete (d)
CD-3 – Approve Start of Construction
D&D Complete – Completion of D&D work
CD-4 – Approve Start of Operations or Project Closeout

Fiscal Quarter or Date

Fiscal Year	Performance Baseline Validation	MPB CD-3A	MPB CD-3B	MPB CD-3C	Substation CD-3A
FY 2017		2Q FY 2016	1Q FY 2017	1Q FY 2017	3Q FY 2016
FY 2018		3/30/2016	1/13/2017	N/A	N/A
FY 2019		3/30/2016	1/13/2017	N/A	N/A

MPB CD-3A – Long Lead Procurement for site preparation and long lead procurements

[a] The schedule is estimated and consistent with the high end of the schedule range.

MPB CD-3B – Long Lead Procurements

MPB CD-3C – Cancelled as reflected in the FY 2018 CPDS

Substation CD-3A – Cancelled as reflected in the FY 2018 CPDS

Project Cost History

Overall Project (06-D-141-01 through 06-D-141-09)

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2011	351,149	935,000-1,604,000	1,124,000-1,928,000	276,000-472,000	TBD	TBD	1,400,000-3,500,000
FY 2012	528,690	3,174,779-5,320,310	3,703,000-5,849,000	497,000-651,000	N/A	497,000-651,000	4,200,000-6,500,000
FY 2013	566,192	3,136,808-5,150,808	3,703,000-5,717,000	497,000-783,000	N/A	497,000-783,000	4,200,000-6,500,000
FY 2014	1,164,000	TBD	TBD	TBD	N/A	TBD	TBD
FY 2015	TBD	TBD	TBD	TBD	N/A	TBD	TBD
FY 2016	TBD	TBD	TBD	TBD	N/A	TBD	TBD
FY 2017	1,880,000	4,103,000	5,983,000	517,000	0	517,000	6,500,000
FY 2018	1,926,000	4,148,500	6,074,500	425,500	0	425,500	6,500,000
FY 2019	1,855,809	4,463,724	6,319,533	180,467	0	180,467	6,500,000

Site Readiness Subproject (06-D-141-01)

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2015	N/A	64,000	64,000	1,000	N/A	1,000	65,000
FY 2016		64,000	64,000	1,000	N/A	1,000	65,000
FY 2017	0	43,277	43,277	0	0	0	43,277
FY 2018	0	43,277	43,277	0	0	0	43,277
FY 2019	0	43,714	43,714	0	0	0	43,714[a]

Site Infrastructure and Services Subproject (06-D-141-05)

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2015	N/A	58,000	58,000	1,500	N/A	1,500	59,500
FY 2016	N/A	84,500	84,500	500	N/A	500	85,000
FY 2017	0	78,000	78,000	500	0	500	78,500
FY 2018	0	78,000	78,000	500	0	500	78,500
FY 2019	0	78,000	78,000	500	0	500	78,500

[a] The change on Site Readiness from FY 2018 to FY 2019 was due to the settling of fee on the M&O work. As the accounting systems are audited and contracts are closed out, costs may be adjusted down or up accordingly.

Substation Subproject (06-D-141-07)

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2017	0	48,000	48,000	2,000	0	2,000	50,000
FY 2018	0	60,000	60,000	0	0	0	60,000
FY 2019	0	60,000	60,000	0	0	0	60,000

Mechanical Electrical Building (MEB) Subproject (06-D-141-06)

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2017	0	540,000	540,000	60,000	0	60,000	600,000
FY 2018	0	284,000	284,000	0	0	0	284,000
FY 2019	0	283,917	283,917	83	0	83	284,000

Process Support Facilities Subproject (06-D-141-08)

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2017	0	55,000	55,000	5,000	0	5,000	60,000
FY 2018	0	111,000	111,000	10,000	0	10,000	121,000
FY 2019	0	116,702	116,702	4,298	0	4,298	121,000

Salvage and Accountability Building Subproject (06-D-141-09)

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2017	0	1,200,000	1,200,000	130,000	0	130,000	1,330,000
FY 2018	0	1,060,250	1,060,250	25,000	0	25,000	1,085,250
FY 2019	0	1,013,761	1,013,761	16,239	0	16,239	1,030,000

Main Process Building Subproject (06-D-141-04)

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2015	TBD	TBD	TBD	TBD	N/A	TBD	TBD
FY 2016	TBD	TBD	TBD	TBD	N/A	TBD	TBD
FY 2017	1,880,000	2,138,723	4,018,723	319,500	0	319,500	4,338,223
FY 2018[a]	1,926,000	2,511,973	4,437,973	390,000	0	390,000	4,827,973
FY 2019	1,855,809	2,867,630	4,723,439	159,347	0	159,347	4,882,786

2. Project Scope and Justification

Scope

The UPF Project, which consists of a series of industrial and nuclear buildings and supporting infrastructure, is a major system acquisition that was selected in the Record of Decision for the Complex Transformation Supplemental Programmatic Environmental Impact Statement to ensure the long-term viability, safety, and security of the EU capability at the Y-12

[a] Cost is at the high end of the cost range adjusted to balance the overall project to $6.5 billion.

National Security Complex. Within budget constraints, the UPF project focuses on modernizing uranium processing capabilities at Y-12 to reduce program and safety risk. The UPF project provides new buildings to replace the Building 9212 capabilities for Highly Enriched Uranium (HEU) casting, oxide production, recovery, decontamination and assay. Coordination between Headquarters Acquisition and Project Management, the Uranium Program Manager, the NNSA Production Office and the UPF Project Office is essential as the uranium mission strategy and associated implementation plans define how the uranium capabilities are transitioned, relocated, sustained and/or replaced.

The goals and objectives of the UPF Project are to support the following modernization strategy:

- Ensure the long-term capability and improve the reliability of EU operations;
- Replace deteriorating, end-of-life buildings with modern manufacturing buildings;
- Significantly improve the health and safety posture for workers and the public by replacing administrative controls with engineered controls to manage the risks related to worker safety, criticality safety, fire protection, and environmental compliance.

The UPF project consists of the following subprojects:

Site Readiness Subproject (06-D-141-01): The Site Readiness Subproject scope included Bear Creek Road relocation, including a bridge overpass of the haul road; installation of potable water lines paralleling the new road; electrical line demolition to make way for the road and clear the construction site; electrical line and communication cable installation; preparation of the West Borrow area to receive excess-soil and preparation and maintenance of a spoil area for wet soil; extension of an existing haul road for access to the construction site; and jack-and-bore installation of casings for future utilities.

Site Infrastructure and Services Subproject (06-D-141-05): The SIS Subproject is under construction. Completed SIS scope includes demolition of Building 9107 and its hillside, installation of haul road security features, completion of a sedimentation basin, a concrete batch plant and completion of the Construction Support Building.

Substation Subproject (06-D-141-07): The Substation Subproject provides for the installation of the 161kV Main Electrical Substation for the Uranium Processing Facility Project and capacity for the rest of the Y-12 plant. The Substation will provide electrical power from the Tennessee Valley Authority (TVA) 161kV transmission system. The Substation Subproject includes all equipment, facilities or structures needed for a fully operational substation including the high voltage superstructure, control house buildings, site work, equipment foundations, oil containment system, fencing, outdoor lighting, grounding system and all underground raceways, conduits and cable trenches, transmission lines, access road and fire protection for the substation. The CD-3A for long lead equipment was cancelled in 2016.

Mechanical Electrical Building (MEB) Subproject (06-D-141-06): The Mechanical Electrical Building will house the utility support systems for both the Main Process Building and the Salvage and Accountability Building. The Mechanical Electrical Building Subproject will construct a facility and install the utility equipment and support systems required by both the Main Process Building (MPB) and the Salvage and Accountability Building (SAB). The MEB will be a stand-alone building housing mechanical, electrical, heating, ventilation, and air conditioning, utility equipment and support systems. The MEB will be constructed to nonnuclear commercial industrial standards. This subproject includes support buildings including leased temporary and permanent construction support facilities.

Process Support Facilities Subproject (06-D-141-08): The Process Support Facilities Subproject provides facilities for the chilled water, instrument air, demineralized water, waste management, and chemical and gas storage needed to support the MPB and SAB.

Salvage and Accountability Building Subproject (06-D-141-09): The SAB will contain the following processes: waste preparation, decontamination, nondestructive analysis, the clean and contaminated shops, chemical recovery, calcination and leaching, electronics and calibration maintenance, filter room, and personnel-related rooms. The SAB will be constructed to standards commensurate with the radioactive hazard and security requirements for the materials and processes contained within. This subproject includes support buildings including a fire tank pump building as well as the

Personnel Support Building which provides personnel access and monitoring station, truck bay, loading dock and material access. Long lead equipment purchases associated with the SAB Subproject will be allocated to the SAB TPC.

Long Lead Procurements, CD-3B: Includes long lead gloveboxes, skids, and select long lead procurements for structural steel, rebar, embeds and specialty items associated with SAB.

Main Process Building Subproject (06-D-141-04): The MPB will house the casting and oxide production capabilities. It also contains nondestructive analysis and waste preparations, furnaces and repacking, and spaces needed for process support such as the shift manager's office, restrooms, and other personnel-related rooms. The MPB will be constructed to nuclear standards commensurate with high-hazard materials and security for the processes to be carried out within. The MPB Subproject will include the construction of the HEUMF connector, and the new Perimeter Intrusion Detection and Assessment System surrounding the UPF campus and support buildings. Design costs for the UPF project are included in the Main Process Building Subproject baseline, as design costs are not tracked for each individual UPF subproject.

Site Preparation and Long Lead Procurements, CD-3A: Includes excavation and fill for the MPB, SAB and the MEB; installation of temporary facilities, power, storm water and sanitary sewers; and long lead procurements of tower cranes and rebar for the MEB slab.

Long Lead Procurements, CD-3B: Includes long lead gloveboxes, skids and select long lead procurements for structural steel, rebar, embeds and specialty items associated with MPB.

Justification

The UPF Project is needed to ensure the long-term viability, safety, and security of the Enriched Uranium (EU) capability in the United States. The UPF Project will support the Nation's nuclear weapons stockpile, down blending of EU in support of nonproliferation, and provide uranium as feedstock for fuel for naval reactors. Currently, these capabilities reside in aged and "genuinely decrepit" facilities as noted by the 2009 Strategic Posture Commission. There is substantial risk that the existing facilities will continue to deteriorate to the point of significant impact to Defense Programs, Defense Nuclear Nonproliferation, and Naval Reactors programs. The impacts could result in loss of the U.S. capability to maintain the nuclear weapons stockpile through life extension programs, shutdown of the U.S. Navy nuclear powered fleet due to lack of EU fuel feedstock materials, and impact to the Defense Nuclear Nonproliferation program's ability to reduce the enrichment level of foreign research reactors through supply of lower enrichment fuels manufactured at Y-12. The risk of inadvertent or accidental shutdown of the existing facilities is high and may occur prior to completion and startup of the UPF Project.

The project is being conducted in accordance with the project management requirements in DOE O 413.3B, Program and Project Management for the Acquisition of Capital Assets. Consistent with DOE O 413.3B, Earned Value information for all subprojects and the UPF design effort will be reported in the Project Assessment and Reporting System (PARS). Funds appropriated under this data sheet may be used for the incremental funding and execution of the project on an annual basis. Funds appropriated under this data sheet may be used for contracted support services to the Federal Project Director and to conduct reviews of design and construction.

Key Performance Parameters (KPPs)

The Threshold KPPs represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion. The Objective KPPs represent the desired project performance.

Performance Measure	Threshold	Objective
UPF supports phasing out mission dependency on 9212 by 2025	Threshold Performance Parameters are identified in the Classified Project Requirements Document	Objective Performance Parameters are identified in the Classified Project Requirements Document

3. Project Cost and Schedule

Financial Schedule

UPF funding is appropriated at the Overall Project level (06-D-141) is allocated to the subprojects in the tables below.

Site Readiness Subproject (06-D-141-01)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2016	N/A	0	0
FY 2017	N/A	0	0
Total Design	N/A	0	0
Construction			
FY 2013	43,714	43,714	5,242
FY 2014	0	0	25,928
FY 2015	0	0	12,107
FY 2016	0	0	437[a]
FY 2017	0	0	0
Total Construction	43,714	43,714	43,714
Total Estimated Costs (TEC)			
FY 2013	43,714	43,714	5,242
FY 2014	0	0	25,928
FY 2015	0	0	12,107
FY 2016	0	0	437
FY 2017	0	0	0
Total TEC	**43,714**	**43,714**	**43,714**
Other Project Costs (OPC)			
FY 2016	0	0	0
FY 2017	0	0	0
Total OPC	0	0	0
Total Project Costs (TPC)			
FY 2013	43,714	43,714	5,242
FY 2014	0	0	25,928

[a] The change on Site Readiness from in FY 2016 was due to the settling of fee on the M&O work. As the accounting systems are audited and contracts are closed out, costs may be adjusted down or up accordingly.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2015	0	0	12,107
FY 2016	0	0	437
FY 2017	0	0	0
Grand Total	**43,714**	**43,714**	**43,714**

Site Infrastructure and Services Subproject (06-D-141-05)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2016	N/A	0	0
FY 2017	N/A	0	0
Total Design	N/A	0	0
Construction			
FY 2015	78,000	78,000	8,746
FY 2016	0	0	26,875
FY 2017	0	0	23,166
FY 2018	0	0	19,213
FY 2019	0	0	0
Total Construction	78,000	78,000	78,000
Total Estimated Costs (TEC)			
FY 2015	78,000	78,000	8,746
FY 2016	0	0	26,875
FY 2017	0	0	23,166
FY 2018	0	0	19,213
FY 2019	0	0	0
Total TEC	**78,000**	**78,000**	**78,000**
Other Project Costs (OPC)			
FY 2017	500	500	5
FY 2018	0	0	495
Total OPC	500	500	500
Total Project Costs (TPC)			

	Budget Authority (Appropriations)	Obligations	Costs
FY 2015	78,000	78,000	8,746
FY 2016	0	0	26,875
FY 2017	500	500	23,171
FY 2018	0	0	19,708
FY 2019	0	0	0
Grand Total	**78,500**	**78,500**	**78,500**

Substation Subproject (06-D-141-07)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2016	N/A	0	0
FY 2017	N/A	0	0
Total Design	N/A	0	0
Construction			
FY 2016	60,000	60,000	0
FY 2017	0	0	11,064
FY 2018	0	0	35,008
FY 2019	0	0	10,559
FY 2020	0	0	3,369
Total Construction	60,000	60.000	60,000
Total Estimated Costs (TEC)			
FY 2016	60,000	60,000	0
FY 2017	0	0	11,064
FY 2018	0	0	35,008
FY 2019	0	0	10,559
FY 2020	0	0	3,369
Total TEC	**60,000**	**60,000**	**60,000**
Other Project Costs (OPC)			
FY 2016	0	0	0
FY 2017	0	0	0

	Budget Authority (Appropriations)	Obligations	Costs
Total OPC	0	0	0
Total Project Costs (TPC)			
FY 2016	60,000	60,000	0
FY 2017	0	0	11,064
FY 2018	0	0	35,008
FY 2019	0	0	10,559
FY 2020	0	0	3,369
Grand Total	**60,000**	**60,000**	**60,000**

Mechanical Electrical Building (MEB) Subproject (06-D-141-06)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2016	N/A	0	0
FY 2017	N/A	0	0
Total Design	N/A	0	0
Construction			
FY 2017	55,000	55,000	1,420
FY 2018	160,000	160,000	75,105
FY 2019	68,917	68,917	112,517
FY 2020	0	0	70,786
FY 2021	0	0	19,089
FY 2022	0	0	5,000
Total Construction	283,917	283,917	283,917
Total Estimated Costs (TEC)			
FY 2017	55,000	55,000	1,420
FY 2018	160,000	160,000	75,105
FY 2019	68,917	68,917	112,517
FY 2020	0	0	70,786
FY 2021	0	0	19,089
FY 2022	0	0	5,000

	Budget Authority (Appropriations)	Obligations	Costs
Total TEC	**283,917**	**283,917**	**283,917**
Other Project Costs (OPC)			
FY 2019	83	83	0
FY 2020	0	0	40
FY 2021	0	0	43
Total OPC	83	83	83
Total Project Costs (TPC)			
FY 2017	55,000	55,000	1,420
FY 2018	160,000	160,000	75,105
FY 2019	69,000	69,000	112,517
FY 2020	0	0	70,826
FY 2021	0	0	19,132
FY 2022	0	0	5,000
Grand Total	**284,000**	**284,000**	**284,000**

Process Support Facilities Subproject (06-D-141-08)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2016	N/A	0	0
FY 2017	N/A	0	0
Total Design	N/A	0	0
Construction			
FY 2018	10,000	10,000	8,941
FY 2019	20,000	20,000	19,788
FY 2020	40,000	40,000	36,055
FY 2021	45,702	45,702	30,757
FY 2022	1,000	1,000	8,029
FY 2023	0	0	5,710
FY 2024	0	0	3,711
FY 2025	0	0	3,711

	Budget Authority (Appropriations)	Obligations	Costs
Total Construction	116,702	116,702	116,702
Total Estimated Costs (TEC)			
FY 2018	10,000	10,000	8,941
FY 2019	20,000	20,000	19,788
FY 2020	40,000	40,000	36,055
FY 2021	45,702	45,702	30,757
FY 2022	1,000	1,000	8,029
FY 2023	0	0	5,710
FY 2024	0	0	3,711
FY 2025	0	0	3,711
Total TEC	**116,702**	**116,702**	**116,702**
Other Project Costs (OPC)			
FY 2023	1,500	1,500	1,453
FY 2024	2,798	2,798	1,428
FY 2025	0	0	1,417
Total OPC	4,298	4,298	4,298
Total Project Costs (TPC)			
FY 2018	10,000	10,000	8,941
FY 2019	20,000	20,000	19,788
FY 2020	40,000	40,000	36,055
FY 2021	45,702	45,702	30,757
FY 2022	1,000	1,000	8,029
FY 2023	1,500	1,500	7,163
FY 2024	2,798	2,798	5,139
FY 2025	0	0	5,128
Grand Total	**121,000**	**121,000**	**121,000**

Salvage and Accountability Building Subproject (06-D-141-09)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2016	N/A	0	0
FY 2017	N/A	0	0
Total Design	N/A	0	0
Construction			
FY 2018	195,000	195,000	122,263
FY 2019	203,000	203,000	241,957
FY 2020	252,001	252,001	234,934
FY 2021	202,000	202,000	178,780
FY 2022	150,000	150,000	145,024
FY 2023	11,760	11,760	47,800
FY 2024	0	0	23,954
FY 2025	0	0	19,049
Total Construction	1,013,761	1,013,761	1,013,761
Total Estimated Costs (TEC)			
FY 2018	195,000	195,000	122,263
FY 2019	203,000	203,000	241,957
FY 2020	252,001	252,001	234,934
FY 2021	202,000	202,000	178,780
FY 2022	150,000	150,000	145,024
FY 2023	11,760	11,760	47,800
FY 2024	0	0	23,954
FY 2025	0	0	19,049
Total TEC	**1,013,761**	**1,013,761**	**1,013,761**
Other Project Costs (OPC)			
FY 2023	7,874	7,874	5,808
FY 2024	8,365	8,365	5,327
FY 2025	0	0	5,104
Total OPC	16,239	16,239	16,239
Total Project Costs (TPC)			

	Budget Authority (Appropriations)	Obligations	Costs
FY 2018	195,000	195,000	122,263
FY 2019	203,000	203,000	241,957
FY 2020	252,001	252,001	234,934
FY 2021	202,000	202,000	178,780
FY 2022	150,000	150,000	145,024
FY 2023	19,634	19,634	53,608
FY 2024	8,365	8,365	29,281
FY 2025	0	0	24,153
Grand Total	**1,030,000**	**1,030,000**	**1,030,000**

Main Process Building Subproject (06-D-141-04)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2005	0	0	0
FY 2006	5,000	5,000	0
FY 2007	5,000	5,000	677
FY 2008	38,583	38,583	33,950
FY 2009	90,622	90,622	79,184
FY 2010	94,000	94,000	80,959
FY 2011	114,786	114,786	109,855
FY 2012	160,194	160,109	170,700
FY 2013	269,069	269,026	192,389
FY 2014	301,886[a]	301,886	198,448
FY 2015	253,429[b]	252,323	220,761[c]
FY 2016	298,000	297,978	309,154[a]

[a] In FY 2014, $5,000,000 in prior year funding was reprogrammed from 06-D-141, Uranium Processing Facility to Maintenance and Repair of Facilities at Y-12. Change from FY 2018 CPDS also reflects a rescission of $2,114,341.
[b] In FY 2016, $2,885,659 in prior year funding was reprogrammed from 06-D-141, Uranium Processing Facility to Uranium Sustainment: Storage under the Directed Stockpile Work program. Change from FY 2018 CPDS also reflects a rescission of $685,002.08
[c] Updated to reflect actual costs following DCAA audit.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2017	179,384	179,248	326,205
FY 2018	45,856	47,248	133,527
Total Design	1,855,809	1,855,809	1,855,809
Construction			
FY 2016	72,000	72,000	4,958
FY 2017	340,116	340,116	54,263
FY 2018	251,644	250,252	217,521
FY 2019	410,500	410,500	577,566
FY 2020	452,499	452,499	511,161
FY 2021	500,798	500,798	516,624
FY 2022	465,000	465,000	368,638
FY 2023	242,116	179,193	192,605
FY 2024	132,957	181,619	245,822
FY 2025	0	15,653	178,472
Total Construction	2,867,630	2,867,630	2,867,630
Total Estimated Costs (TEC)			
FY 2005	0	0	0
FY 2006	5,000	5,000	0
FY 2007	5,000	5,000	677
FY 2008	38,583	38,583	33,950
FY 2009	90,622	90,622	79,184
FY 2010	94,000	94,000	80,959
FY 2011	114,786	114,786	109,855
FY 2012	160,194	160,109	170,700
FY 2013	269,069	269,026	192,389
FY 2014	301,886	301,886	198,448
FY 2015	253,429	252,323	220,761
FY 2016	370,000	369,978	314,112
FY 2017	519,500	519,364	380,468
FY 2018	297,500	297,500	351,048
FY 2019	410,500	410,500	577,566
FY 2020	452,499	452,499	511,161
FY 2021	500,798	500,798	516,624

	Budget Authority (Appropriations)	Obligations	Costs
FY 2022	465,000	465,000	368,638
FY 2023	242,116	179,193	192,605
FY 2024	132,957	181,619	245,822
FY 2025	0	15,653	178,472
Total TEC	**4,723,439**	**4,723,439**	**4,723,439**
Other Project Costs (OPC)			
FY 2005	12,113	12,113	12,113
FY 2006	7,809	7,809	7,809
FY 2007	10,082	10,082	10,082
FY 2008	11,730	11,730	11,730
FY 2009	14,000	14,000	14,000
FY 2010	20,500	20,500	20,500
FY 2011	18,894	18,894	18,409[a]
FY 2012	0	0	0
FY 2013	0	0	0
FY 2014	0	0	0
FY 2015	0	0	0
FY 2016	0	0	0
FY 2017	0	0	0
FY 2018	500	500	407
FY 2019	500	500	378
FY 2020	500	500	336
FY 2021	1,500	1,500	1,363
FY 2022	4,000	4,000	3,789
FY 2023	36,750	25,000	24,208
FY 2024	20,469	27,000	27,419
FY 2025	0	5,219	6,804
Total OPC	159,347	159,347	159,347
Total Project Costs (TPC)			
FY 2005	12,113	12,113	12,113
FY 2006	12,809	12,809	7,809
FY 2007	15,082	15,082	10,759

[a] Updated to reflect actual costs following DCAA audit.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2008	50,313	50,313	45,680
FY 2009	104,622	104,622	93,184
FY 2010	114,500	114,500	101,459
FY 2011	133,680	133,680	128,264
FY 2012	160,194	160,109	170,700
FY 2013	269,069	269,026	192,389
FY 2014	301,886	301,886	198,448
FY 2015	253,429	252,323	220,761
FY 2016	370,000	369,978	314,112
FY 2017	519,500	519,364	380,468
FY 2018	298,000	298,000	351,455
FY 2019	411,000	411,000	577,944
FY 2020	452,999	452,999	511,497
FY 2021	502,298	502,298	517,987
FY 2022	469,000	469,000	372,427
FY 2023	278,866	204,193	216,813
FY 2024	153,426	208,619	273,241
FY 2025	0	20,872	185,276
Grand Total	**4,882,786**	**4,882,786**	**4,882,786**

Overall Project (06-D-141)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2005	0	0	0
FY 2006	5,000	5,000	0
FY 2007	5,000	5,000	677
FY 2008	38,583	38,583	33,950
FY 2009	90,622	90,622	79,184
FY 2010	94,000	94,000	80,959
FY 2011	114,786	114,786	109,855

	Budget Authority (Appropriations)	Obligations	Costs
FY 2012	160,194	160,109	170,700
FY 2013	269,069	269,026	192,389
FY 2014	301,886	301,886	198,448
FY 2015	253,429	252,323	220,761
FY 2016	298,000	297,978	309,154
FY 2017	179,384	179,248	326,205
FY 2018	45,856	47,248	133,527
Total Design	1,855,809	1,855,809	1,855,809
Construction			
FY 2012	0	0	0
FY 2013	43,714	43,714	5,242
FY 2014	0	0	25,928
FY 2015	78,000	78,000	20,853
FY 2016	132,000	132,000	32,270
FY 2017	395,116	395,116	89,913
FY 2018	616,644	615,252	478,051
FY 2019	702,417	702,417	962,387
FY 2020	744,500	744,500	856,305
FY 2021	748,500	748,500	745,250
FY 2022	616,000	616,000	526,691
FY 2023	253,876	190,953	246,115
FY 2024	132,957	181,619	273,487
FY 2025	0	15,653	201,232
Total Estimated Costs (TEC)			
FY 2005	0	0	0
FY 2006	5,000	5,000	0
FY 2007	5,000	5,000	677
FY 2008	38,583	38,583	33,950
FY 2009	90,622	90,622	79,184
FY 2010	94,000	94,000	80,959
FY 2011	114,786	114,786	109,855
FY 2012	160,194	160,109	170,700
FY 2013	312,783	312,740	197,631

	Budget Authority (Appropriations)	Obligations	Costs
FY 2014	301,886	301,886	224,376
FY 2015	331,429	330,323	241,614
FY 2016	430,000	429,978	341,424
FY 2017	574,500	574,364	416,118
FY 2018	662,500	662,500	611,578
FY 2019	702,417	702,417	962,387
FY 2020	744,500	744,500	856,305
FY 2021	748,500	748,500	745,250
FY 2022	616,000	616,000	526,691
FY 2023	253,876	190,953	246,115
FY 2024	132,957	181,619	273,487
FY 2025	0	15,653	201,232
Total TEC	**6,319,533**	**6,319,533**	**6,319,533**
Other Project Costs (OPC)			
FY 2005	12,113	12,113	12,113
FY 2006	7,809	7,809	7,809
FY 2007	10,082	10,082	10,082
FY 2008	11,730	11,730	11,730
FY 2009	14,000	14,000	14,000
FY 2010	20,500	20,500	20,500
FY 2011	18,894	18,894	18,409
FY 2012	0	0	0
FY 2013	0	0	0
FY 2014	0	0	0
FY 2015	0	0	0
FY 2016	0	0	0
FY 2017	500	500	5
FY 2018	500	500	902
FY 2019	583	583	378
FY 2020	500	500	376
FY 2021	1,500	1,500	1,406
FY 2022	4,000	4,000	3,789
FY 2023	46,124	34,374	31,469

	Budget Authority (Appropriations)	Obligations	Costs
FY 2024	31,632	38,163	34,174
FY 2025	0	5,219	13,325
Total OPC	**180,467**	**180,467**	**180,467**
Total Project Costs (TPC)			
FY 2005	12,113	12,113	12,113
FY 2006	12,809	12,809	7,809
FY 2007	15,082	15,082	10,759
FY 2008	50,313	50,313	45,680
FY 2009	104,622	104,622	93,184
FY 2010	114,500	114,500	101,459
FY 2011	133,680	133,680	128,264
FY 2012	160,194	160,109	170,700
FY 2013	312,783	312,740	197,631
FY 2014	301,886[a]	301,886	224,376
FY 2015	331,429[b]	330,323	241,614
FY 2016	430,000	429,978	341,424
FY 2017	575,000	574,864	416,123
FY 2018	663,000	663,000	612,480
FY 2019	703,000	703,000	962,765
FY 2020	745,000	745,000	856,681
FY 2021	750,000	750,000	746,656
FY 2022	620,000	620,000	530,480
FY 2023	300,000	225,327	277,584
FY 2024	164,589	219,782	307,661
FY 2025	0	20,872	214,557
Grand Total	**6,500,000**	**6,500,000**	**6,500,000**

[a] In FY 2014, $5,000,000 in prior year funding was reprogrammed from 06-D-141, Uranium Processing Facility to Maintenance and Repair of Facilities at Y-12. Change from FY 2018 CPDS also reflects a rescission of $2,114,341.

[b] In FY 2016, $2,885,659 in prior year funding was reprogrammed from 06-D-141, Uranium Processing Facility to Uranium Sustainment: Storage under the Directed Stockpile Work program. Change from FY 2018 CPDS also reflects a rescission of $685,002.08.

Details of Project Cost Estimate

Site Readiness Subproject (06-D-141-01)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	0	0	N/A
Contingency	0	0	N/A
Total Design	0	0	N/A
Construction			
Site Preparation	43,714	43,277	50,200
Equipment	0	0	0
Construction	0	0	0
Other, as needed	0	0	0
Contingency	0	0	13,800
Total Construction	43,714	43,277	64,000
Other TEC (if any)			
Cold Startup	0	0	0
Contingency	0	0	0
Total, Other TEC	0	0	0
Total Estimated Cost	43,714	43,277	64,000
Contingency, TEC	0	0	13,800
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	0
Conceptual Planning	0	0	0
Conceptual Design	0	0	0
Start-up	0	0	1,000
Contingency	0	0	0
Total, OPC	0	0	1,000
Contingency, OPC	0	0	0
Total Project Cost	**43,714**	**43,277**	**65,000**
Total Contingency (TEC+OPC)	**0**	**0**	**13,800**

Site Infrastructure and Services Subproject (06-D-141-05)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	0	0	0
Contingency	0	0	0
Total Design	0	0	0
Construction			
Site Preparation	0	28,000	26,000
Equipment	0	0	0
Construction	60,000	32,000	30,000
Other, as needed	0	0	0
Contingency	18,000	18,000	22,500
Total Construction	78,000	78,000	78,500
Other TEC (if any)			
Cold Startup	0	0	0
Contingency	0	0	0
Total, Other TEC	0	0	0
Total Estimated Cost	78,000	78,000	78,500
Contingency, TEC	18,000	18,000	22,500
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	0
Conceptual Planning	0	0	0
Conceptual Design	0	0	0
Start-up	460	500	0
Contingency	40	0	0
Total, OPC	500	500	0
Contingency, OPC	40	0	0
Total Project Cost	**78,500**	**78,500**	**78,500**
Total Contingency (TEC+OPC)	**18,040**	**18,000**	**22,500**

Substation Subproject (06-D-141-07)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	0	0	0
Contingency	0	0	0
Total Design	0	0	0
Construction			
Site Preparation	0	3,000	3,000
Equipment	0	47,000	47,000
Construction	46,277	0	0
Other, as needed	0	0	0
Contingency	13,723	10,000	10,000
Total Construction	60,000	60,000	60,000
Other TEC (if any)			
Cold Startup	--	--	--
Contingency	--	--	--
Total, Other TEC	--	--	--
Total Estimated Cost	60,000	60,000	60,000
Contingency, TEC	13,723	10,000	10,000
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	0
Conceptual Planning	0	0	0
Conceptual Design	0	0	0
Start-up	0	0	0
Contingency	0	0	0
Total, OPC	0	0	0
Contingency, OPC	0	0	0
Total Project Cost	**60,000**	**60,000**	**60,000**
Total Contingency (TEC+OPC)	**13,723**	**10,000**	**10,000**

Mechanical Electrical Building (MEB) Subproject (06-D-141-06)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	0	0	0
Contingency	0	0	0
Total Design	0	0	0
Construction			
Site Preparation	0	0	0
Equipment	18,213	20,000	20,000
Construction	186,740	184,000	184,000
Other, as needed	0	0	0
Contingency	78,964	80,000	80,000
Total Construction	283,917	284,000	284,000
Other TEC (if any)			
Cold Startup	0	0	0
Contingency	0	0	0
Total, Other TEC	0	0	0
Total Estimated Cost	283,917	284,000	284,000
Contingency, TEC	78,964	80,000	80,000
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	0
Conceptual Planning	0	0	0
Conceptual Design	0	0	0
Start-up	76	0	0
Contingency	7	0	0
Total, OPC	83	0	0
Contingency, OPC	7	0	0
Total Project Cost	**284,000**	**284,000**	**284,000**
Total Contingency (TEC+OPC)	**78,971**	**80,000**	**80,000**

Process Support Facilities Subproject (06-D-141-08)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	0	0	N/A
Contingency	0	0	N/A
Total Design	0	0	N/A
Construction			
Site Preparation	0	0	N/A
Equipment	10,305	11,000	N/A
Construction	89,834	80,000	N/A
Other, as needed	0	0	N/A
Contingency	16,563	20,000	N/A
Total Construction	116,702	111,000	N/A
Other TEC (if any)			
Cold Startup	0	0	N/A
Contingency	0	0	N/A
Total, Other TEC	0	0	N/A
Total Estimated Cost	116,702	111,000	N/A
Contingency, TEC	16,563	20,000	N/A
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	N/A
Conceptual Planning	0	0	N/A
Conceptual Design	0	0	N/A
Start-up	3,954	9,500	N/A
Contingency	344	500	N/A
Total, OPC	4,298	10,000	N/A
Contingency, OPC	344	500	N/A
Total Project Cost	**121,000**	**121,000**	**N/A**
Total Contingency (TEC+OPC)	**16,907**	**20,500**	**N/A**

Salvage and Accountability Building Subproject (06-D-141-09)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	0	0	N/A
Contingency	0	0	N/A
Total Design	0	0	N/A
Construction			
Site Preparation	0	0	N/A
Equipment	176,019	240,000	N/A
Construction	732,268	670,250	N/A
Other, as needed	0	0	N/A
Contingency	105,474	150,000	N/A
Total Construction	1,013,761	1,060,250	N/A
Other TEC (if any)			
Cold Startup	0	0	N/A
Contingency	0	0	N/A
Total, Other TEC	0	0	N/A
Total Estimated Cost	1,013,761	1,060,250	N/A
Contingency, TEC	105,474	150,000	N/A
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	N/A
Conceptual Planning	0	0	N/A
Conceptual Design	0	0	N/A
Start-up	14,940	20,000	N/A
Contingency	1,299	5,000	N/A
Total, OPC	16,239	25,000	N/A
Contingency, OPC	1,299	5,000	N/A
Total Project Cost	**1,030,000**	**1,085,250**	**N/A**
Total Contingency (TEC+OPC)	**106,773**	**155,000**	**N/A**

Main Process Building Subproject (06-D-141-04)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	1,835,809	1,776,000	N/A
Contingency	20,000	150,000	N/A
Total Design	1,855,809	1,926,000	N/A
Construction			
Site Preparation	83,818	80,000	N/A
Equipment	373,353	350,000	N/A
Construction	2,004,918	1,538,373	N/A
Other, as needed	0	0	N/A
Contingency	405,541	543,600	N/A
Total Construction	2,867,630	2,511,973	N/A
Other TEC (if any)			
Cold Startup	0	0	N/A
Contingency	0	0	N/A
Total, Other TEC	0	0	N/A
Total Estimated Cost	4,723,439	4,437,973	N/A
Contingency, TEC	425,541	693,600	N/A
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	N/A
Conceptual Planning	30,000	30,000	N/A
Conceptual Design	64,643	64,500	N/A
Start-up	59,528	275,500	N/A
Contingency	5,176	20,000	N/A
Total, OPC	159,347	390,000	N/A
Contingency, OPC	5,176	20,000	N/A
Total Project Cost	**4,882,786**	**4,827,973**	**N/A**
Total Contingency (TEC+OPC)	**430,717**	**713,600**	**N/A**

Overall Project (06-D-141)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	1,835,809	1,776,000	N/A
Contingency	20,000	150,000	N/A
Total Design	1,855,809	1,926,000	N/A
Construction			
Site Preparation	127,532	154,277	N/A
Equipment	577,890	668,000	N/A
Construction	3,120,037	2,504,623	N/A
Other, as needed	0	0	N/A
Contingency	638,265	821,600	N/A
Total Construction	4,463,724	4,148,500	N/A
Other TEC (if any)			
Cold Startup	0	0	N/A
Contingency	0	0	N/A
Total, Other TEC	0	0	N/A
Total Estimated Cost	6,319,533	6,074,500	N/A
Contingency, TEC	658,265	971,600	N/A
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	N/A
Conceptual Planning	30,000	30,000	N/A
Conceptual Design	64,643	64,500	N/A
Start-up	78,958	305,500	N/A
Contingency	6,866	25,500	N/A
Total, OPC	180,467	425,500	N/A
Contingency, OPC	6,866	25,500	N/A
Total Project Cost	**6,500,000**	**6,500,000**	**N/A**
Total Contingency (TEC+OPC)	**665,131**	**997,100**	**N/A**

Schedule of Appropriations Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	Outyears	Total
FY 2011	TEC	1,233,620	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	TPC	1,499,649	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FY 2012	TEC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	TPC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FY 2013	TEC	2,254,185	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	129,128	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	TPC	2,383,313	TBD	TBD	TBD	TBD	TBD	TBD	TBD	6,500,000
FY 2014	TEC	2,809,095	616,952	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	150,313	24,000	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	TPC	2,959,408	640,952	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FY 2015	TEC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	TPC	2,490,096	515,000	520,000	TBD	TBD	TBD	TBD	TBD	TBD
FY 2016	TEC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	TPC	2,490,096	515,000	520,000	525,000	TBD	TBD	TBD	TBD	TBD
FY 2017	TEC	TBD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	TBD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	2,560,096	620,000	620,000	620,000	635,000	645,000	500,000	299,904	6,500,000
FY 2018	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	2,560,096	663,000	722,000	735,000	740,000	630,000	385,000	64,904	6,500,000
FY 2019	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	2,560,096	663,000	703,000	745,000	750,000	620,000	300,000	158,904	6,500,000

4. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	2025
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset (fiscal quarter)	N/A

Related Funding Requirements

(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	0	466	0	32,915

5. D&D Information

The new area being constructed in this project is replacing existing facilities; however, the costs of D&D of the facilities that are being replaced are not included in the costs of this construction project. D&D of existing facilities will be the responsibility of the DOE Office of Environmental Management.

The construction of the UPF Project will add approximately 230,000 base-level square[a] feet of new buildings to the Y-12 footprint and will allow eventual replacement of functions in Building 9212 including EU casting and EU chemical processing operations. The final D&D and demolition of these areas are not considered part of the UPF project. Building 9107 (11,000 square feet) was demolished as part of the SIS Subproject to facilitate clearing the UPF construction site.

6. Acquisition Approach

The NNSA Federal Project Director and the Integrated Project Team will be responsible for the execution of the project. The Management and Operating (M&O) partners for Y-12 are the designated design authority. The Office of Defense Programs (NA-10) and the Uranium Program Manager are responsible for defining program requirements, selecting the preferred alternatives, and for any project scope changes. The Office of Acquisition and Project Management (NA-APM) is responsible for providing support for alternative studies, and serves as the lead NNSA office during design and construction of the project. The UPF Project is being executed through several acquisition strategies, to include firm-fixed-price design-bid-build and design-build contracts, and cost-plus design-build contracts.

The Department will administer Architect-Engineer and Construction Contracts utilizing the M&O and stand-alone contract vehicles. Additionally, the United States Army Corps of Engineers (USACE) will have acquisition and project management responsibility for appropriate scopes of work as determined by the Department.

Construction scope for the Site Infrastructure and Services Subproject, Mechanical Electrical Building Subproject, Substation Subproject, and Site Preparation is being performed under firm fixed price construction contracts or subcontracts when determined to be the best value for the government. The remaining subprojects are being assessed for best value acquisition strategies to include fixed price and cost plus subcontracts based on Federal Acquisition Regulation principles.

[a] Square footage figures rounded to the next highest 1,000 square feet.

04-D-125, Chemistry and Metallurgy Research Replacement (CMRR) Project
Los Alamos National Laboratory (LANL), Los Alamos, New Mexico
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary: The FY 2019 Request for the Chemistry and Metallurgy Research Replacement (CMRR) Project is $235,095K. Critical Decision (CD)-2/3 for the first two current subprojects, RLUOB Equipment Installation Phase 2 (REI2) and PF-4 Equipment Installation (PEI1) was approved on October 31, 2016 with a total project cost (TPC) for both subprojects of $1,027,250K. CD-1, Approve Alternative Selection and Cost Range, for the CMRR project was approved on August 21, 2014 with a cost range of $2,400,000K - $2,900,000K and CD-4 in FY 2024.

This project was initiated in FY 2004.

Execution of the CMRR Project under the cost and schedule parameters established at CD-1 is principally dependent on predictable, stable appropriations at the CMRR project (04-D-125) level. Without the ability to move funds between subprojects, the completion dates for the PEI2 and RC3 subprojects will challenge the programmatic need dates associated with the LANL mission. This risk can be reduced by allocating funds at the CMRR project level in FY 2019, allowing any efficiencies realized on the REI2 and PEI1 subprojects to be used to advance the PEI2 and RC3 subprojects.

Significant Changes:

As with the FY 2018 Construction Project Data Sheet (CPDS), this FY 2019 CPDS uses the current structure (or phasing per DOE Order 413.3B) of the CMRR project scope as (4) active subprojects under one project, which are necessary to provide continuity in analytical chemistry (AC) and materials characterization (MC) capabilities and support the cessation of programmatic operations in the existing CMR. This structure was approved by the Deputy Secretary of Energy on November 25, 2015.

This Construction Project Data Sheet reflects:

- The project structure approved on November 25, 2015.
- An FY 2019 funding request intended to preserve the project baselines established for the REI2 and PEI1 subprojects.
- A forecast change to the planned critical milestones for the PEI2 and RC3 subprojects. Schedules have been adjusted to stay within funding totals for the overall CMRR Future Year Nuclear Security Program (FYNSP). To support programmatic milestones, baselining the RC3 subproject is prioritized ahead of PEI2. Fully outfitting the RLUOB provides Analytical Chemistry (AC) capabilities needed to support plutonium mission activities.

The CMRR subprojects are described below:

RLUOB Subproject (04-D-125-01): CD-4 approved on June 24, 2010.
RLUOB Equipment Installation (REI1) Subproject (04-D-125-02): CD-4 approved on June 20, 2013.
Nuclear Facility (NF) Subproject (04-D-125-03): This subproject is cancelled.

REI Phase 2 (REI2) Subproject (04-D-125-04): Transfers part of AC and MC capabilities from CMR to RLUOB by designing, purchasing, and installing additional equipment in RLUOB. A CD-3A request for procurement of long lead equipment and site preparations, following a reconciled Independent Cost Estimate (ICE) conducted by DOE-PM, was approved for REI2 on December 18, 2014. CD-3B for additional long lead procurements for REI2 was approved on December 22, 2015. REI2 CD-2/3 approval was received on October 31, 2016 with the Performance baseline established at $633,250K. CD-4 completion is scheduled for January 5, 2022.

PF-4 Equipment Installation Phase 1 (PEI1) Subproject (04-D-125-05): Maximizes use of PF-4 by decommissioning and decontaminating (D&D) old gloveboxes and equipment, reconfiguring and reusing existing gloveboxes, consolidating and relocating existing capabilities, and installing new gloveboxes and equipment for AC/MC capabilities. PEI1 will establish AC and MC capabilities that utilize larger amounts of nuclear materials and therefore are required to be in PF-4 operational space. CD-3A for long lead procurements for PEI1 was approved on March 18, 2015. CD-3B for additional long lead procurements was approved on December 22, 2015. PEI1 CD-2/3 approval was received on October 31, 2016 with the Performance Baseline established at $394,000K. CD-4 completion is scheduled for April 30, 2022.

PF-4 Equipment Installation Phase 2 (PEI2) Subproject (04-D-125-06)/(PF-4 Reconfiguration Project – 17-D-126): Maximize use of PF-4 by consolidating and relocating existing capabilities, replacing existing equipment, installing gloveboxes and equipment and D&D of existing laboratory space for AC/MC capabilities. PEI2 will establish enduring AC and MC capabilities for supporting NNSA actinide-based missions. The preliminary cost range for the work in this subproject is $523,000K - $675,340K; the cost estimate will be updated prior to CD-2/3 approval for this subproject. An integrated master schedule will be developed at CD-2/3.

Re-categorizing RLUOB to Hazard Category 3 (RC3) Subproject (04-D-125-07)/(RLUOB Reconfiguration Project – 17-D-125): Maximizes use of RLUOB by reconfiguring existing laboratory space and equipping the remaining empty laboratories with AC and MC capabilities, and enables the RLUOB to be re-categorized facility to a limited hazard category-3 nuclear facility. RC3 will establish enduring AC and MC capabilities for supporting NNSA actinide-based missions. The preliminary cost range for the work in this subproject is $208,000K - $339,335K; the cost estimate will be updated prior to CD-2/3 approval for this subproject. An integrated master schedule will be developed at CD-2/3.

A Federal Project Director (FPD) is assigned to each sub-project.

Critical Milestone History

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2004	07/16/2002	N/A	1QFY2004		N/A	2QFY2004	N/A	1QFY2011
FY 2005	07/16/2002	N/A	3QFY2004		N/A	3QFY2005	N/A	3QFY2012
FY 2006	07/16/2002	N/A	2QFY2005	4QFY2005	N/A	1QFY2006	N/A	4QFY2010
FY 2007	07/16/2002	N/A	09/30/2005	1QFY2006	N/A	1QFY2006	N/A	1QFY2013
FY 2008	07/16/2002	N/A	09/30/2005	10/21/2005	N/A	1QFY2006	N/A	1QFY2013
FY 2009	07/16/2002	N/A	09/30/2005	TBD	N/A	TBD	N/A	TBD
FY 2010	07/16/2002	N/A	09/30/2005	TBD	N/A	TBD	N/A	TBD
FY 2011	07/16/2002	N/A	05/18/2005	TBD	N/A	TBD	N/A	TBD
FY 2012	07/16/2002	N/A	05/18/2005	4QFY2012	N/A	4QFY2012	N/A	TBD
FY 2012 Rep	07/16/2002	N/A	05/18/2005	TBD	TBD	TBD	N/A	TBD
FY 2016	07/16/2002	N/A	4QFY2014	3QFY2016	2QFY2016	3QFY2016	4QFY2019	4QFY2024
FY 2017	07/16/2002	N/A	08/21/2014	3QFY2016	2QFY2016	3QFY2016	4QFY2019	4QFY2024
FY 2018	07/16/2002	N/A	08/21/2014	2QFY2022	3QFY2021	2QFY2022	4QFY2026	4QFY2026
FY 2019	07/16/2002	8/21/2014	08/21/2014	4QFY2022	4QFY2022	4QFY2022	4QFY2026	4QFY2026[a]

[a] The indicated CD-4 dates for PEI2 and RC3 are preliminary estimates. At CD-2/3, the CD-4 dates for PEI2 and RC3 will be updated to reflect the approved performance baselines.

RLUOB Subproject (04-D-125-01)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2011	07/16/2002	N/A	05/18/2005	10/21/2005	N/A	10/21/2005	N/A	02/28/2010
FY 2012	07/16/2002	N/A	05/18/2005	10/21/2005	N/A	10/21/2005	N/A	06/24/2010
FY 2012 Rep	07/16/2002	N/A	05/18/2005	10/21/2005	N/A	10/21/2005	N/A	06/24/2010
FY 2016	07/16/2002	N/A	05/18/2005	10/21/2005	N/A	10/21/2005	N/A	06/24/2010
FY 2017	07/16/2002	N/A	05/18/2005	10/21/2005	N/A	10/21/2005	N/A	06/24/2010
FY 2018	07/16/2002	N/A	05/18/2005	10/21/2005	N/A	10/21/2005	N/A	06/24/2010
FY 2019	07/16/2002	N/A	05/18/2005	10/21/2005	N/A	10/21/2005	N/A	06/24/2010

RLUOB Equipment Installation (REI1) Subproject (04-D-125-02)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2011	07/16/2002	N/A	05/18/2005	07/17/2009	N/A	07/17/2009	N/A	04/30/2013
FY 2012	07/16/2002	N/A	05/18/2005	07/17/2009	N/A	07/17/2009	N/A	04/30/2013
FY 2012 Rep	07/16/2002	N/A	05/18/2005	07/17/2009	N/A	07/17/2009	N/A	3QFY2013
FY 2016	07/16/2002	N/A	05/18/2005	07/17/2009	N/A	07/17/2009	N/A	06/20/2013
FY 2017	07/16/2002	N/A	05/18/2005	07/17/2009	N/A	07/17/2009	N/A	06/20/2013
FY 2018	07/16/2002	N/A	05/18/2005	07/17/2009	N/A	07/17/2009	N/A	06/20/2013
FY 2019	07/16/2002	N/A	05/18/2005	07/17/2009	N/A	07/17/2009	N/A	06/20/2013

Nuclear Facility (NF) Subproject (04-D-125-03)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2011	07/16/2002	N/A	05/18/2005	TBD	N/A	TBD	N/A	TBD
FY 2012	07/16/2002	N/A	05/18/2005	4QFY2012	N/A	4QFY2012	N/A	TBD
FY 2012 Rep	07/16/2002	N/A	05/18/2005	TBD	TBD	TBD	N/A	TBD
FY 2016	07/16/2002	N/A	05/18/2005	Cancelled	Cancelled	Cancelled	N/A	Cancelled
FY 2017	07/16/2002	N/A	05/18/2005	Cancelled	Cancelled	Cancelled	N/A	Cancelled
FY 2018	07/16/2002	N/A	05/18/2005	Cancelled	Cancelled	Cancelled	N/A	Cancelled
FY 2019	07/16/2002	N/A	05/18/2005	Cancelled	Cancelled	Cancelled	N/A	Cancelled

REI Phase 2 (REI2) Subproject (04-D-125-04)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2016	07/16/2002	8/21/2014	8/21/2014	3QFY2016	2QFY2016	3QFY2016	N/A	1QFY2020
FY 2017	07/16/2002	8/21/2014	8/21/2014	3QFY2016	2QFY2016	3QFY2016	N/A	1QFY2020
FY 2018 PB	07/16/2002	8/21/2014	8/21/2014	10/31/2016	4/6/2016	10/31/2016	N/A	2QFY2022
FY 2019	07/16/2002	8/21/2014	8/21/2014	10/31/2016	4/6/2016	10/31/2016	N/A	2QFY2022

Fiscal Quarter or Date

Fiscal Year	Performance Baseline Validation	CD-3A	CD-3B
FY 2016		12/18/2014	2QFY2015
FY 2017		12/18/2014	12/22/2015
FY 2018		12/18/2014	12/22/2015
FY 2019		12/18/2014	12/22/2015

CD-3A – Approve Long-Lead Procurements
CD-3B – Approve Long-Lead Procurements

PF-4 Equipment Installation Phase 1 (PEI1) Subproject (04-D-125-05)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2016	07/16/2002	4QFY2015	4QFY2014	3QFY2016	2QFY2016	3QFY2016	4QFY2019	1QFY2024
FY 2017	07/16/2002	8/21/2014	08/21/2014	3QFY2016	2QFY2016	3QFY2016	4QFY2019	1QFY2020
FY 2018 PB	07/16/2002	8/21/2014	08/21/2014	10/31/2016	12/1/2016	10/31/2016	4QFY2019	3QFY2022
FY 2019	07/16/2002	8/21/2014	08/21/2014	10/31/2016	12/1/2016	10/31/2016	4QFY2019	3QFY2022

Fiscal Quarter or Date

Fiscal Year	Performance Baseline Validation	CD-3A	CD-3B
FY 2016		03/18/2015	12/22/2015
FY 2017		03/18/2015	12/22/2015
FY 2018		03/18/2015	12/22/2015
FY 2019		03/18/2015	12/22/2015

CD-3A – Approve Long-Lead Procurements
CD-3B – Approve Long-Lead Procurements

PF-4 Equipment Installation Phase 2 (PEI2) Subproject (04-D-125-06)/(PF-4 Reconfiguration Project – 17-D-126)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2016	07/16/2002	8/21/14	4QFY2014	3QFY2016	2QFY2016	3QFY2016	4QFY2019	1QFY2024
FY 2017	07/16/2002	8/21/14	08/21/2014	3QFY2016	2QFY2016	3QFY2016	4QFY2019	1QFY2024
FY 2018	07/16/2002	8/21/14	08/21/2014	4QFY2021	4QFY2020	4QFY2021	4QFY2026	4QFY2026
FY 2019	07/16/2002	8/21/14	08/21/2014	4QFY2022	4QFY2022	4QFY2022	4QFY2026	4QFY2026[a]

[a] The indicated CD-4 dates for PEI2 and RC3 are preliminary estimates. At CD-2/3, the CD-4 dates for PEI2 and RC3 will be updated to reflect the approved performance baselines.

Re-categorizing RLUOB to Hazard Category 3 (RC3) Subproject (04-D-125-07)/(RLUOB Reconfiguration Project – 17-D-125)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2016	07/16/2002	08/21/2014	4QFY2014	3QFY2018	2QFY2017	4QFY2017	N/A	1QFY2024
FY 2017	07/16/2002	08/21/2014	08/21/2014	3QFY2018	2QFY2017	4QFY2017	N/A	1QFY2024
FY 2018	07/16/2002	08/21/2014	08/21/2014	2QFY2022	3QFY2021	2QFY2022	N/A	4QFY2026
FY 2019	07/16/2002	08/21/2014	08/21/2014	2QFY2021	2QFY2021	2QFY2021	N/A	4QFY2026[a]

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete(d)
CD-3 – Approve Start of Construction
D&D Complete – Completion of D&D work
CD-4 – Approve Start of Operations or Project Closeout

Project Cost History

(Dollars in Thousands)

Fiscal Year	TEC, Design 03-D-103	TEC, Design/ Construction 04-D-125	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2004	N/A	N/A	500,000	100,000	N/A	N/A	600,000
FY 2005	N/A	N/A	500,000	100,000	N/A	N/A	600,000
FY 2006	N/A	N/A	750,000	100,000	N/A	N/A	850,000
FY 2007	N/A	N/A	738,097	100,000	N/A	N/A	838,097
FY 2008	65,939	672,158	738,097	100,000	N/A	N/A	838,098
FY 2009	TBD	TBD	TBD	TBD	N/A	TBD	TBD
FY 2010	65,138	TBD	TBD	TBD	N/A	TBD	TBD
FY 2016	63,646	2,295,936	2,359,582	463,721	54,000	517,721	2,877,303
FY 2017	63,646	2,243,436	2,307,082	516,221	54,000	570,221	2,877,303
FY 2018	63,573	2,209,842	2,273,415	549,815	54,000	603,815	2,877,230
FY 2019[a]	63,573	2,209,069	2,272,642	550,588	54,000	604,588	2,877,230

[a] The indicated project totals are preliminary estimates for PEI2 and RC3, and are at the high end of the cost range. They have been adjusted to balance the overall project. At CD-2/3, project estimates for PEI2 and RC3 will be updated to reflect the approved performance baselines.

RLUOB Subproject (04-D-125-01)[a]

(Dollars in Thousands)

Fiscal Year	TEC, Design 03-D-103	TEC, Design/ Construction 04-D-125	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2011	N/A	159,130	159,130	4,870	N/A	4,870	164,000
FY 2012	N/A	159,130	159,130	4,870	N/A	4,870	164,000
FY 2012 Rep	N/A	159,130	159,130	4,870	N/A	4,870	164,000
FY 2016	N/A	194,130	194,130	4,870	N/A	4,870	199,000
FY 2017	N/A	194,130	194,130	4,870	N/A	4,870	199,000
FY 2018	N/A	194,130	194,130	4,870	N/A	4,870	199,000
FY 2019	N/A	194,130	194,130	4,870	N/A	4,870	199,000

RLUOB Equipment Installation (REI1) Subproject (04-D-125-02)[a]

(Dollars in Thousands)

Fiscal Year	TEC, Design 03-D-103	TEC, Design/ Construction 04-D-125	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2011	N/A	152,900	152,900	46,500	N/A	46,500	199,400
FY 2012	N/A	152,900	152,900	46,500	N/A	46,500	199,400
FY 2012 Rep	N/A	152,900	152,900	46,500	N/A	46,500	199,400
FY 2016	N/A	151,963	151,963	44,797	N/A	44,797	196,760
FY 2017	N/A	151,963	151,963	44,797	N/A	44,797	196,760
FY 2018	N/A	151,963	151,963	44,797	N/A	44,797	196,760
FY 2019	N/A	151,963	151,963	44,797	N/A	44,797	196,760

Nuclear Facility (NF) Subproject (03-D-103 and 04-D-125-03)[b]

(Dollars in Thousands)

Fiscal Year	TEC, Design 03-D-103	TEC, Design/ Construction 04-D-125	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2011	65,138	TBD	TBD	TBD	N/A	TBD	TBD
FY 2012	65,138	3,239,862 – 5,169,862	3,305,000 – 5,235,000	405,000 - 625,000	N/A	405,000- 625,000	3,710,000 - 5,860,000
FY 2012 Rep	65,138	TBD	TBD	4,870	N/A	TBD	TBD
FY 2016	63,646	391,324	454,970	40,274	N/A	40,274	495,244
FY 2017	63,646	391,324	454,970	40,274	N/A	40,274	495,244
FY 2018	63,573	336,919	400,492	39,054	N/A	39,054	439,546
FY 2019	63,573	336,919	400,492	39,054	N/A	39,054	439,546

[a] Beginning in the FY 2016 Congressional Budget Justification Sheet, the completed subproject (RLUOB) and cancelled subproject (NF) total costs have been adjusted to match final expenditures. Final costs adjusted to account for official contract closeout of all past CMRR design and construction contracts.

[b] Beginning in the FY 2016 Congressional Budget Justification Sheet, the completed subproject (RLUOB) and cancelled subproject (NF) total costs have been adjusted to match final expenditures. Final costs adjusted to account for official contract closeout of all past CMRR design and construction contracts.

REI Phase 2 (REI2) Subproject (04-D-125-04)

(Dollars in Thousands)

Fiscal Year	TEC, Design 03-D-103	TEC, Design/ Construction 04-D-125	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2016	0	540,000	540,000	135,000	N/A	135,000	675,000
FY 2017	0	540,000	540,000	135,000	N/A	135,000	675,000
FY 2018	0	488,040	488,040	145,210	N/A	145,210	633,250
FY 2019	0	488,040	488,040	145,210	N/A	145,210	633,250

PF-4 Equipment Installation Phase 1 (PEI1) Subprojects (04-D-125-05)

(Dollars in Thousands)

Fiscal Year	TEC, Design 03-D-103	TEC, Design/ Construction 04-D-125	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2016	0	1,071,000	1,071,000	240,000	54,000	294,000	1,365,000
FY 2017	0	257,595	257,595	57,405	N/A	57,405	315,000
FY 2018	0	292,300	292,300	101,700	N/A	101,700	394,000
FY 2019	0	292,300	292,300	101,700	N/A	101,700	394,000

PF-4 Equipment Installation Phase 2 (PEI2) Subproject (04-D-125-06)/(PF-4 Reconfiguration Project – 17-D-126)

(Dollars in Thousands)

Fiscal Year	TEC, Design 03-D-103	TEC, Design/ Construction 04-D-125	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2017	0	471,500	471,500	159,500	54,000	213,500	685,000
FY 2018	0	475,538	475,538	145,802	54,000	199,802	675,340
FY 2019[a]	0	475,242	475,242	146,098	54,000	200,098	675,340

Re-categorizing RLUOB to Hazard Category 3 (RC3) Subproject (04-D-125-07)/(RLUOB Reconfiguration Project – 17-D-125)

(Dollars in Thousands)

Fiscal Year	TEC, Design 03-D-103	TEC, Design/ Construction 04-D-125	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2017	0	289,405	289,405	75,595	N/A	75,595	365,000
FY 2018	0	270,952	270,952	68,382	N/A	68,382	339,334
FY 2019[b]	0	270,475	270,475	68,859	N/A	68,859	339,334

[a] The indicated project totals are preliminary estimates for PEI2 and are at the high end of the cost range. These have been adjusted to balance the overall project. At CD-2/3, project estimates will be updated to reflect the approved performance baselines.

[b] The indicated project totals are preliminary estimates for RC3 are at the high end of the cost range. These have been adjusted to balance the overall project. At CD-2/3, project estimates for RC3 will be updated to reflect the approved performance baselines.

2. Project Scope and Justification

Scope

The CMRR Project as originally proposed relocated and consolidated mission critical analytical chemistry (AC), material characterization (MC), and actinide research and development (R&D) capabilities, and provided special nuclear material (SNM) storage and large vessel handling capabilities. The SNM storage and large vessel handling capabilities originally planned for CMRR-NF are not included in the current set of CMRR subprojects. This data sheet provides information related to four subprojects to transition AC and MC capabilities into RLUOB and PF-4 to ensure continuity in plutonium support capabilities and enable the cessation of program operations in CMR.

The CMRR line item subprojects are as follows:

- **RLUOB Subproject (04-D-125-01):** Construction of a 203,686 gross square foot (gsf) facility to house laboratory space capable of handling radiological quantities of SNM; a 22,071 gsf utility building sized to provide utility services (including chilled and hot water, potable hot/cold water, compressed air, and process gases) for all CMRR facility elements; office space for CMRR workers located outside of perimeter security protection systems; and space for centralized TA-55 training activities. The RLUOB became fully functional and operational after the completion of the equipment installation effort for this facility in the REI phase.

- **RLUOB Equipment Installation (REI1) Subproject (04-D-125-02):** Equipment installation included gloveboxes, hoods, AC/MC instrumentation, security and communication hardware, and final facility tie-ins and operational readiness/turnover activities. RLUOB equipment fabrication, installation, testing, and acceptance physically completed in FY 2012. Staff occupation of the office spaces has occurred and CD-4 has been approved. The facility exceeded its sustainability goal of LEED Silver by achieving LEED Gold in June 2012.

- **Nuclear Facility (NF) Subproject (04-D-125-03):** This subproject is cancelled with the remaining mission need (excluding SNM storage and large vessel handling) for CMRR to be met by REI2, PEI1, PEI2, and RC3.

- **REI Phase 2 (REI2) Subproject (04-D-125-04):** Maximizes the use of RLUOB laboratories by both reconfiguring some existing laboratory space and equipping empty laboratories with AC and MC capabilities. The RLUOB will operate at the increased radiological limit, 38.6 g of Pu-239 equivalent, consistent with the new limit established by NNSA Supplemental Guidance NA-1 SD G 1027, which enables additional AC and MC operations to move in. New gloveboxes/hoods and equipment will be installed in RLUOB through this subproject. This project makes progress toward ceasing program operations in CMR. Specific capabilities in REI2 scope include, but are not limited to, the following:
  - Trace Elements Sample Preparation
  - Mass Spectrometry Sample Preparation
  - X-Ray Fluorescence Sample Preparation and Instruments
  - Radiochemistry Counting Laboratory and Sample Preparation
  - Oxide and Metal Sample Distribution
  - Coulometry
  - AC and MC Capabilities for R&D and Troubleshooting

- **PF-4 Equipment Installation Phase 1 (PEI1) Subproject (04-D-125-05):** The PEI1 subproject involves the following: relocation of existing PF-4 processes to create open consolidated space, reusing existing gloveboxes for new processes, decontamination and decommissioning (D&D) of old gloveboxes/equipment in PF-4 to create open laboratory space; and, installation of new gloveboxes/equipment in the created open space. PEI1 will support the AC and MC capabilities that require the processing of larger amounts of nuclear material. This project makes progress toward ceasing program operations in CMR. These capabilities support pit production, pit surveillance, plutonium science and other national security programs. The removal work will be executed as site-prep work within this subproject. Specific capabilities in PEI1 scope include, but are not limited to the following:

- Sample Preparation Surface Science
- Mechanical Testing
- Physical Properties
- Small Sample Fabrication and Preparation

- **PF-4 Equipment Installation Phase 2 (PEI2) Subproject (04-D-125-06)/ (PF-4 Reconfiguration Project – 17-D-126):** Maximize use of PF-4 by consolidating and relocating existing capabilities, replacing existing equipment, installing gloveboxes and equipment and D&D of existing laboratory space for AC/MC capabilities. PEI2 will establish enduring AC and MC capabilities for supporting NNSA actinide-based missions. Specific capabilities in PEI2 scope include, but are not limited to the following:
  - Physical Properties
  - Small Sample Fabrication and Preparation
  - Mechanical Testing
  - Sample Preparation
  - Surface Science

- **Re-categorizing RLUOB to Hazard Category 3 (RC3) Subproject (04-D-125-07)/(RLUOB Reconfiguration Project – 17-D-125):** Maximize use of RLUOB by reconfiguring existing laboratory space, equipping the remaining empty laboratories with AC and MC capabilities, and re-categorizing RLUOB to a hazard category-3 facility with a material limit. RC3 will establish enduring AC and MC capabilities for supporting NNSA actinide-based missions. Specific capabilities in RC3 scope include, but are not limited to the following:
  - AC Sample Preparation
  - Pu Assay
  - Interstitial Analysis
  - Beryllium Analysis

Justification

As defined in the current Mission Need Statement (MNS), the mission of the Chemistry and Metallurgy Research Replacement Project is to ensure continuity in enduring analytical chemistry and materials characterization capabilities for NNSA actinide-based missions in support of stockpile stewardship. The AC and MC capabilities provided by this project support pit production, pit surveillance, plutonium science and other national security programs. During development of the plutonium strategy, a joint NNSA and DOD-CAPE business case analysis (BCA) indicated that optimizing RLUOB and repurposing space in PF-4 should be started as soon as possible to maintain continuity in AC and MC capabilities.

The project is being conducted in accordance with the project management requirements in DOE Order 413.3B, Program and Project Management for the Acquisition of Capital Assets.

Funds appropriated for this project may be used to provide independent assessments and other direct contractual support determined necessary by the FPD for the planning and execution of this project.

Key Performance Parameters (KPPs)

REI Phase 2 (REI2) Subproject (04-D-125-04): Transfer AC/MC capabilities from CMR to the RLUOB and complete transition to operations (i.e., preparation of operational startup, management self-assessments and hot testing) of AC/MC capabilities in eight RLUOB laboratory rooms as referenced in the CMRR REI2 and PEI1 Transition to Operations (TTO) Plan (CMRR-PLAN-00004) and PEP section 5.19 Transition to Operations.

PF-4 Equipment Installation Phase 1 (PEI1) Subproject (04-D-125-05): Transfer AC/MC capabilities from CMR to PF-4 and complete transition to operations (i.e., preparation of operational startup, management self-assessments and hot testing) of AC/MC capabilities in PF-4 Rooms 115/124 and nondestructive analysis (NDA) capability as referenced in the CMRR REI2 and PEI1 TTO Plan (CMRR-PLAN-00004) and PEP Section 5.20 Transition to Operations.

3. Project Cost and Schedule

Financial Schedule

Prior Subprojects (RLUOB/REI/Nuclear Facility)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Cost
Total Estimated Costs (TEC)			
Design (03-D-103-010)			
FY 2004	9,500	0	0
FY 2005	13,567	23,067	1,848
FY 2006	27,910	27,910	19,147
FY 2007	14,161	14,161	27,213
FY 2008	0	0	15,079
FY 2009	0	0	-329
FY 2010	0	0	44
FY 2011	0	0	0
FY 2012	-1,565	-1,565	339
FY 2013	0	0	188
FY 2014	0	0	44
FY 2015	73	73	0
FY 2016	-73	-73	0
Total Design (03-D-103-010)	**63,573**	**63,573**	**63,573**
Design (04-D-125)			
FY 2007	11,489	11,489	3,109
FY 2008	41,581	41,581	24,713
FY 2009	92,196	92,196	47,102
FY 2010	57,000	57,000	62,252
FY 2011	146,699	146,699	101,924
FY 2012	38,610	38,610	132,593
FY 2013	0	0	15,158
FY 2014	0	0	724
FY 2015	0	0	-646
FY 2016	0	0	0
FY 2017	0	0	0
FY 2018	0	0	0
FY 2019	-646	-646	0
Total Design (04-D-125)	**386,929**	**386,929**	**386,929**
Total Design			
FY 2004	9,500	0	0
FY 2005	13,567	23,067	1,848
FY 2006	27,910	27,910	19,147
FY 2007	25,650	25,650	30,322
FY 2008	41,581	41,581	39,792
FY 2009	92,196	92,196	46,773
FY 2010	57,000	57,000	62,296
FY 2011	146,699	146,699	101,924

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Cost
FY 2012	37,045	37,045	132,932
FY 2013	0	0	15,346
FY 2014	0	0	768
FY 2015	73	73	-646
FY 2016	-73	-73	0
FY 2017	0	0	0
FY 2018	0	0	0
FY 2019	-646	-646	0
Total Design (04-D-125)	**450,502**	**450,502**	**450,502**
Construction (04-D-125)			
FY 2004	9,941	0	0
FY 2005	39,684	49,625	0
FY 2006	54,450	54,450	15,933
FY 2007	41,933	41,933	29,214
FY 2008	32,560	32,560	50,236
FY 2009	4,998	4,998	62,288
FY 2010	40,000	40,000	40,515
FY 2011	59,000	59,000	82,942
FY 2012	14,868	14,868	16,306[a]
FY 2013	0	0	-5[b]
FY 2014	0	0	-68
FY 2015	-73	-73	-1,264
FY 2016	0	0	-14
FY 2017	0	0	0
FY 2018	0	0	0
FY 2019	-1,278	-1,278	0
FY 2020	0	0	0
FY 2021	0	0	0
Total Construction (04-D-125)	**296,083**	**296,083**	**296,083**
TEC (04-D-125)			
FY 2004	19,441	0	0
FY 2005	53,251	72,692	1,848
FY 2006	82,360	82,360	35,080
FY 2007	67,583	67,583	59,536
FY 2008	74,141	74,141	90,028
FY 2009	97,194	97,194	109,061
FY 2010	97,000	97,000	102,811
FY 2011	205,699	205,699	184,866
FY 2012	51,913	51,913	149,238
FY 2013	0	0	15,341
FY 2014	0	0	700
FY 2015	0	0	-1,910
FY 2016	-73	-73	-14

[a] Correction to prior year Appropriation and Obligation in Prior Subproject to reflect accurate distribution.
[b] Correction to prior year Appropriation and Obligation in Prior Subproject to reflect accurate distribution.

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Cost
FY 2017	0	0	0
FY 2018	0	0	0
FY 2019	-1,924	-1,924	0
FY 2020	0	0	0
FY 2021	0	0	0
Total TEC (04-D-125)	**746,585**	**746,585**	**746,585**
Other Project Cost (OPC)			
(OPC except D&D)			
FY 2002	1,665	1,665	1,665
FY 2003	12,177	12,177	10,853
FY 2004	7,214	7,214	7,702
FY 2005	7,164	7,164	4,934
FY 2006	1,209	1,209	4,265
FY 2007	4,187	4,187	1,196
FY 2008	0	0	2,335
FY 2009	9,000	9,000	9,075
FY 2010	14,403	14,403	14,666
FY 2011	30,668	30,668	19,240
FY 2012	1,051	0	9,142
FY 2013	0	1,051	3,665
FY 2014	0	0	-17
FY 2015	0	0	0
FY 2016	-17	-17	0
FY 2017	0	0	0
FY 2018	0	0	0
Total OPC except D&D (04-D-125)	**88,721**	**88,721**	**88,721**
Total Project Cost (TPC)			
FY 2002	1,665	1,665	1,665
FY 2003	12,177	12,177	10,853
FY 2004	26,655	7,214	7,702
FY 2005	60,415	79,856	6,782
FY 2006	83,569	83,569	39,345
FY 2007	71,770	71,770	60,732
FY 2008	74,141	74,141	92,363
FY 2009	106,194	106,194	118,136
FY 2010	111,403	111,403	117,477
FY 2011	236,367	236,367	204,106
FY 2012	52,964	51,913	158,380
FY 2013	0	1,051	19,006
FY 2014	0	0	683
FY 2015	0	0	-1,910
FY 2016	-90	-90	-14
FY 2017	0	0	0
FY 2018	0	0	0
FY 2019	-1,924	-1,924	0

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Cost
FY 2020	0	0	0
FY 2021	0	0	0
Total TPC (04-D-125)	**835,306**	**835,306**	**835,306**

REI Phase 2 (REI2) Subproject (04-D-125-04)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Cost
Design (04-D-125-04)			
FY 2012	32,000	0	0
FY 2013	0	0	0
FY 2014	0	32,000	841
FY 2015	9,359	9,359	19,452
FY 2016	840	840	21,564
FY 2017	2,617	2,617	2,271
FY 2018	0	0	688
Total Design (04-D-125-04)	**44,816**	**44,816**	**44,816**
Construction (04-D-125-04)			
FY 2012	4,140	0	0
FY 2013	0	0	0
FY 2014	0	0	0
FY 2015	0	3,299	3,299
FY 2016	107,160	104,701	29,447
FY 2017	55,383	58,683	91,100
FY 2018	111,691	111,691	121,421
FY 2019	99,262	78,224	98,937
FY 2020	60,270	74,128	86,522
FY 2021	5,318	12,498	12,498
Total Construction (04-D-125-04)	**443,224**	**443,224**	**443,224**
TEC (04-D-125-04)			
FY 2012	36,140	0	0
FY 2013	0	0	0
FY 2014	0	32,000	841
FY 2015	9,359	12,658	22,751
FY 2016	108,000	105,541	51,011
FY 2017	58,000	61,300	93,371
FY 2018	111,691	111,691	122,109
FY 2019	99,262	78,224	98,937
FY 2020	60,270	74,128	86,522
FY 2021	5,318	12,498	12,498
Total TEC (04-D-125-04)	**488,040**	**488,040**	**488,040**
Other Project Cost (OPC) (OPC except D&D)			
FY 2012	8,049	0	0

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Cost
FY 2013	0	0	0
FY 2014	0	8,049	4,371
FY 2015	79	79	363
FY 2016	9,000	9,000	3,061
FY 2017	17,000	10,000	8,835
FY 2018	15,334	18,892	29,390
FY 2019	50,000	40,000	37,375
FY 2020	30,000	43,442	40,290
FY 2021	15,748	15,748	21,525
Total OPC except D&D (04-D-125-04)	**145,210**	**145,210**	**145,210**
Total Project Cost (TPC)			
FY 2012	44,189	0	0
FY 2013	0	0	0
FY 2014	0	40,049	5,212
FY 2015	9,438	12,737	23,114
FY 2016	117,000	114,541	54,072
FY 2017	75,000	71,300	102,206
FY 2018	127,025	130,583	151,499
FY 2019	149,262	118,224	136,312
FY 2020	90,270	117,570	126,812
FY 2021	21,066	28,246	34,023
Total TPC (04-D-125-04)	**633,250**	**633,250**	**633,250**

PF-4 Equipment Installation Phase 1 (PEI1) Subproject (04-D-125-05)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Cost
Design (04-D-125-05)			
FY 2012	8,300	0	0
FY 2013	0	0	0
FY 2014	0	8,300	0
FY 2015	17,262	10,700	18,942
FY 2016	6,171	12,035	12,035
FY 2017	2,575	3,273	1,575
FY 2018	0	0	1,756
FY 2019	0	0	0
Total Design (04-D-125-05)	**34,308**	**34,308**	**34,308**
Construction (04-D-125-05)			
FY 2012	48,497	0	0
FY 2013	0	0	0
FY 2014	0	13,390	0
FY 2015	0	0	7,891
FY 2016	9,016	34,754	14,569
FY 2017	66,022	16,428	42,112
FY 2018	28,499	87,462	83,065
FY 2019	45,580	45,580	44,415

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Cost
FY 2020	54,574	54,574	52,545
FY 2021	5,804	5,804	13,395
FY 2022	0	0	0
FY 2023	0	0	0
FY 2024	0	0	0
Total Construction (04-D-125-05)	**257,992**	**257,992**	**257,992**
TEC (04-D-125-05)			
FY 2012	56,797	0	0
FY 2013	0	0	0
FY 2014	0	21,690	0
FY 2015	17,262	10,700	26,833
FY 2016	15,187	46,789	26,604
FY 2017	68,597	19,701	43,687
FY 2018	28,499	87,462	84,821
FY 2019	45,580	45,580	44,415
FY 2020	54,574	54,574	52,545
FY 2021	5,804	5,804	13,395
FY 2022	0	0	0
FY 2023	0	0	0
FY 2024	0	0	0
Total TEC (04-D-125-05)	**292,300**	**292,300**	**292,300**
Other Project Cost (OPC)			
(OPC except D&D)			
FY 2012	8,559	0	0
FY 2013	0	0	0
FY 2014	0	7,302	4,089
FY 2015	0	488	413
FY 2016	0	0	3,280
FY 2017	7,018	7,741	7,749
FY 2018	21,715	21,715	21,715
FY 2019	25,000	25,046	24,221
FY 2020	23,600	23,600	13,589
FY 2021	15,808	15,808	26,644
FY 2022	0	0	0
FY 2023	0	0	0
FY 2024	0	0	0
Total OPC except D&D (04-D-125-05)	**101,700**	**101,700**	**101,700**
Total Project Cost (TPC)			
FY 2012	65,356	0	0
FY 2013	0	0	0
FY 2014	0	28,992	4,089
FY 2015	17,262	11,188	27,246
FY 2016	15,187	46,789	29,884
FY 2017	75,615	27,442	51,436
FY 2018	50,214	109,177	106,536

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Cost
FY 2019	70,580	70,626	68,636
FY 2020	78,174	78,174	66,134
FY 2021	21,612	21,612	40,039
Total TPC (04-D-125-05)	**394,000**	**394,000**	**394,000**

PF-4 Equipment Installation Phase 2 (PEI2) Subproject (04-D-125-06)/(PF-4 Reconfiguration Project – 17-D-126)[a]

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Cost
Design (04-D-125-06)/(17-D-126)			
FY 2012	0	0	0
FY 2013	0	0	0
FY 2014	0	0	0
FY 2015	9,000	0	0
FY 2016	8,500	16,272	16,272
FY 2017	1,591	1,591	1,591
FY 2018	0	0	0
FY 2019	15,253	13,662	12,253
FY 2020	7,100	8,328	7,100
FY 2021	5,213	6,804	9,441
Total Design (04-D-125-06)/(17-D-126)	**46,657**	**46,657**	**46,657**
Construction (04-D-125-06)/(17-D-126)			
FY 2012	0	0	0
FY 2013	0	0	0
FY 2014	0	0	0
FY 2015	0	0	0
FY 2016	14,923	14,923	14,923
FY 2017	6,409	6,409	5,799
FY 2018	2,718	2,718	2,718
FY 2019	924	924	0
FY 2020	9,191	9,191	8,772
FY 2021	103,542	103,542	104,171
FY 2022	125,287	125,287	126,611
FY 2023	165,591	165,591	107,040
FY 2024	0	0	58,551
Total Construction (04-D-125-06)	**428,585**	**428,585**	**428,585**
TEC (04-D-125-06)/(17-D-126)			
FY 2012	0	0	0
FY 2013	0	0	0
FY 2014	0	0	0
FY 2015	9,000	0	0

[a] Outyear funding amounts for subprojects in 04-D-125 may be revised in future budget requests as NNSA develops the baselines for the remaining subprojects to support *Critical Decision (CD)-2/3, Approve Performance Baseline and Approve Start of Construction* for each subproject consistent with DOE Order 413.3B Change 4.

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Cost
FY 2016	23,423	31,195	31,195
FY 2017	8,000	8,000	7,390
FY 2018	2,718	2,718	2,718
FY 2019	16,177	14,586	12,253
FY 2020	16,291	17,519	15,872
FY 2021	108,755	110,346	113,612
FY 2022	125,287	125,287	126,611
FY 2023	165,591	165,591	107,040
FY 2024	0	0	58,551
Total TEC (04-D-125-06)/ (17-D-126)	**475,242**	**475,242**	**475,242**
Other Project Cost (OPC)			
(OPC except D&D)			
FY 2012	296	0	0
FY 2013	0	0	0
FY 2014	0	0	0
FY 2015	0	0	0
FY 2016	0	296	296
FY 2017	0	0	0
FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	0	0	0
FY 2021	20,491	20,491	19,930
FY 2022	33,989	33,989	33,950
FY 2023	30,322	30,322	30,787
FY 2024	61,000	61,000	61,135
Total OPC except D&D (04-D-125-06)/ (17-D-126)	**146,098**	**146,098**	**146,098**
Other Project Cost (OPC) D&D			
FY 2020	0	0	0
FY 2021	0	0	0
FY 2022	24,000	0	0
FY 2023	30,000	54,000	54,000
FY 2024	0	0	0
FY 2025	0	0	0
Total OPC D&D (04-D-125-06)/ (17-D-126)	**54,000**	**54,000**	**54,000**
Total Other Project Cost (OPC)			
FY 2012	296	0	0
FY 2013	0	0	0
FY 2014	0	0	0
FY 2015	0	0	0
FY 2016	0	296	296
FY 2017	0	0	0
FY 2018	0	0	0
FY 2019	0	0	0

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Cost
FY 2020	0	0	0
FY 2021	20,491	20,491	19,930
FY 2022	57,989	33,989	33,950
FY 2023	60,322	84,322	84,787
FY 2024	61,000	61,000	61,135
Total OPC (04-D-125-06)/(17-D-126)	**200,098**	**200,098**	**200,098**
Total Project Cost (TPC)			
FY 2012	296	0	0
FY 2013	0	0	0
FY 2014	0	0	0
FY 2015	9,000	0	0
FY 2016	23,423	31,491	31,491
FY 2017	8,000	8,000	7,390
FY 2018	2,718	2,718	2,718
FY 2019	16,177	14,586	12,253
FY 2020	16,291	17,519	15,872
FY 2021	129,246	130,837	133,542
FY 2022	183,276	159,276	160,561
FY 2023	225,913	249,913	191,827
FY 2024	61,000	61,000	119,686
Total TPC (04-D-125-06)/(17-D-126)	**675,340**	**675,340**	**675,340**

Re-categorizing RLUOB to Hazard Category 3 (RC3) Subproject (04-D-125-07)/(RLUOB Reconfiguration Project – 17-D-125)[a]

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Cost
Design (04-D-125-07)/(17-D-125)			
FY 2012	0	0	0
FY 2013	0	0	0
FY 2014	0	0	0
FY 2015	0	0	0
FY 2016	0	0	0
FY 2017	0	0	0
FY 2018	0	0	0
FY 2019	1,000	1,000	1,000
FY 2020	30,000	30,000	30,000
FY 2021	13,000	13,000	13,000
FY 2022	0	0	0
Total Design (04-D-125-07)/(17-D-125)	**44,000**	**44,000**	**44,000**
Construction (04-D-125-07)/(17-D-125)			
FY 2012	0	0	0

[a] Outyear funding amounts for subprojects in 04-D-125 may be revised in future budget requests as NNSA develops the baselines for the remaining subprojects to support *Critical Decision (CD)-2/3, Approve Performance Baseline and Approve Start of Construction* for each subproject consistent with DOE Order 413.3B Change 4.

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Cost
FY 2013	0	0	0
FY 2014	0	0	0
FY 2015	0	0	0
FY 2016	0	0	0
FY 2017	0	0	0
FY 2018	0	0	0
FY 2019	0	0	0
FY 2020	24,865	24,865	22,000
FY 2021	85,463	85,463	87,000
FY 2022	86,724	86,724	85,046
FY 2023	24,810	24,810	17,246
FY 2024	4,613	4,613	15,183
Total Construction (04-D-125-07)/ (17-D-125)	**226,475**	**226,475**	**226,475**
TEC (04-D-125-07)/(17-D-125)			
FY 2012	0	0	0
FY 2013	0	0	0
FY 2014	0	0	0
FY 2015	0	0	0
FY 2016	0	0	0
FY 2017	0	0	0
FY 2018	0	0	0
FY 2019	1,000	1,000	1,000
FY 2020	54,865	54,865	52,000
FY 2021	98,463	98,463	100,000
FY 2022	86,724	86,724	85,046
FY 2023	24,810	24,810	17,246
FY 2024	4,613	4,613	15,183
Total TEC (04-D-125-07)/ (17-D-125)	**270,475**	**270,475**	**270,475**
Other Project Cost (OPC)			
(OPC except D&D)			
FY 2012	639	0	0
FY 2013	0	0	0
FY 2014	0	0	0
FY 2015	0	0	0
FY 2016	0	162	162
FY 2017	1,000	1,000	321
FY 2018	943	943	1,622
FY 2019	0	477	477
FY 2020	0	0	0
FY 2021	3,619	3,619	1,733
FY 2022	15,000	15,000	13,000
FY 2023	33,277	33,277	31,437
FY 2024	14,381	14,381	20,107

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Cost
Total OPC except D&D (04-D-125-07)/(17-D-125)	**68,859**	**68,859**	**68,859**
Total Project Cost (TPC)			
FY 2012	639	0	0
FY 2013	0	0	0
FY 2014	0	0	0
FY 2015	0	0	0
FY 2016	0	162	162
FY 2017	1,000	1,000	321
FY 2018	943	943	1,622
FY 2019	1,000	1,477	1,477
FY 2020	54,865	54,865	52,000
FY 2021	102,082	102,082	101,733
FY 2022	101,724	101,724	98,046
FY 2023	58,087	58,087	48,683
FY 2024	18,994	18,994	35,290
Total TPC (04-D-125-07)/(17-D-125)	**339,334**	**339,334**	**339,334**

Total Project

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Cost
Design (03-D-103-010)			
FY 2004	9,500	0	0
FY 2005	13,567	23,067	1,848
FY 2006	27,910	27,910	19,147
FY 2007	14,161	14,161	27,213
FY 2008	0	0	15,079
FY 2009	0	0	-329
FY 2010	0	0	44
FY 2011	0	0	0
FY 2012	-1,565	-1,565	339
FY 2013	0	0	188
FY 2014	0	0	44
FY 2015	73	73	0
FY 2016	-73	-73	0
Total Design (03-D-103-010)	**63,573**	**63,573**	**63,573**
Design (04-D-125)			
FY 2007	11,489	11,489	3,109
FY 2008	41,581	41,581	24,713
FY 2009	92,196	92,196	47,102
FY 2010	57,000	57,000	62,252
FY 2011	146,699	146,699	101,924
FY 2012	78,910	38,610	132,593

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Cost
FY 2013	0	0	15,158[a]
FY 2014	0	40,300	1,565
FY 2015	35,621	20,059	37,748
FY 2016	15,511	29,147	49,871
FY 2017	6,783	7,481	5,437
FY 2018	0	0	2,444
FY 2019	15,607	14,016	13,253
FY 2020	37,100	38,328	37,100
FY 2021	18,213	19,804	22,441
FY 2022	0	0	0
Total Design (04-D-125)	**556,710**	**556,710**	**556,710**
Construction (04-D-125)			
FY 2004	9,941	0	0
FY 2005	39,684	49,625	0
FY 2006	54,450	54,450	15,933
FY 2007	41,933	41,933	29,214
FY 2008	32,560	32,560	50,236
FY 2009	4,998	4,998	62,288
FY 2010	40,000	40,000	40,515
FY 2011	59,000	59,000	82,942
FY 2012	67,505	14,868	16,306
FY 2013	0	0	-5
FY 2014	0	13,390	-68
FY 2015	-73	3,226	9,926
FY 2016	131,099	154,378	58,925
FY 2017	127,814	81,520	139,011
FY 2018	142,908	201,871	207,204
FY 2019	144,488	123,450	143,352
FY 2020	148,900	162,758	169,839
FY 2021	200,127	207,307	217,064
FY 2022	212,011	212,011	211,657
FY 2023	190,401	190,401	124,286
FY 2024	4,613	4,613	73,734
Total Construction (04-D-125)	1,652,359	1,652,359	1,652,359
TEC (04-D-125)			
FY 2004	19,441	0	0
FY 2005	53,251	72,692	1,848
FY 2006	82,360	82,360	35,080
FY 2007	67,583	67,583	59,536
FY 2008	74,141	74,141	90,028
FY 2009	97,194	97,194	109,061
FY 2010	97,000	97,000	102,811
FY 2011	205,699	205,699	184,866
FY 2012	144,850	51,913	149,238

[a] Correction to prior year Appropriation and Obligation in Prior Subproject to reflect accurate distribution.

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Cost
FY 2013	0	0	15,341
FY 2014	0	53,690	1,541
FY 2015	35,621	23,358	47,674
FY 2016	146,537	183,452	108,796
FY 2017	134,597	89,001	144,448
FY 2018	142,908	201,871	209,648
FY 2019	160,095	137,466	156,605
FY 2020	186,000	201,086	206,939
FY 2021	218,340	227,111	239,505
FY 2022	212,011	212,011	211,657
FY 2023	190,401	190,401	124,286
FY 2024	4,613	4,613	73,734
Total TEC (04-D-125)	**2,272,642**	**2,272,642**	**2,272,642**
Other Project Cost (OPC)			
(OPC except D&D)			
FY 2002	1,665	1,665	1,665
FY 2003	12,177	12,177	10,853
FY 2004	7,214	7,214	7,702
FY 2005	7,164	7,164	4,934
FY 2006	1,209	1,209	4,265
FY 2007	4,187	4,187	1,196
FY 2008	0	0	2,335
FY 2009	9,000	9,000	9,075
FY 2010	14,403	14,403	14,666
FY 2011	30,668	30,668	19,240
FY 2012	18,594	0	9,142
FY 2013	0	1,051	3,665
FY 2014	0	15,351	8,443
FY 2015	79	567	776
FY 2016	8,983	9,441	6,799
FY 2017	25,018	18,741	16,905
FY 2018	37,992	41,550	52,727
FY 2019	75,000	65,523	62,073
FY 2020	53,600	67,042	53,879
FY 2021	55,666	55,666	69,832
FY 2022	48,989	48,989	46,950
FY 2023	63,599	63,599	62,224
FY 2024	75,381	75,381	81,242
Total OPC except D&D	**550,588**	**550,588**	**550,588**
		Other Project Cost (OPC) D&D	
OPC D&D			
FY 2020	0	0	0
FY 2021	0	0	0
FY 2022	24,000	0	0
FY 2023	30,000	54,000	54,000

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Cost
FY 2024	0	0	0
FY 2025	0	0	0
Total OPC D&D	**54,000**	**54,000**	**54,000**
OPC Total			
OPC Total			
FY 2002	1,665	1,665	1,665
FY 2003	12,177	12,177	10,853
FY 2004	7,214	7,214	7,702
FY 2005	7,164	7,164	4,934
FY 2006	1,209	1,209	4,265
FY 2007	4,187	4,187	1,196
FY 2008	0	0	2,335
FY 2009	9,000	9,000	9,075
FY 2010	14,403	14,403	14,666
FY 2011	30,668	30,668	19,240
FY 2012	18,594	0	9,142
FY 2013	0	1,051	3,665
FY 2014	0	15,351	8,443
FY 2015	79	567	776
FY 2016	8,983	9,441	6,799
FY 2017	25,018	18,741	16,905
FY 2018	37,992	41,550	52,727
FY 2019	75,000	65,523	62,073
FY 2020	53,600	67,042	53,879
FY 2021	55,666	55,666	69,832
FY 2022	72,989	48,989	46,950
FY 2023	93,599	117,599	116,224
FY 2024	75,381	75,381	81,242
Total OPC	**604,588**	**604,588**	**604,588**
Total Project Costs (TPC)			
FY 2002	1,665	1,665	1,665
FY 2003	12,177	12,177	10,853
FY 2004	26,655	7,214	7,702
FY 2005	60,415	79,856	6,782
FY 2006	83,569	83,569	39,345
FY 2007	71,770	71,770	60,732
FY 2008	74,141	74,141	92,363
FY 2009	106,194	106,194	118,136
FY 2010	111,403	111,403	117,477
FY 2011	236,367	236,367	204,106
FY 2012	163,444	51,913	158,380
FY 2013	0	1,051	19,006[a]
FY 2014	0	69,041	9,984
FY 2015	35,700	23,925	48,450

[a] Correction to prior year Appropriation and Obligation in Prior Subproject to reflect accurate distribution.

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Cost
FY 2016	155,520	192,893	115,595
FY 2017	159,615	107,742	161,353
FY 2018	180,900	243,421	262,375
FY 2019	235,095	202,989	218,678
FY 2020	239,600	268,128	260,818
FY 2021	274,006	282,777	309,337
FY 2022	285,000	261,000	258,607
FY 2023	284,000	308,000	240,510
FY 2024	79,994	79,994	154,976
Total TPC	**2,877,230**	**2,877,230**	**2,877,230**

Details of Project Cost Estimate

Prior Subprojects (RLUOB/REI/Nuclear Facility)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	N/A	N/A	N/A
Contingency	N/A	N/A	N/A
Total, Design	450,502	450,502	N/A
Construction			
Site Work	N/A	N/A	N/A
Equipment	N/A	N/A	N/A
Construction	N/A	N/A	N/A
Other, as needed	N/A	N/A	N/A
Contingency	N/A	N/A	N/A
Total, Construction	296,083	296,083	N/A
Other TEC (if any)			
Cold Startup	N/A	N/A	N/A
Contingency	N/A	N/A	N/A
Total, Other TEC	N/A	N/A	N/A
Total Estimated Cost	746,585	746,585	N/A
Contingency, TEC	N/A	N/A	N/A
Other Project Cost (OPC)			
OPC except D&D			
R&D	N/A	N/A	N/A

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Conceptual Planning	N/A	N/A	N/A
Conceptual Design	N/A	N/A	N/A
Other OPC Costs	N/A	N/A	N/A
Contingency	N/A	N/A	N/A
Total, OPC	88,721	88,721	N/A
Contingency, OPC	N/A	N/A	N/A
Total Project Cost	835,306	835,306	N/A
Total Contingency (TEC+OPC)	N/A	N/A	N/A

REI Phase 2 (REI2) Subproject (04-D-125-04)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design			
Contingency			
Total, Design	44,816	44,816	44,816
Construction			
Site Work	5,461	5,461	5,461
Equipment	52,089	52,089	52,089
Construction	305,023	305,023	305,023
Other, as needed	0	0	0
Contingency	80,651	80,651	80,651
Total, Construction	443,224	443,224	443,224
Other TEC (if any)			
Cold Startup	N/A	N/A	N/A
Contingency	N/A	N/A	N/A
Total, Other TEC	N/A	N/A	N/A
Total Estimated Cost	488,040	488,040	488,040
Contingency, TEC	80,651	80,651	80,651
Other Project Cost (OPC)			
OPC except D&D			
R&D			

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Conceptual Planning	1,883	1,883	1,883
Conceptual Design	2,663	2,663	2,663
Other OPC Costs	81,070	81,070	81,070
Contingency	59,594	59,594	59,594
Total, OPC	145,210	145,210	145,210
Contingency, OPC	59,594	59,594	59,594
Total Project Cost	**633,250**	**633,250**	**633,250**
Total Contingency (TEC+OPC)	***140,245***	***140,245***	***140,245***

PF-4 Equipment Installation Phase 1 (PEI1) Subproject (04-D-125-05)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design			
Contingency			
Total, Design	34,308	34,308	34,308
Construction			
Site Work	43,054	43,054	45,054
Equipment	11,842	11,842	11,842
Construction	137,892	137,892	137,892
Other, as needed			
Contingency	65,204	65,204	65,204
Total, Construction	257,992	257,992	257,992
Other TEC (if any)			
Cold Startup	N/A	N/A	N/A
Contingency	N/A	N/A	N/A
Total, Other TEC	N/A	N/A	N/A
Total Estimated Cost	**292,300**	**292,300**	**292,300**
Contingency, TEC	*65,204*	*65,204*	*65,204*
Other Project Cost (OPC)			
OPC except D&D			
R&D			

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Conceptual Planning	2,189	2,189	2,189
Conceptual Design			
Other OPC Costs	63,686	63,686	86,686
Contingency	35,825	35,825	35,825
Total, OPC	**101,700**	**101,700**	**101,700**
Contingency, OPC	*35,825*	*35,825*	*35,825*
Total Project Cost	**394,000**	**394,000**	**394,000**
Total Contingency (TEC+OPC)	***101,029***	***101,029***	***101,029***

PF-4 Equipment Installation Phase 2 (PEI2) Subproject (04-D-125-06)/ (PF-4 Reconfiguration Project – 17-D-126)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design			N/A
Contingency			N/A
Total, Design	46,657	46,953	N/A
Construction			
Site Work			N/A
Equipment			N/A
Construction			N/A
Other, as needed			N/A
Contingency			N/A
Total, Construction	428,585	428,585	N/A
Other TEC (if any)			
Cold Startup			N/A
Contingency			N/A
Total, Other TEC			N/A
Total Estimated Cost	**475,242**	**475,538**	
Contingency, TEC			
Other Project Cost (OPC)			
OPC D&D			
OPC D&D	54,000	54,000	

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
OPC except D&D			
R&D			
Conceptual Planning			N/A
Conceptual Design			N/A
Other OPC Costs	146,098	145,802	N/A
Contingency			N/A
Total, OPC	**200,098**	**199,802**	N/A
Contingency, OPC			N/A
Total Project Cost	**675,340**	**675,340**	N/A
Total Contingency (TEC+OPC)			N/A

Re-categorizing RLUOB to Hazard Category-3 (RC3) Subproject (04-D-125-07)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design			N/A
Contingency			N/A
Total, Design	44,000	44,000	N/A
Construction			
Site Work			N/A
Equipment			N/A
Construction			N/A
Other, as needed			N/A
Contingency			N/A
Total, Construction	226,475	226,952	N/A
Other TEC (if any)			
Cold Startup			N/A
Contingency			N/A
Total, Other TEC			N/A
Total Estimated Cost	**270,475**	**270,952**	
Contingency, TEC			
Other Project Cost (OPC)			

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
OPC except D&D			
R&D			
Conceptual Planning			N/A
Conceptual Design			N/A
Other OPC Costs	68,859	68,382	N/A
Contingency			N/A
Total, OPC	68,859	68,382	N/A
Contingency, OPC			N/A
Total Project Cost	**339,334**	**339,334**	N/A
Total Contingency (TEC+OPC)			N/A

Schedule of Appropriations Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY2017	FY2018	FY2019	FY2020	FY2021	FY2022	OutYears	Total
FY 2009	TEC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	TPC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FY 2010	TEC	670,331	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	86,814	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	TPC	757,145	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FY 2011	TEC	1,856,330	0	0	0	0	0	0	1,532,769	3,389,099
	OPC	105,401	0	0	0	0	0	0	300,500	405,901
	TPC	1,961,731	0	0	0	0	0	0	1,833,269	3,795,000
FY 2012	TEC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	TPC	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FY 2016	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	1,139,093	159,615	180,900	216,095	239,600	289,000	294,000	359,000	2,877,303
FY 2017	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	1,139,093	159,615	180,900	216,095	239,600	289,000	294,000	359,000	2,877,303
FY 2018	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	1,139,020	159,615	180,900	236,095	239,600	274,000	289,000	359,000	2,877,230
FY 2019	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	1,139,020	159,615	180,900	235,095	239,600	274,006	285,000	363,994	2,877,230[a]

Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	1Q FY 2022
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	1Q FY 2072

Related Funding Requirements

(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	25	25	1,250	1,250

[a] Outyear funding amounts for subprojects in 04-D-125 may be revised in future budget requests as NNSA develops the baselines for the remaining subprojects to support Critical Decision (CD)-2/3, Approve Performance Baseline and Approve Start of Construction for each subproject consistent with DOE Order 413.3B Change 4.

D&D Information

For RLUOB and REI, the new area being constructed by these subprojects replaces existing facilities; however, the costs of D&D of the facilities that are being replaced are not included in the costs of this construction project.

For REI2, PEI1, PEI2, and RC3, there is no new area (footprint) being constructed in these subprojects.

Current Future Years Nuclear Security Program (FYNSP) funding profiles do not include the funding for the D&D of the CMR . CMR D&D is not part of the CMRR project scope. Some removal of contaminated equipment in PF-4 will occur using project funds; these totals are reflected in the D&D totals.

Square footage associated with construction of the RLUOB and the Central Utility Building will be offset by LANL "banked excess" D&D space. Given planned new construction (including RLUOB) at LANL and planned excess facility reductions, LANL is projecting it will have banked adequate square footage before CMR is demolished.

	REI1 Square Feet	REI2 Square Feet	PEI1 Square Feet	Office Building Square Feet
New area constructed previously by this project at Los Alamos National Laboratory	225,757	10,000	40,000	48,000
Area of D&D in this project at Los Alamos National Laboratory	0	0	0	0
Area at Los Alamos National Laboratory to be transferred, sold, and/or D&D outside the project including area previously "banked"	225,757	10,000	40,000	48,000
Area of D&D in this project at other sites	0	0	0	0
Area at other sites to be transferred, sold, and/or D&D outside the project including area previously "banked"	0	0	0	0
Total area eliminated	0	0	0	0

4. Acquisition Approach

The CMRR Acquisition Strategy is based on procurement strategies specific for each subproject of the CMRR project in order to mitigate overall technical and schedule risk. The RLUOB subproject was executed via LANL-issued design-build subcontract based on performance specifications developed during CMRR Conceptual Design. The REI subproject was executed via LANL-issued final design-bid build construction contracts. The REI2 subproject is being executed via LANL-issued final design-bid-build construction contracts. The PEI1 subproject is being executed, and the PEI2 subproject will be executed, via LANL-issued final design, and the construction will be self-performed in the PF-4. The RC3 subproject will be executed via LANL-issued final design-bid-build construction contract. Selected non-nuclear design and construction will be executed via the US Army Corps of Engineers. The performance baselines for each subproject will be established upon completion of 90% design maturity to allow development of credible cost estimates in accordance with DOE Order 413.3B and NNSA policy.

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Secure Transportation Asset

Overview

The Secure Transportation Asset (STA) program safely and securely transports nuclear weapons, weapons components, and special nuclear materials to meet projected DOE, DOD, and other customer requirements.

The STA program includes the Operations and Equipment and Program Direction subprograms. The Operations and Equipment subprogram provides for STA's transportation service infrastructure, which is critical in meeting NNSA's nuclear security enterprise initiatives documented in the Stockpile Stewardship and Management Plan. The Program Direction subprogram provides salaries, travel, and other related expenses for the federal agents and the secure transportation workforce.

The STA current mission capacity will meet the prioritized NNSA Stockpile refurbishment and modernization initiatives and other DOE workload. The Secure Transportation Steering Committee will continue to balance and prioritize customer requests against STA capacity. Since its formal creation in 1974, the program has maintained its long legacy of no loss of cargo and no radiological release on any shipment. However, aging transportation assets must be replaced in order to maintain the required safe and secure convoy profile.

Highlights of the FY 2019 Budget Request

The pillars of the STA security concept are specialized vehicles to include highly secure trailers, well trained agents, and robust communication systems. The $278,639,000 FY 2019 Budget Request is +$29,750,000 or 12 percent above the FY 2017 enacted amount. In FY 2019, Mobile Guardian Transporter (MGT) development includes the completion of both the Prototype 2 (P-2) Rolling Chassis Manufacturing Readiness Review and the Cargo Manufacturing Readiness Review, as well as the assembly, integration, and crash test of Prototype 1 (P-1). The FY 2019 funding also supports the Safeguards Transporter (SGT) risk reduction initiatives to extend the life of the SGT, replacement of vehicles and tractors, and efforts to restore federal agent strength levels required to meet the STA mission capacity. The increase in Program Direction funding supports inflation as well as the anticipated increase in federal agents and services to support the workforce in accomplishing the mission.

Since the earliest possible date to field the MGT is FY 2025, STA implemented a risk reduction effort to keep a portion of the SGT fleet in operation far beyond the 20-year service life. SGTs were designed to meet safety standards through FY 2018 and safety risk will continue to increase over time. The risk-reduction efforts continue to ensure the SGT meets Nuclear Explosive Safety Study (NESS) requirements associated with transporting nuclear weapons and components. In FY 2019 STA will perform a side impact crash test of the MGT P-1 unit, with the completion of the baseline design review in FY 2020. The final design process begins in FY 2020 and is scheduled for completion in FY 2021. The procurement process for Prototype 2 (P-2) begins in FY 2020. The planned MGT funding profile reflects the First Production Unit (FPU) in late FY 2025.

STA has committed to a stable human resources strategy to achieve an optimal agent force structure and meet the NNSA's nuclear security enterprise priorities and mission requirements. It takes many years to achieve any substantial growth in the agent force due to a 20 year retirement, stringent hiring process, and attrition. Efforts to increase Federal Agent staffing numbers include modifications to the position qualifications, level of risk acceptance associated with the Human Reliability Program (HRP), and clearance requirements for Federal Agent Candidates to allow participation in the Nuclear Material Courier Basic training without a clearance. Initiatives have been implemented that allow recruits to be brought on board and placed into Agent training once the psychological and medical screening are successfully completed. Currently STA is 86 Federal Agents short of being fully staffed. NNSA began multiple new hiring initiatives in FY 2017. With these in place STA anticipates onboarding 36 Agents in FY 2018 and 40 in FY 2019.

Major Outyear Priorities and Assumptions

Outyear funding levels for Secure Transportation Asset total $1,359,710,000 for FY 2020 through FY 2023. STA priorities include the following:

- Provide for STA's transportation service infrastructure such as specialized vehicles to include highly secure trailers, well trained agents, and robust communication systems

- Provide personnel to support the safe and secure transportation of nuclear weapons, weapons components and special nuclear materials

Secure Transportation Asset
Funding

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Secure Transportation Asset				
Operations and Equipment	151,771	150,741	176,617	+24,846
Program Direction - Albuquerque	97,118	96,458	102,022	+4,904
Total, Secure Transportation Asset	**248,889**	**247,199**	**278,639**	**+29,750**

Outyears for Secure Transportation Asset
Funding

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Secure Transportation Asset (STA)				
Operations and Equipment	226,882	215,801	220,089	224,860
Program Direction - Albuquerque	112,804	116,632	119,860	122,782
Total, Secure Transportation Asset	**339,686**	**332,433**	**339,949**	**347,642**
Federal FTEs	**517**	**519**	**519**	**522**

Secure Transportation Asset
Funding

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Secure Transportation Asset (STA)				
Operations and Equipment				
Mission Capacity	57,890	52,061	62,893	+5,003
Security/Safety Capability	17,742	19,510	20,683	+2,941
Infrastructure and C5 Systems	25,512	20,878	30,392	+4,880
Program Management	9,475	10,458	10,817	+1,342
Mobile Guardian Transporter	41,152	47,834	51,832	+10,680
Total, Operations and Equipment	**151,771**	**150,741**	**176,617**	**+24,846**
Program Direction				
Salaries and Benefits	79,004	78,467	81,639	+2,635
Travel	5,085	5,050	5,664	+579
Other Related Expenses	13,029	12,941	14,719	+1,690
Total, Program Direction	**97,118**	**96,458**	**102,022**	**+4,904**
Total, Secure Transportation Asset	**248,889**	**247,199**	**278,639**	**+29,750**
Federal FTEs - Program Direction Funded	491	509	512	+21
Federal FTEs - WCF Funded	0	0	0	0

Secure Transportation Asset
Explanation of Major Changes
(Dollars in Thousands)

	FY 2019 Request vs FY 2017 Enacted
Secure Transportation Asset	
Operations and Equipment: The MGT program development schedule includes increases for the completion of both the Prototype 2 (P-2) Rolling Chassis Manufacturing Readiness Review and the Cargo Manufacturing Readiness Review as well as the assembly, integration, and crash test of Prototype 1 (P-1). In addition, funding will support SGT Risk Reduction Initiatives to maintain the SGT beyond its 20 year useful life, performance of deferred maintenance and minor construction projects of existing facilities, purchase of Federal Agent equipment and vehicles, procurement of upgraded long-lead communications equipment for the Transportation Emergency Control Center (TECC)/Emergency Operations Center to support the transition to the new NNSA Complex in FY 2020, and initiation of the design, production, and receipt of the First Production Unit and three (3) additional units of the Next Generation Armored Tractor.	+24,846
Program Direction: The funding increase supports inflation as well as efforts to increase the number of federal agents. Efforts to increase Federal Agent staffing numbers include modifications to the position qualifications, level of risk acceptance associated with the Human Reliability Program (HRP) and clearance requirements for Federal Agent Candidates to allow participation in the Nuclear Material Courier Basic training without a clearance. Initiatives have been implemented that allow recruits to be brought on board and placed into Agent training once the psychological and medical screenings are successfully completed. The increase also reflects STA's portion of the Albuquerque Complex fees, DOE Common Operating Environment (DOECOE) Information Technology Fees, as well as inflation on support service contracts.	+4,904
Total, Secure Transportation Asset	**+ 29,750**

Secure Transportation Asset
Operations and Equipment

Description
Within the STA Operations and Equipment subprogram, five activities make unique contributions to the safety and security of the nuclear stockpile. These activities accomplish the following:

(1) Mission Capacity – provides mission-essential agent equipment, maintenance, modification, and replacement of the transportation fleet, and aviation services
(2) Security/Safety Capability - provides Agent Candidate Training (ACT) to increase the federal agent workforce, develop and implement new fleet technologies, execute agent sustainment training, and implement Security, Safety, and Emergency Response programs, uniforms, or allowances as authorized by 5 U.S.C. 5901-5902
(3) Infrastructure and Command and Control, Communication, Computer and Cyber (C5) Systems - provides support for minimal maintenance and minor construction projects and C5 systems
(4) Program Management - provides corporate functions and business operations that control, assist, and direct secure transport operations
(5) Mobile Guardian Transporter (MGT) – provides the design, development, test, and fabrication of the MGT

The Mission Capacity activity sustains STA systems capacity through equipment purchases to fulfill the present transportation requirements. STA must maintain assets to support current and future missions based on changing customer needs and threats. These assets include agent equipment, vehicles (tractors, trailers, and escort vehicles), and aircraft. Modernizing and sustaining these assets requires an integrated, long-term strategy and a substantial investment. The STA strategy includes eliminating outdated assets, refurbishing existing assets to extend their useful life, and procuring new assets. This includes the following activities:
(1) Replace the vehicle fleet with new-vehicles including the design, engineering, testing, and fielding of specialized vehicles, tractors, and trailers necessary for successful convoy operations
(2) Maintain the aviation program, to include the maintenance, sustainment, and replacement of the aircraft fleet
(3) Maintain the readiness posture of the STA fleet

The Security/Safety Capability activity sustains STA systems capacity through safety and security upgrades. This includes the following activities:
(1) Identify, design, and test new fleet and mission technologies. Deliverables include safety and security upgrades as well as enhancements to the secure trailers, analysis of intelligence data, dissemination of information, and the application of emerging physical security technology
(2) Conduct ACT classes to increase the agent end-strength, including the equipping and training of federal agent candidates
(3) Maintain specialized federal agent skills and qualifications, sustain and support training to include technical equipment, logistics, curriculum development, and staffing necessary to conduct Special Response Force (SRF) training, Operational Readiness Training (ORT), Validation Force-on-Force (VFOF) exercises, and agent sustainment training. Sustainment training includes surveillance detection, tactics, advanced driving, and firearms. Contracts for mission operation support and off-site training venues capable of supporting unit or command training
(4) Maintain security and safety programs. Includes liaison activities with state and local law enforcement organizations, analysis of security methods and equipment, vulnerability assessments, development of the Safeguards and Security Plan and combat simulation computer modeling, validation of safety and security, and execution of safety studies and safety engineering for the Safety Basis, Nuclear Explosive Safety, and over-the-road safety issues
(5) Maintain the NNSA Emergency Operations Center (EOC) in Albuquerque, New Mexico and train and exercise the STA response capability. Includes the Emergency Management Program, Federal Agent Incident Command System refresher, and sustainment training
(6) Research unmanned systems to determine viability for use in the STA mission to conduct safe and secure operations

The Infrastructure and Command, and Control, Communication, Computer, and Cyber (C5) Systems activity sustains the infrastructure and command and control system platforms operated by STA. Mission support systems provide the critical information necessary to ensure mission success. This includes the information that is obtained, analyzed, and disseminated prior to the mission, the continuous monitoring of that information to ensure it is accurate and valid, and the constant communication within the convoys and between the convoy and headquarters. This must be accomplished seamlessly in real-time while balancing the evolving requirements of cyber security to ensure system reliability and integrity. Additionally, STA will leverage other information technology systems supporting business processes and operations to improve the efficiency and effectiveness of the STA mission. This funding supports the following sub-elements:

(1) Modernize and maintain C5 systems activities to maintain vigilant oversight of nuclear convoys. Operate the Transportation Emergency Control Centers (TECC) and maintain the New Mexico Relay Station, as well as maintain communications systems across the STA
(2) Maintain and expand a secure unclassified to classified controlled interface, Mission Management System. This allows communications from unclassified to classified systems, and maintenance and enhancement of a common operating picture for the TECC as well as convoys
(3) Expand, upgrade, and maintain the STA facilities and equipment in support of mission requirements. STA has approximately 68 facilities, many of which are in disrepair as a result of deferred maintenance. This includes utilities, maintenance, upgrades, and minor construction projects. Facilities include federal agent commands, vehicle mechanical and electronic maintenance facilities, training facilities, and facilities operated to house support staff

The Program Management activity creates a well-managed, responsive, and accountable organization by employing effective business practices for the STA program. This goal includes:

(1) Corporate functions such as technical document support and business operations that control, assist, and direct secure transport operations including supplies, equipment, and regulation control processes
(2) Assess, evaluate, and improve work functions and processes including self-assessments, routine STA intranet support, configuration management, implementation of the Quality Assurance program, and business integration activities

The Mobile Guardian Transporter (MGT) activity provides for the design, development, and testing of the MGT, the replacement for the existing SGT. The MGT will assure the safety and security of existing and planned future cargo and containers, protect the public and meet nuclear explosive safety requirements associated with accident scenarios, reduce the risk to new security threats, and provide the means for enhanced communications. This includes the following activities:

(1) Prototype Assembly and Testing
(2) Mechanical Systems Development
(3) Electronics and Auxiliary Systems Development
(4) Active Delay System (ADS) Development
(5) Assembly Integration and Test
(6) Enhanced Cargo Restraint Development

FY 2020 - FY 2023 Key Milestones

- Continue risk reduction efforts to keep a portion of the SGT fleet in operation far beyond the 20-year service life
- Continue MGT development towards the first production unit delivery in FY 2025
- Continue to purchase Federal Agent equipment and vehicles

Operations and Equipment

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Operations and Equipment $151,771,000	**Operations and Equipment $176,617,000**	**Operations and Equipment +$24,846,000**
Mission Capacity $57,890,000	**Mission Capacity $62,893,000**	**Mission Capacity +$5,003,000**
• Accepted Delivery of 14 Escort Vehicle-light Chassis, 8 Support Vehicles, and 7 Replacement Armored Tractors (RATs). • Initiated activities for aviation maintenance contract re-compete.	• Design and build the Next Generation Armored Tractor to obtain steady state production; Includes delivery of the First Production Unit and three (3) additional tractors. • Build 12 SV2 vehicles, refurbish 6 EVLCs.	The increase represents inflation and: • Initiation of the design and build of the Next Generation Armored Tractor. • Increase in Support Vehicle production requirements. • Increase for Safeguards Transporter (SGT) risk reduction initiatives.
Security/Safety Capability $17,742,000	**Security/Safety Capability $20,683,000**	**Security/Safety Capability +$2,941,000**
• Conducted ACT classes. • Conducted an operational emergency response exercise. • Conducted Security Site Survey and Staff Assistance Visits.	• Conduct ACT classes. • Conduct an operational emergency response exercise. • Continue research and testing of unmanned systems to determine viability for use in the STA mission. • Conduct Security Site Survey and Staff Assistance Visits. • Continue National Incident Management System/Incident Command System (NIMS/ICS) training program for agents and staff.	• The increase reflects inflation for support service contracts and M&Os as well as efforts to identify use of unmanned systems.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Infrastructure and C5 Systems $25,512,000	**Infrastructure and C5 Systems $30,392,000**	**Infrastructure and C5 Systems +$4,880,000**
• Implemented increased capability for STA's Mission Management System (MMS), a data warehouse for long-term storage of STA mission data. • Provided for minor construction projects at the federal agent commands and STA Headquarters (HQs).	• Integrate High-Frequency Communications systems into the vehicle fleet as a backup system to reach the Transportation Emergency Control Center (TECC) in the event of Internet collapse. • Implement STA Active Security Doctrine in cyber security operations. • Apply additional data to the Mission Management System (MMS) (Phase IV) to include personnel schedules, qualifications, and maintenance information to enhance STA's Common Operating Picture. • Procure upgraded long-lead communications equipment for the TECC/Emergency Operations Center to support the transition to the new NNSA Complex in FY 2020. • Implement the Vehicle and Property Management System • Conduct maintenance and minor construction projects at the federal agent commands and STA HQs.	• The increase represents costs for performing deferred maintenance and minor construction projects at STA facilities and the procurement of upgraded long-lead communications equipment for the TECC/Emergency Operations Center to support the transition to the new NNSA Complex in FY 2020.
Program Management $9,475,000	**Program Management $10,817,000**	**Program Management +$1,342,000**
• Executed program with efficient support service contracts for acquisitions and personnel service support. • Conducted Quality Assurance assessments. • Continued corporate business services and integration activities.	• Execute program with efficient support service contracts for acquisitions and personnel service support. • Conduct Quality Assurance assessments. • Continue corporate business services and integration activities.	• The increase reflects inflation applied to support services and M&O support.
Mobile Guardian Transporter $41,152,000	**Mobile Guardian Transporter $51,832,000**	**Mobile Guardian Transporter +$10,680,000**
• Continued baseline design activities. • Completed Crash Unit Manufacturing Readiness Review.	• Assembly, integration, and testing of Prototype 1 (P-1) 　○ Includes side impact crash testing of P-1. • Completion of the Prototype 2 (P-2) Rolling Chassis Manufacturing Readiness Review. • Completion of the Cargo Manufacturing Readiness Review.	• The increase reflects several critical MGT milestones including assembly integration and testing of P-1 (to include the P-1 crash test) and completion of the P-2 Rolling Chassis Manufacturing Readiness Review and the Cargo Manufacturing Readiness Review.

Secure Transportation Asset
Program Direction

Description

The STA Program Direction subprogram provides personnel to support the security and safety of the nuclear stockpile. The total planned Full Time Equivalents (FTEs) support the federal agent force, federal pilots, emergency management, security and safety programs and other key elements of the STA mission. The subprogram includes execution of the Human Reliability Program (HRP), Albuquerque Complex fees, Department of Energy Common Operating Environment (DOECOE) Information Technology Infrastructure services, and support systems for staff.

Salaries and benefits are provided for the program staff located at Albuquerque, New Mexico; Fort Chaffee, Arkansas; and for federal agents and support staff at the three federal agent force locations in Albuquerque, New Mexico, Oak Ridge, Tennessee, and Amarillo, Texas. It also includes salaries, overtime, worker's compensation, and health/retirement benefits associated with federal agents, secondary positions, and support staff. The total onboard count may not match the planned FTEs. Funding allocations account for projected/average vacancy rates over the entire year and may not match actual onboard FTEs at any given time.

Travel is associated with secure convoys, training at other federal facilities and military installations, and program oversight.

Other Related Expenses provides required certification training for the handling of nuclear materials by federal agents as well as staff professional development. Maintains the HRP for federal agents and designated staff. Provides for Permanent Change of Station (PCS) moves and other contractual service requirements to include facility maintenance, Albuquerque Complex fee, which includes a portion of the security fees, utilities, and other services rendered. In addition, provides payment for the DOECOE Information Technology infrastructure services.

FY 2020 - FY 2023 Key Milestones

- Provide for salaries, travel, and other related expenses for the federal agents and the secure transportation federal and non-federal workforce.

Program Direction

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Program Direction $97,118,000	**Program Direction $102,022,000**	**Program Direction +$4,904,000**
Salaries and Benefits $79,004,000	**Salaries and Benefits $81,639,000**	**Salaries and Benefits +$2,635,000**
• Recruited, hired, and retained quality personnel based on current and future mission needs. • Continued to fill agent vacancies to support workload requirements. • Conducted Agent Candidate Training (ACT) classes.	• Recruit, hire, and retain quality personnel based on current and future mission needs. • Continue to fill agent vacancies to support workload requirements. • Continue to conduct ACT classes.	• The increase supports efforts to increase the number of federal agents including modifications to the position qualifications and level of risk acceptance associated with the Human Reliability Program (HRP) and clearance requirements for Federal Agent Candidates to allow participation in the Nuclear Material Courier Basic training without a clearance.
Travel $5,085,000	**Travel $5,664,000**	**Travel +$579,000**
• Continued to support travel required to transport nuclear weapons, components, and special nuclear material. • Continued to support federal facilities that provided unique training to maintain agent skill sets.	• Continue to support travel required to transport nuclear weapons, components, and special nuclear material. • Continue to support federal facilities that provide unique training to maintain agent skill sets.	• The increase supports projected travel requirements for FY 2019.
Other Related Expenses $13,029,000	**Other Related Expenses $14,719,000**	**Other Related Expenses +$1,690,000**
• Applied HRP reviews to ACT candidates. • Conducted federal agent candidate training at Federal Law Enforcement Training Center (FLETC) • Provided for processing of security clearances. • Supported Department of Energy Common Operating Environment (DOECOE) and tenant fees.	• Apply HRP reviews to incumbents and ACT candidates. • Conduct federal agent candidate training at FLETC. • Processing of security clearances. • Support DOECOE and Albuquerque Complex tenant fees.	• The increase represents inflation, increased training and Albuquerque Complex tenant fees.

Secure Transportation Asset
Performance Measures

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Safe and Secure Shipments - Annual percentage of shipments completed safely and securely without compromise/loss of nuclear weapons/components or a release of radioactive material.							
Target	100% of shipments	100% of shipments	100% of shipments	100% of shipments	100% of shipments	100% of shipments	100% of shipments
Result	**Met** - 100						
Endpoint Target	Annually, ensure that 100% of shipments are completed safely and securely without compromise/loss of nuclear weapons/components or a release of radioactive material.						

Secure Transportation Asset
Capital Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2017 Current	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted	Outyears to Completion
Capital Operating Expenses Summary (including Major Items of Equipment (MIE))								
Capital Equipment >$500K (including MIE)	N/A	60,693	2,749	2,749	2,809	2,871	+122	N/A
Plant Projects (GPP and IGPP)	N/A	3,840	0	0	0	0	0	N/A
Total, Capital Operating Expenses	**N/A**	**64,533**	**2,749**	**2,749**	**2,809**	**2,871**	**+122**	N/A
Capital Equipment > $500K (including MIE)								
Total Non-MIE Capital Equipment	N/A	60,693	2,749	2,749	2,809	2,871	+122	N/A
Total, Capital Equipment (including MIE)	N/A	**60,693**	**2,749**	**2,749**	**2,809**	**2,871**	**+122**	**0**
Plant Projects (GPP and IGPP)								
Total Plant Projects (GPP/IGPP)	N/A	3,840	0	0	0	0	0	0
Total, Plant Projects (GPP/IGPP)	**N/A**	**3,840**	**0**	**0**	**0**	**0**	**0**	**0**
Total, Capital Summary	**N/A**	**64,533**	**2,749**	**2,749**	**2,809**	**2,871**	**+122**	**0**

Outyears for Secure Transportation Asset

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Capital Operating Expenses Summary (including MIE)				
Capital Equipment >$500K (including MIE)	2,934	2,999	3,065	3,132
Plant Projects (GPP)	0	0	0	0
Total, Capital Operating Expenses	**2,934**	**2,999**	**3,065**	**3,132**

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Defense Nuclear Security

Overview
The Defense Nuclear Security (DNS) program is an essential component of the NNSA nuclear security enterprise. The core mission is to develop and implement security programs, including protection, control, and accountability of materials, as well as the physical security of NNSA facilities, including the national laboratories, production plants, processing facilities, and the Nevada National Security Site (NNSS), which support NNSA missions. DNS provides protection for NNSA personnel, facilities, nuclear weapons, and materials from a full spectrum of threats, ranging from minor security incidents to acts of terrorism. In addition, DNS provides nuclear security expertise for a broad set of 21st century national security needs, in line with its core mission, such as those in defense nuclear nonproliferation, homeland security, and intelligence. DNS employs over 1,500 protective force officers, securing more than 4,400 buildings, and protecting over 49,800 personnel.

Highlights of the FY 2019 Budget Request
The $690,638,000 FY 2019 Budget Request is +5,138,000 or 1% above the FY 2017 enacted amount. The Budget Request for FY 2019 includes funding to fill positions in key security program areas at the sites, including protective forces, physical security systems, information security, technical security, personnel security, nuclear material control and accountability, and security program operations and planning. It also includes planning and conceptual design funds for a series of future projects to sustain and recapitalize the Perimeter Intrusion Detection and Assessment Systems (PIDAS) at the Pantex Plant and Y-12 National Security Complex. Design work for PIDAS projects is underway. Preliminary estimates are included within the recently completed 10-year Refresh Plan, and future budget requests will reflect the detailed funding requirements. Because work is in the planning phase, currently, no PIDAS fencing is scheduled to be constructed in FY 2019.

In FY 2020, the Device Assembly Facility (DAF) Argus Line Item Project at the NNSS will reach completion. Remaining Other Project Costs (OPC) funds will be used for project certification and turnover to operations. Argus is the NNSA standard security system to integrate access control, intrusion detection, and video assessment of alarms for protection of high consequence assets.

Major Outyear Priorities and Assumptions
Outyear funding levels for Defense Nuclear Security total $3,128,933 for FY 2020 through FY 2023. This assumes no significant cost increases for Design Basis Threat (DBT) implementation or other major changes in security requirements to support NNSA program work.

- Complete Counter Unmanned Aerial System (C-UAS) deployment
- Continue executing critical security infrastructure projects
- Implement the 2016 DBT policy based on updated analyses

Defense Nuclear Security
Funding

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Defense Nuclear Security				
Operations and Maintenance				
Protective Forces	393,764	391,090	376,279	-17,485
Physical Security Systems	98,540	97,871	105,193	+6,653
Information Security	32,766	32,543	43,011	+10,245
Personnel Security	33,516	33,288	40,376	+6,860
Materials Control and Accountability	26,965	26,782	31,125	+4,160
Security Program Operations and Planning	84,449	83,876	94,654	+10,205
Total, Operations and Maintenance	**670,000**	**665,450**	**690,638**	**+20,638**
Construction	15,500	15,395	0	-15,500
Total, Defense Nuclear Security	**685,500**	**680,845**	**690,638**	**+5,138**

Outyears for Defense Nuclear Security
Funding

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Defense Nuclear Security				
Operations and Maintenance				
Protective Forces	371,359	379,157	387,120	395,249
Physical Security Systems	107,403	111,658	114,975	114,312
Information Security	43,914	44,836	45,778	46,739
Personnel Security	41,224	42,090	42,974	43,876
Materials Control and Accountability	31,779	32,446	33,127	33,823
Security Program Operations and Planning	96,646	98,676	100,748	102,864
Total, Operations and Maintenance	**692,325**	**708,863**	**724,722**	**736,863**
Construction	104,530	64,224	49,200	48,206
Total, Defense Nuclear Security	**796,855**	**773,087**	**773,922**	**785,069**

Defense Nuclear Security
Explanation of Major Changes
(Dollars in Thousands)

	FY 2019 Request vs FY 2017 Enacted
Defense Nuclear Security	
Operations and Maintenance: The increase reflects costs associated with additional security systems maintenance and Argus modernization costs; implementation of a Technical Security Program across the enterprise; OPC for future Perimeter Intrusion Detection and Assessment System (PIDAS) sustainment and recapitalization at Pantex and Y-12; and salary growth across all security program areas at the sites.	+20,638
Construction: No Line Item funding is requested in FY 2019. In FY 2017, funds were provided to complete the DAF Argus project at NNSS ($13,000,000) and for the West End Protected Area Reduction project at Y-12 ($2,500,000).	-15,500
Total, Defense Nuclear Security	**+5,138**

Defense Nuclear Security
Operations and Maintenance

Description

Defense Nuclear Security Operations and Maintenance integrates personnel, equipment, and procedures to protect physical assets and resources against theft, sabotage, diversion, or other criminal acts. Each NNSA site or facility has an approved Site Security Plan detailing protection measures and resources needed to protect site security interests.

Protective Forces include duties, specialized training, performance testing, facilities, equipment, weapons/firearms, ammunition, vehicles, and other expenses. These forces are each site's primary front-line protection, consisting of armed, uniformed officers. Protective Forces are an integral part of a site's security posture and are trained in tactics and procedures necessary to protect site interests.

Physical Security Systems includes intrusion detection and assessment systems (IDAS), performance testing and certification/recertification, access control systems, barrier and delay mechanisms, canine explosive detection programs, and tactical systems. Many of the systems are in use well beyond their lifecycle and require increased maintenance and testing. Additional investment in critical security systems and infrastructure upgrade projects are necessary to sustain these systems. This also includes the centrally-managed Argus program for sites possessing Category I quantities of Special Nuclear Material (SNM) and the Physical Security Center of Excellence at Sandia, New Mexico.

Information Security provides classification guidance, technical surveillance countermeasures, operations security, and classified matter protection and control. This includes administrative requirements for maintaining security containers and combinations, marking, and control systems.

Personnel Security includes access authorizations, badging programs, Human Reliability Programs (HRP), control of classified and unclassified visits, and assignments by foreign nationals. It encompasses the administrative support to the site clearance process, including processes for security clearance determinations at each site to ensure that individuals are eligible for access to classified information or matter, and/or access to or control over SNM or nuclear weapons.

Materials Control and Accountability (MC&A) controls and accounts for special and alternate nuclear materials through measurements, quality assurance, accounting, containment, surveillance, and physical inventory. This activity also includes the Local Area Nuclear Material Accountability System (LANMAS) software application, as well as training and operational support provided to DOE and NNSA sites and facilities to use as the core of their nuclear accountability systems. The LANMAS software is used by 18 DOE sites, 5 of which are NNSA sites.

Security Program Operations and Planning includes: development of budgets; responses to audits and information requests, Site Security Plans, vulnerability/risk assessments, performance testing and assurance activities; security incident and reporting management; security surveys and self-assessments; activities related to deviation requests; and control of security technology transfer activities, processing facility clearances, and Foreign Ownership, Control, or Influence (FOCI) determinations for security contracts.

FY 2020 - FY 2023 Key Milestones

Physical Security Systems

- Complete C-UAS implementation at sites possessing Category 0/1 quantities of SNM
- Complete Security Infrastructure Revitalization Program projects

Security Program Operations & Planning

- Complete all vulnerability analysis and risk assessments in support of DBT implementation

Operations and Maintenance

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Operations and Maintenance $670,000,000	**Operations and Maintenance $690,638,000**	**Operations and Maintenance +$20,638,000**
Protective Forces $393,764,000	**Protective Forces $376,279,000**	**Protective Forces -$-17,485,000**
• Maintains sufficient protective forces to meet protection requirements based on approved vulnerability and risk assessments. • Addresses non-nuclear security protection requirements and "lower level threat" scenarios, in a graded, prioritized manner.	• Maintains sufficient protective forces to meet protection requirements based on approved vulnerability and risk assessments. • Addresses non-nuclear security protection requirements and "lower level threat" scenarios, in a graded, prioritized manner.	• Reflects realignment of request with more accurate program requirements based on FY 2017 actuals. • Reflects anticipated savings from new contract award at NNSS.
Physical Security Systems $98,540,000	**Physical Security Systems $105,193,000**	**Physical Security Systems +$6,653,000**
• Funds preventive and corrective maintenance for physical security systems and infrastructure at NNSA sites, and provides protection against the threat as documented in the 2008 Graded Security Protection policy.	• Funds preventive and corrective maintenance for physical security systems and infrastructure at NNSA sites, and provides protection against the threat as documented in the 2008 Graded Security Protection policy. • Includes OPC for preliminary planning and design for future PIDAS replacements at Pantex and Y-12.	• Reflects regular escalation and funds ongoing maintenance of aging systems and high-priority security infrastructure upgrades. Includes Physical Security Center of Excellence activities at Sandia.
Information Security $32,766,000	**Information Security $43,011,000**	**Information Security +$10,245,000**
• Maintains an information protection program and permits filling vacancies at several sites.	• Maintains an information protection program and permits staff increases to implement new DOE Order 470.6, *Technical Security Program*.	• Reflects regular escalation and realignment of request with more accurate program requirements based on FY 2017 actuals. Includes funding to implement new DOE Order 470.6, *Technical Security Program*.
Personnel Security $33,516,000	**Personnel Security $40,376,000**	**Personnel Security +$6,860,000**
• Maintains a personnel security program while implementing efficiencies in a risk-based manner.	• Maintains a personnel security program while implementing efficiencies in a risk-based manner.	• Reflects regular escalation and realignment of request with more accurate program requirements based on FY 2017 actuals.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Materials Control and Accountability $26,965,000	**Materials Control and Accountability $31,125,000**	**Materials Control and Accountability +$4,160,000**
• Provides for control and accountability of special and alternative nuclear materials and maintains a level of effort that is a critical part of NNSA's layered protection program. • Continues implementation of the LANMAS software upgrade. • Permits backfill of key positions at several sites.	• Provides for control and accountability of special and alternative nuclear materials and maintains a level of effort that is a critical part of NNSA's layered protection program. • Continues implementation of the LANMAS software upgrade. • Permits backfill of key positions at several sites.	• Reflects regular escalation and realignment of request with more accurate program requirements based on FY 2017 actuals.
Security Program Operations and Planning $84,449,000	**Security Program Operations and Planning $94,654,000**	**Security Program Operations and Planning +$10,205,000**
• Maintains site security plans, risk/vulnerability assessment capabilities, budget development, management of site programs for incidents of security concern, and security awareness programs. • Includes OPC for preliminary planning and design for future PIDAS replacements at Pantex and Y-12.	• Maintains site security plans, risk/vulnerability assessment capabilities, budget development, management of site programs for incidents of security concern, and security awareness programs.	• Reflects regular escalation and minor, planned increases for analysis required to implement the 2016 Design Basis Threat.

Defense Nuclear Security
Construction

Description

The DNS Construction supports critical facilities within the NNSA nuclear security enterprise such as Project 14-D-710, Device Assembly Facility (DAF) Argus Installation Project at the NNSS. The Argus project works in conjunction with and relies on both the Entry Guard Station Expansion and legacy completed projects. Argus is necessary to support the DAF complex, which is a critical facility within the NNSA nuclear security enterprise designed for the staging of SNM.

The Argus security system, once complete, will replace the aging Process Equipment Control Operating System (PECOS) in the DAF at the NNSS. Argus is the recommended NNSA enterprise security system and integrates access control, intrusion detection, and video assessment of alarms to protect and control high-consequence assets. Completion of this project provides the required security to protect SNM using capabilities of the HSPD-12 badge credentials.

Funding for 17-D-710, the West End Protected Area Reduction, or Protected Area Reduction Project at Y-12 was provided in 2017 ($2,500,000). This project will install a new Perimeter Intrusion Detection and Assessment System (PIDAS) section to reduce the Y-12 Protected Area by approximately 50%. CD-0 was approved in September 2017. FY 2017 funding for WEPAR will be used in FY 2018 and FY 2019 to prepare the project for funding in FY 2020.

Construction

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Construction $15,500,000	**Construction $0**	**Construction $-15,500,0000**
• Project construction underway.	• Project construction underway.	• No new Line Item funding requested in FY 2019.

Defense Nuclear Security
Performance Measures

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Protective Force Training Reform - Implement and sustain an Enterprise Mission Essential Task List (EMETL)-based training program for protective forces at all eight NNSA sites.							
Target	90% Index	95% Index	N/A	N/A	N/A	N/A	N/A
Result	**Met** - 90						
Endpoint Target	By FY 2017, produce protective forces that are high-performing in mission accomplishment with a necessary/appropriate training program that minimizes unproductive training time, maintaining a 95% index thereafter.						
FY 2019 Note:	This Performance Measure is being replaced with the new Protective Force Law Enforcement First Responder – Tactical Casualty Care (LEFR-TCC) Program Implementation Performance Measure.						
Protective Force Law Enforcement First Responder – Tactical Casualty Care (LEFR-TCC) Program Implementation - Implement and sustain a LEFR-TCC program for protective forces at all eight NNSA sites.							
Target	N/A	N/A	90% Index	90% Index	95% Index	95% Index	95% Index
Result	N/A						
Endpoint Target	By FY 2021, implement a standardized LEFR-TCC program in which 95% of uniformed protective force personnel and instructors are trained at the user level, maintaining 95% thereafter.						
Physical Security Infrastructure Recapitalization (PSIR) – Implement and maintain a physical security life cycle management process, including on-time and to standard supplemental deliverables after implementation.							
Target	90% Index	95% Index	N/A	N/A	N/A	N/A	N/A
Result	**Met** - 90						
Endpoint Target	By 2017, achieve defensible prioritization of systems investments based on risk, more efficient bulk procurements, more common systems configurations/designs, timely redistribution of inventories based on site needs, and more accurate reporting to external stakeholders on condition of NNSA security systems, maintaining a 95% index thereafter.						
FY 2019 Note:	This Performance Measure is being replaced with the new Security Infrastructure Revitalization Program (SIRP) Performance Measure.						

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023

Security Infrastructure Revitalization Program (SIRP) - Implement, mature, and standardized systems in order to drive an effective, efficient, and sustainable NNSA nuclear security program. This will ensure a repeatable and defensible approaches to nuclear security across the broader NNSA nuclear security enterprise process for conducting site vulnerability and risk assessments and provide a set of consistent deliverables to help Federal oversight ensure the security program is integrated, robust, and efficient.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Target	N/A	N/A	80% Index	83% Index	86% Index	89% Index	92% Index
Result	N/A						

Endpoint Target: By 2023, achieve defensible prioritization of systems investments based on risk, more common systems configurations/designs, timely redistribution of inventories based on site needs, and more accurate reporting to external stakeholders on condition of NNSA security systems, maintaining a 95% index thereafter.

FY 2019 Note: There are a number of security infrastructure projects across all the sites. NNSA has established a deliberate process to validate and prioritize requirements, and use a consistent approach to design. Once approved and funded, these projects will be executed over the FYNSP period. The lower percentage enables NNSA to show progress over the FYNSP.

Enterprise Risk Management (ERM) – Implement and sustain a repeatable process for conducting site vulnerability and risk assessments and a set of consistent deliverables to help Federal oversight ensure the security program is integrated, robust, and efficient.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Target	90% Index	95% Index	N/A	N/A	N/A	N/A	N/A
Result	**Met** - 90						

Endpoint Target: By 2017, achieve an improved corporate understanding of site operations, protection strategies, and risk acceptance that enables decision-makers to make true cost/benefit and risk acceptance decisions for physical security, better risk-informed resource allocation decisions, and more balance across NNSA sites, maintaining a 95% index thereafter.

FY 2019 Note: This Performance Measure is being replaced with the new Enterprise Safeguards and Security Planning and Analysis Program (E-SSPAP) Performance Measure.

Enterprise Safeguards & Security Planning & Analysis Pgm – Implement, mature, and expand the E-SSPAP in order to drive a standardized effective, efficient, and sustainable field nuclear security program.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Target	N/A	N/A	90% Index	90% Index	95% Index	95% Index	95% Index
Result	N/A						

Endpoint Target: By 2021, achieve an improved corporate understanding of site operations, protection strategies, and risk acceptance that enables decision-makers to make true cost/benefit and risk acceptance decisions for physical security, better risk-informed resource allocation decisions, and more balance across NNSA sites, maintaining a 95% index thereafter.

Defense Nuclear Security
Capital Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2017 Request	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted	Outyears to Completion
Capital Operating Expenses Summary (including Major Items of Equipment (MIE))								
Capital Equipment >$500K (including MIE)	N/A	0	1,413	1,413	1,444	1,476	+63	N/A
Plant Projects (GPP and IGPP)	N/A	0	21,131	21,131	24,596	32,071	+10,940	N/A
Total, Capital Operating Expenses	**N/A**	**0**	**22,544**	**22,544**	**26,040**	**33,547**	**+11,003**	N/A
Capital Equipment > $500K (including MIE)								
Total Non-MIE Capital Equipment	N/A	0	1,413	1,413	1,444	1,476	+63	N/A
Total, Capital Equipment (including MIE)	N/A	**0**	**1,413**	**1,413**	**1,444**	**1,476**	**+63**	**0**
Plant Projects (GPP and IGPP)								
Total Plant Projects (GPP/IGPP)	N/A	0	21,131	21,131	21,596	22,071	+940	0
Protective Force Battle Training Building, LANL	7,500	0	0	0	1,500	4,500	+4,500	1,500
Zone 4 PIDAS Vehicle Barriers, PTX	9,300	0	0	0	0	0	+0	9,300
Zone 12 PIDAS Vehicle Barriers, PTX	13,300	0	0	0	0	0	+0	13,300
PIDAS Vehicle Barriers, Y-12	9,300	0	0	0	0	0	+0	9,300
TA-72 Outdoor Range Upgrades Project, LANL	8,000	0	0	0	1,500	5,500	+5,500	1,000
Total, Plant Projects (GPP/IGPP)	**N/A**	**0**	**21,131**	**21,131**	**24,596**	**32,071**	**+10,940**	**34,400**
Total, Capital Summary	**N/A**	**0**	**22,544**	**22,544**	**26,040**	**33,547**	**+11,003**	**34,400**

Outyears for Defense Nuclear Security

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Capital Operating Expenses Summary (including MIE)				
Capital Equipment >$500K (including MIE)	1,508	1,541	1,575	1,610
Plant Projects (GPP)	35,557	23,053	23,560	24,078
Total, Capital Operating Expenses	**37,065**	**24,594**	**25,135**	**25,688**

Defense Nuclear Security
Construction Projects Summary

	(Dollars in Thousands)					
	Total	Prior Years	FY 2017 Enacted	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
17-D-710, Protected Area Reduction, Y-12						
Total Estimated Cost (TEC)	56,100	0	2,500	0	0	-2,500
Other Project Cost (OPC)	5,014	0	0	0	0	0
Total Project Cost, 17-D-710, Protected Area Reduction, Y-12	**61,114**	**0**	**2,500**	**0**	**0**	**-2,500**
14-D-710, DAF Argus, NNSS						
Total Estimated Cost (TEC)	29,633	16,633	13,000	0	0	-13,000
Other Project Cost (OPC)	6,792	3,567	300	1,050	1,875	+1,575
Total Project Cost, 14-D-710, DAF Argus, NNSS	**36,425**	**20,200**	**13,300**	**1,050**	**1,875**	**-11,425**
Total All Construction Projects						
Total Estimated Cost (TEC)	85,733	16,633	15,500	0	0	-15,500
Other Project Cost (OPC)	11,806	3,567	300	1,050	1,875	+1,575
Total Project Cost (TPC) All Construction Projects	**97,539**	**20,200**	**15,800**	**1,050**	**1,875**	**-13,925**

Outyears to Completion for Defense Nuclear Security

	(Dollars in Thousands) FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
23-D-XXX, Additional SIRP Projects				
Total Estimated Cost (TEC)	0	0	0	17,956
Other Project Cost (OPC)	0	0	0	
Total Project Cost, Additional SIRP Projects	**0**	**0**	**0**	**17,956**
20-D-XXX, Zone 4 PIDAS Replacement, PX				
Total Estimated Cost (TEC)	20,230	9,924	21,000	2,250
Other Project Cost (OPC)	0	0	0	0
Total Project Cost, 20-D-XXX, Zone 4 PIDAS Replacement, PX	**20,230**	**9,924**	**21,000**	**2,250**
20-D-XXX, Zone 12 PIDAS Replacement, PX				
Total Estimated Cost (TEC)	16,900	14,500	19,000	6,000
Other Project Cost (OPC)	0	0	0	0
Total Project Cost, 19-D-XXX, Zone 12 PIDAS Replacement, PX	**16,900**	**14,500**	**19,000**	**6,000**
20-D-XXX, PIDAS Replacement, Y-12				
Total Estimated Cost (TEC)	26,800	26,800	9,200	22,000
Other Project Cost (OPC)	0	0	0	0
Total Project Cost, 19-D-XXX, PIDAS Replacement, Y-12	**26,800**	**26,800**	**9,200**	**22,000**
17-D-710, Protected Area Reduction, Y-12				
Total Estimated Cost (TEC)	40,600	13,000	0	0
Other Project Cost (OPC)	0	2,000	3,014	0
Total Project Cost, 17-D-710, Protected Area Reduction, Y-12	**40,600**	**15,000**	**3,014**	**0**
Total All Construction Projects				
Total Estimated Cost (TEC)	104,530	64,224	49,200	48,206
Other Project Cost (OPC)	0	2,000	3,014	0
Total Project Cost (TPC) All Construction Projects	**104,530**	**66,224**	**52,214**	**48,206**

Defense Nuclear Security
Other Information

Full Cost Recovery Estimates

The FY 2019 Budget Request provides direct funding for mission-based program for DNS. Strategic Partnership Projects will continue to fund an allocable share of the base program through full cost recovery. Extraordinary security requirements for Strategic Partnership Projects, such as dedicated security for special projects or exercises on an extended basis, will be a direct charge to those customers.

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Site				
Kansas City National Security Campus	493	687	696	+203
Lawrence Livermore National Laboratory	13,264	9,200	9,200	- 4,064
Los Alamos National Laboratory	4,154	5,445	5,455	+1,301
Nevada National Security Site	0	1,100	1,100	+1,100
NNSA Production Office	1,392	2,433	3,063	+1,671
Sandia National Laboratories	15,138	23,100	23,657	+8,519
Total	**34,441**	**41,965**	**43,171**	**+8,730**

Information Technology and Cybersecurity

Overview

The Information Technology and Cybersecurity Program is responsible for Information Sharing and Information Safeguarding to support the mission of NNSA. The office supports Information Technology (IT) and Cybersecurity solutions, including continuous monitoring, cloud-based technologies, and enterprise security technologies (i.e., identity, credential, and access management) to help meet security challenges. This program is firmly based on practical principles that will continue to provide superior information management support to current operations while implementing unclassified and classified cloud-based technologies to support the NNSA nuclear security enterprise. To provide for the protection of NNSA information and information assets, the program collaborates and coordinates with the DOE Office of the Chief Information Officer (OCIO) on the development and implementation of cybersecurity and information technology solutions. The requested funds for the Information Technology and Cybersecurity Program operate cyber infrastructure at NNSA sites, implement requirements for classified computing environment directed by the Committee on National Security Systems (CNSS), and execute Public Key Infrastructure (PKI) capabilities for authentication to unclassified and classified networks and applications.

The NNSA Information Technology and Cybersecurity Program focuses on the development of integrated IT initiatives that provide an effective technology infrastructure and support to NNSA's nuclear security enterprise shared services. These initiatives will fundamentally redesign the NNSA IT environments to provide a secure set of capabilities including unified communication, federated identity services, agile cloud infrastructure, and next-generation collaboration services across the NNSA nuclear security enterprise including headquarters, laboratories, and plants. The approach will provide commodity services that can be used in the future with NNSA Management and Operating (M&O) partners to improve security of sensitive unclassified and classified NNSA data, lower IT costs, and host shared services. In addition, the strategy will provide a dramatic step forward in collaboration capabilities by delivering a federated, unclassified, unified communications capability and the deployment of a secure, agency wide network.

The Information Technology and Cybersecurity Program sets forth goals and objectives to guide the execution of the NNSA Information Management Program in support of the NNSA mission and objectives. By achieving these goals and objectives, NNSA improves protection of information and information assets, counters new and evolving threats, educates and aids its workforce, and supports the development of mission-oriented requirements that effectively integrate security into everyday operations.

Achieving and maintaining a secure NNSA information environment for the enterprise requires an approach that combines defense-in-depth and defense-in-breadth principles with essential guiding tenets that align the Information Technology and Cybersecurity Program with NNSA cultural and business drivers. The underlying set of four guiding tenets of risk management, agility, trust, and partnership align with the people, processes, and technology elements to support the defense-in-depth values of achieving mission effectiveness and are integral to the success of the Information Technology and Cybersecurity Program.

While facing the current challenges, the NNSA Information Technology and Cybersecurity Program will continue focusing on improving both the performance of its staff and the security of the IT environment across the NNSA nuclear security enterprise. The program will also continue maintaining and modernizing the aging IT and Cybersecurity infrastructure that supports mission activities within the weapons program classified information processing environment, nuclear material transport, weapon modernization, and incident response. The NNSA Information Technology and Cybersecurity Program will continue evaluating risk and allocating resources to reduce threats and support the mission of the NNSA.

Highlights of the FY 2019 Budget Request

In FY 2019, the Information Technology and Cybersecurity Program plans to:

- Continue modernization of the Enterprise Secure Network (ESN) by enhancing the core services and collaborative capabilities and consolidating disparate networks.
- Bolster the enterprise network security posture by addressing known critical capability gaps at the NNSA Information Assurance Response Center (IARC) and continue strengthening the M&O Cyber operations at each NNSA site.

- Modernize the Cybersecurity infrastructure, comprised of almost 100 sensors and over 70 data acquisition servers dispersed nationwide for the IARC. The IARC is responsible for providing 24/7/365 Cybersecurity services to 66 current and any future NNSA and DOE networking enclaves. The IARC's services and service levels meet strict Federal requirements that permit sites to maintain mission-essential access to the Federal classified networks, SIPRNET and ESN. The IARC also provides near-real-time network defense and incident response services that protect these classified and unclassified enclaves and information from attacks. As a participant with the JC3 Program, the IARC also supports enterprise-level cyber threat management and situational awareness for the Department.
- Implement the NNSA Application Modernization Strategy, which seeks to minimize the number of disparate NNSA federal business and mission support IT applications in favor of a platform-based approach. This facilitates reduced hardware, software, and labor costs via rapid application development, single sign-on, and maximum re-use of hardware infrastructure, software licenses, custom code, logic/workflows, data objects; it is an organized effort to cultivate enterprise-wide adoption of shared infrastructure capabilities by the NNSA federal and M&O communities.
- Continue to mature the Continuous Monitoring capabilities across the NNSA nuclear security enterprise providing strong Cybersecurity situational awareness to NNSA senior leadership.
- Implement a Telecommunications Security Program within NNSA to deliver more effective oversight, greatly reducing negative impacts to the mission programs while increasing visibility, oversight of risks, and governance of this critical function.

Major Outyear Priorities and Assumptions

- Recommendations for improvement identified by DISA that currently exist at the NNSA Information Assurance Response & Security Operations Center
- M&O's ability to operate at a healthy level to perform adequate cybersecurity operations
- Implementation of full operating capability for cybersecurity to include IDS, IPS, CDM, DRM and DLP capabilities
- Implementation of automated authority by leveraging Continuous Diagnostics and Mitigation capabilities for non-national security systems
- Establishment of department-wide cybersecurity sensor platform solution to enhance capabilities and functionality
- Consolidation of Cybersecurity Awareness Training across the NNSA nuclear security enterprise into a single offering
- Delivery of classified VOIP for the ESN
- Implementation of an enterprise classified electronic records system service
- Modernization of the federal unclassified IT environment by offering desktop services through NNSA
- Implement enterprise-wide collaboration services MS O365, Enterprise SharePoint

Information Technology and Cybersecurity
Funding

	(Dollars in Thousands)			
	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Information Technology and Cybersecurity				
Cybersecurity				
Infrastructure Program	118,892	118,085	155,175	+36,283
Technology Application Development	4,000	3,973	4,000	0
Total, Cybersecurity	**122,892**	**122,057**	**159,175**	**+36,283**
Enterprise Secure Computing	23,700	23,539	25,500	+1,800
Federal Unclassified Information Technology	30,000	29,796	36,500	+6,500
Total, Information Technology and Cybersecurity	**176,592**	**175,393**	**221,175**	**+44,583**

Outyears for Information Technology and Cybersecurity
Funding

	(Dollars in Thousands)			
	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Information Technology and Cybersecurity				
Cybersecurity				
Infrastructure Program	177,611	170,423	179,423	178,871
Technology Application Development	4,000	4,000	4,000	4,000
Total, Cybersecurity	**181,611**	**174,423**	**183,423**	**182,871**
Enterprise Secure Computing	26,200	23,300	23,300	23,300
Federal Unclassified Information Technology	83,500	83,500	84,500	85,500
Total, Information Technology and Cybersecurity	**291,311**	**281,223**	**291,223**	**291,671**

Information Technology and Cybersecurity
Explanation of Major Changes
(Dollars in Thousands)

	FY 2019 Request vs FY 2017 Enacted
Information Technology and Cybersecurity	
Cybersecurity: This increase addresses Enterprise capabilities including critical capability gaps at the NNSA Information Assurance Response Center which continuously monitors any network activity within the enterprise to adequately Deter, Protect, Detect, and Adapt against the adversary. It also bolsters the network security posture at NNSA M&O sites in order to increase its defense-in-depth cybersecurity approach to cybersecurity infrastructure operations.	+36,283
Enterprise Secure Computing: This increase represents the continuance of the modernization of the ESN by enhancing the core services, collaborative capabilities, and cyber security as well as the consolidation of disparate networks.	+1,800
Federal Unclassified Information Technology: This increase supports operational baseline increases in IT other direct costs, field IT refresh requirements; funding moved from the Federal Salaries and Expense account to execute and support NNSA field office IT expenses; as well as funds related to oversight activities.	+6,500
Total, Information Technology and Cybersecurity	**+44,583**

Information Technology and Cybersecurity
Cybersecurity

Description
The highly complex and global nature of the NNSA mission environment makes it critically important that information and information assets are managed and protected using an effective risk management approach. Well-informed management decisions require a systematic understanding of the risks inherent in the use of information systems. The entirety of information collected, created, processed, transmitted, stored, or disseminated by, or on behalf of, the NNSA on automated information systems requires a level of protection commensurate with the risk to the information and the associated information processing systems. The information systems facilitating these activities must also be protected.

The infrastructure program supports the cybersecurity operations and activities at NNSA M&O and federal sites. The cybersecurity operations and infrastructure program is built around a defense-in-depth approach for achieving cybersecurity in a highly networked environment. The defense-in-depth approach is a combination of known best practices and cost strategy that relies on the intelligent application of techniques and technologies that exist today to address the increasing number and complexity of cybersecurity threats, vulnerabilities, and risks.

Technology Application Development is responsible for developing and advancing policies and initiatives that support short and long-term solutions to specific cybersecurity needs at NNSA sites and headquarters locations and focuses on emerging technologies and leveraging existing technology resources to create a more secure environment.

FY 2020 – FY 2023 Key Milestones
- Recommendations for improvement identified by DISA that currently exist at the NNSA Information Assurance Response & Security Operations Center
- M&O's ability to operate at a healthy level to perform adequate cybersecurity operations
- Implementation of full operating capability for cybersecurity to include IDS, IPS, CDM, DRM and DLP capabilities
- Implementation of automated authority by leveraging Continuous Diagnostics and Mitigation capabilities for non-national security systems.
- Establishment of department-wide cybersecurity sensor platform solution to enhance capabilities and functionality
- Consolidation of Cybersecurity Awareness Training across the NNSA nuclear security enterprise into a single offering

Cybersecurity

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Cybersecurity $122,892,000	**Cybersecurity $159,175,000**	**Cybersecurity +$36,283,000**
Infrastructure Program $118,892,000	**Infrastructure Program $155,175,000**	**Infrastructure Program +$36,283,000**
• Continued modernization of the Cybersecurity programs at the national security laboratories, plants, and sites to defend against increasingly adaptive threats. • Established automated visibility into connected endpoint systems by way of host based intrusion solutions.	• Bolsters the enterprise network security posture by addressing known critical capability gaps at the IARC. • Funds continued modernization of the Cybersecurity programs at the national security laboratories, plants, and sites to defend against increasingly adaptive threats. • Further strengthens the M&O Cyber operations at each NNSA site along the defense-in-depth approach. • Supports the Enterprise Operations of the NNSA Cybersecurity Infrastructure.	• Addresses some of the known critical capability gaps at the NNSA IARC to continuously monitor any network activity within the enterprise to adequately Deter, Protect, Detect, and Adapt against the adversary. • Bolsters the network security posture at the M&O's to bring their cybersecurity operations closer to maturity. • Increases oversight of activities related to, and ensure agency compliance with, the provisions of Multi-Factor Authentication (MFA).
Technology Application Development $4,000,000	**Technology Application Development $4,000,000**	**Technology Application Development $0**
• Supported research and development on enhanced secure protocol standards specifically designed for Restricted Data in transmission and at rest.	• Provides efforts that primarily focuses on the implementation and integration of leveraging existing industry solutions to NNSA's Network Security Enterprise and program mission to include enterprise efficiency pilots on enhanced secure protocol standards specifically designed for Restricted Data in transmission and at rest.	• No change

Information Technology and Cybersecurity
Enterprise Secure Computing

Description

Enterprise Secure Computing (ESC) provides an enterprise level classified computing infrastructure that supports effective collaboration and information sharing necessary for the NNSA enterprise. It has two components:

- The NNSA Secret Network (NSN) supports the processing of Secret/National Security Information (NSI) and the interconnection with DOD SIPRNET.
- The ESN operates at the Secret/Restricted Data level and consists of independent site installations of standardized equipment and commercial off-the-shelf software integrated through a common infrastructure and shared policies and procedures.

NSN/ESN features an enterprise-level identity model, strong (two-factor) authentication, and a centralized monitoring and analysis capability. The program provides the necessary secure infrastructure and cybersecurity systems required to meet the informational needs of the science-based stockpile stewardship program with a modeling and simulation-based science and engineering environment. ESN and NSN both provide a broad base of security and network services that include application integration, authentication services, directory services, enterprise data resource management, IARC Security Operations Center and Network Operations Center, Identity and Access Management, PKI, and security monitoring/ intrusion detection.

NSN/ESN is the classified environment where each of the DOE/NNSA laboratories and sites communicate and share information regarding NNSA's primary mission. ESC continually looks to improve the infrastructure of the network in order to enhance services to the enterprise. An example of this is the ongoing project to complete the implementation of PKI smart cards on the NSN and begin deployment of PKI smart cards on the ESN. Both efforts will result in the issuance of tokens and enabling network login to the DOE Secret Fabric users to satisfy the Steering Committee of the National Security Systems Governance Board IOC/FOC goals and reduce anonymity. The representatives of the steering committee are from federal agencies that have national security systems. Another example is NSN/ESN to execute the deployment of a modern cross-domain solution to replace the last legacy gateways currently in production during FY 2019. The application of Digital Rights Management (DRM)/Data Loss Protection (DLP) Technology will be expanded during FY 2019 along with enhanced cyber monitoring capabilities.

ESN also serves as the base network for the classified commodity services, which entails a next-generation approach to classified collaborative computing using the above-mentioned secure virtual desktop infrastructure (VDI) to facilitate disparate DOE/NNSA entities to share information. Redundant or complementary networks are consistently evaluated for possible consolidation with support from the respective program offices. This ongoing network consolidation effort will continue to provide the NNSA Information Technology and Cybersecurity Program the ability to more effectively manage the information security posture for the agency and maximize investment allocation across multiple program areas. In addition to consolidation, secure cloud services are more available and reliable across the enterprise. Additional services provided on ESC include expanded use of the enterprise-classified marking system in FY 2019.

The NSN/ESN is currently deployed at NNSA and multiple DOE sites, other departments and organizations, and select allied nations. Additional sites are continually being added to the network.

FY 2020 – FY 2023 Key Milestones

- Delivery of classified VOIP for the ESN
- Implementation of an enterprise classified electronic records system service
- Recapitalization of the ESN

Enterprise Secure Computing

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Enterprise Secure Computing $23,700,000	**Enterprise Secure Computing $25,500,000**	**Enterprise Secure Computing +$1,800,000**
- Continued to upgrade and enhance classified applications and services to improve collaboration and information sharing. - Replaced a legacy gateway with a modern cross-domain capability. - Completed the two-factor authentication PKI for Secret/Restricted Data infrastructure and provide ongoing operations and maintenance of the PKI infrastructure on the Secret/Restricted Data infrastructure. - Continued enhancements for system availability and reliability in the infrastructure and provide additional security measures. - Operated and maintained Secret/Restricted Data infrastructure, including the utilization of the ESNet infrastructure for the network transport layer.	- Enables operations and maintenance of the Secret/Restricted Data infrastructure, Enterprise Secure Network, NNSA Secret Network, and utilization of the ESNet infrastructure for the network transport layer. - Continue enhancements for system availability and reliability in the infrastructure and provide additional security measures. - Continue to upgrade and enhance classified applications and services to improve collaboration and information sharing. - Operate two-factor authentication PKI for Secret/Restricted Data infrastructure and provide ongoing operations and maintenance of the PKI infrastructure on the Secret/Restricted Data infrastructure. - Replace the last legacy gateway with a modern cross-domain capability. - Expanded use of an enterprise-classified marking system and DRM/DLP.	Increase represents the continuance of the modernization of the ESN by enhancing the core services, collaborative capabilities, and cyber security as well as the consolidation of disparate networks.

Information Technology and Cybersecurity
Federal Unclassified Information Technology

Description

Federal Unclassified Information Technology provides corporate-type services in the areas of business, technology, finance, legal, and management to the field offices, the Albuquerque Complex, and NNSA Headquarters upon request in order to support the NNSA mission. Services include but are not limited to: design, development, and maintenance of NNSA field computing activities; voice and data resources for effective communications among NNSA Field Offices, M&O contractors, and NNSA Headquarters; information assurance and cyber security; records management support; coordination, review, and publication of NNSA directives; and printing, reproduction, and forms management services.

Federal Unclassified Information Technology provides commodity-based computing infrastructure, which seeks to facilitate effective collaboration and information sharing necessary for NNSA federal employees and support contractors to execute the NNSA mission. Through regular communication with DOE/NNSA leadership, DOE IT organizations, contract partners in the labs and field, and associates across the federal IT community, NNSA has identified an opportunity to push modernization efforts to implement a true service broker model that will leverage managed services. Building on past organizational successes to modernize and strengthen an aging infrastructure, the NNSA OCIO will push forward to discover new and innovative ways to consume, leverage, share, and safeguard information. Our focus on a managed service model will not only enable NNSA to take advantage of new and emerging technologies while maximizing budget and resources. The model also presents many opportunities to participate in economies of scale and rely on industry's rapid development and testing practices to ensure NNSA is using secure, modern technology. In order to think, behave, and respond as one cohesive agency with a shared, critical national security mission, it is necessary to re-engineer the telecommunications networks and continuously improve service offerings to remove technical barriers to collaboration and outfit employees with effective communication tools to maximize efficiency and lower operational costs.

FY 2020 – FY 2023 Key Milestones

- Modernization of the Federal Unclassified IT environment by offering desktop services through NNSA
- Implement enterprise-wide collaboration services such as MS O365 and Enterprise SharePoint

Federal Unclassified Information Technology

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Federal Unclassified Information Technology $30,000,000	**Federal Unclassified Information Technology $36,500,000**	**Federal Unclassified Information Technology +$6,500,000**
• Continued deployment support of information technology enhancement that facilitates effective collaboration and information sharing necessary for NNSA federal employees and support contractors to carry out the NNSA's mission. • Coordinated and oversaw delivery of federal desktop and video teleconferencing services. • Continued providing IT technical services, incidental advisory, and assistance services. • Continued oversight and implementation of hardware and software licensing, maintenance, and refresh. • Continued funding NNSA field offices IT services provisioned by M&O partners. • Continued work with NNSA M&O partners to implement and operate a shared services model. • Oversaw the M&O partners' unclassified IT programs. • Continued implementation of the application modernization project. • Begin implementation of Enterprise VoIP as a service.	• Continue to support the deployment of information technology enhancements that facilitate effective collaboration and information sharing necessary for NNSA federal employees and support contractors to carry out the NNSA's mission. • Coordinate and oversee the delivery of federal desktop and video teleconferencing services. • Continue to provide IT technical services, incidental advisory, and assistance services. • Continue to oversee the implementation of hardware and software licensing, maintenance, and refresh. • Continue to provide funding for NNSA field office IT services provisioned by M&O partners. • Continue to work with the NNSA M&O partners to implement and operate a shared services model. • Continue to provide oversight of the M&O partners' unclassified IT programs. • Continue implementation of the application modernization project. • Begin implementation of Enterprise VoIP as a service. • Provide oversight of activities related to, and ensure agency compliance with, the provisions of FITARA.	• Increases oversight of activities related to, and ensure agency compliance with, the provisions of FITARA ($1,500,000). • Funding moved from FSE account to execute and support NNSA field office IT expenses ($2,000,000). • Increases operational baseline of the Federal Unclassified Information Technology environment to account for increases in IT Other Direct Costs, field IT refresh requirements, and commodity service expenses across the enterprise ($3,000,000).

Information Technology and Cybersecurity
Performance Measures

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Cybersecurity Assessment Reviews – Annual Percentage of Cybersecurity Site Assessment Reviews conducted by the Office of Enterprise Assessments (EA) or the NA-IM Assessment Team that resulted in the rating of "effective."							
Target	100% of reviews resulting in "effective" rating	100% of reviews resulting in "effective" rating	N/A	N/A	N/A	N/A	N/A
Result	**Met** - 100						
Endpoint Target	Annually, achieve at least an effective rating of 100% of OCIO site assistance visits (SAV) Cybersecurity reviews.						
FY 2019 Note	This Performance Measure is being replaced with the new Cybersecurity PEG Performance Measure.						
Cybersecurity PEG – Annual percentage of performance evaluations of NNSA sites measured against the Objectives and Key Outcomes set forth in FY PEG resulting in the rating of "satisfactory or better" as defined by FAR 16.401 c(3).							
Target	N/A	N/A	100 % of performance evaluations of NNSA sites resulting in at least a "Satisfactory" rating or better per FAR 16.401 c(3)	100 % of performance evaluations of NNSA sites resulting in at least a "Satisfactory" rating or better per FAR 16.401 c(3)	100 % of performance evaluations of NNSA sites resulting in at least a "Satisfactory" rating or better per FAR 16.401 c(3)	100 % of performance evaluations of NNSA sites resulting in at least a "Satisfactory" rating or better per FAR 16.401 c(3)	100 % of performance evaluations of NNSA sites resulting in at least a "Satisfactory" rating or better per FAR 16.401 c(3)
Result	N/A						
Endpoint Target	Annually, achieve at least an effective rating of 100% of OCIO site assistance visits (SAV) Cybersecurity reviews.						

Information Technology and Cybersecurity
Other Information

Full Cost Recovery Estimates

The FY 2019 Budget Request provides direct funding for mission-driven activities focused on research and development of IT and cybersecurity solutions. Because some support is directed to other programs for materials and services provided to agencies outside the Department, these costs will be allocated to the SPP customers as work is accomplished at the contractor site. The table below provides an estimate of costs that will be recovered from SPP customers.

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Site				
Kansas City National Security Campus	400	400	250	- 150
Lawrence Livermore National Laboratory	3,200	3,200	2,500	- 700
Los Alamos National Laboratory	1,400	1,400	1,000	- 400
Nevada National Security Site	600	600	500	- 100
Pantex	80	80	60	- 20
Sandia National Laboratories	8,000	8,000	6,000	- 2,000
Total	**13,680**	**13,680**	**10,310**	**- 3,370**

Defense Nuclear Nonproliferation

Defense Nuclear Nonproliferation

FY 2019 Congressional Budget Request

Defense Nuclear Nonproliferation

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Defense Nuclear Nonproliferation
Proposed Appropriation Language

For Department of Energy expenses, including the purchase, construction, and acquisition of plant and capital equipment and other incidental expenses necessary for defense nuclear nonproliferation activities, in carrying out the purposes of the Department of Energy Organization Act (42 U.S.C. 7101 et seq.), including the acquisition or condemnation of any real property or any facility or for plant or facility acquisition, construction, or expansion, and the purchase of not to exceed three aircraft; *$1,862,825,000, to remain available until expended.*

Note.—A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

Explanation of Change

The FY 2019 Budget Request for Defense Nuclear Nonproliferation (DNN) reflects a 0.9% decrease from the FY 2017 Enacted levels. This decrease is mainly due to the termination of construction activities for the Mixed Oxide (MOX) Fabrication Facility project and transitioning to the dilute and dispose option for plutonium disposition, plus a drop in University of California legacy pension payments.

Public Law Authorizations

- P.L. 106-65, National Nuclear Security Administration Act, as amended
- P.L. 115–31, Consolidated Appropriations Act, 2017
- Continuing Appropriations Act, 2018 (Division D of P.L. 115–56, as amended)
- P.L. 115-91, National Defense Authorization Act for Fiscal Year 2018

Defense Nuclear Nonproliferation

	(Dollars in Thousands)			
	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Defense Nuclear Nonproliferation	1,940,000	1,926,825	1,881,825	-58,175
Use of prior year balances	-38,000	-37,742	-19,000	+19,000
Rescission of Prior Year Balances	-22,262	-3,113	0	+22,262
Total, Defense Nuclear Nonproliferation	**1,879,738**	**1,885,970**	**1,862,825**	**-16,913**

Overview

NNSA helps keep America safe by: preventing adversaries from acquiring nuclear weapons or weapons-usable materials, technology, and expertise; countering efforts to acquire such weapons or materials; and responding to nuclear or radiological accidents and incidents domestically and abroad. NNSA's nonproliferation and counterterrorism activities extend the nation's defenses far beyond America's borders. NNSA programs share the United States' long experience in managing special nuclear materials with partners around the world to achieve international nonproliferation and counterterrorism goals. NNSA leverages the knowledge that underpins the stockpile stewardship program for a range of nonproliferation missions, from assessing foreign weapons programs and potential terrorist devices to managing the proliferation risks posed by civil nuclear applications. By limiting the number of nuclear-capable states and preventing terrorist access to materials and technology that can threaten the United States and its allies, NNSA plays an important role in enhancing global stability and constraints the range of potential threats facing the nation, our allies and partners.

This appropriation funds the core Defense Nuclear Nonproliferation (DNN) program and the Nuclear Counterterrorism and Incident Response (NCTIR) program. DNN and NCTIR have a primary role in the United States' approach for reducing nuclear security risks. These two programs, as part of a whole-of-government approach, provide policy and technical leadership to prevent or limit the spread of materials, technology, and expertise related to weapons of mass destruction (WMD); develop technologies to detect nuclear proliferation; secure or eliminate inventories of nuclear weapons-related materials and infrastructure; and ensure a technically trained emergency management response is available both domestically and worldwide to nuclear and radiological incidents. DNN's efforts reduce the danger that hostile nations or terrorist groups may acquire nuclear devices, radiological dispersal devices, weapons-usable material, nuclear and dual-use commodities and technology, or nuclear-related expertise. The National Security Strategy (NSS) and Nuclear Posture Review (NPR) reinforce the important work of NNSA's nonproliferation programs, including committing to, "augment measures to secure, eliminate, and prevent the spread of WMD and related materials."

These activities are carried out within a dynamic global security environment, as described in NNSA's annual report *Prevent, Counter, and Respond–A Strategic Plan to Reduce Global Nuclear Threats* (https://nnsa.energy.gov/aboutus/ourprograms/dnn/npcr). This environment is characterized by the persistent threat of state or non-state actors seeking to obtain nuclear and radiological materials; state actors potentially undermining arms control agreements and nonproliferation regimes; and an increase in risk of the availability of nuclear and radiological materials as a result of the global expansion of nuclear power and possible spread of fuel cycle technology; increased opportunities for illicit nuclear material trafficking and sophisticated procurement networks; and technology advances (including cyber-related tools) that may shorten nuclear weapon development timelines and complicate nuclear safeguards and security missions.

DNN and NCTIR execute their mission in partnership with other U.S. government agencies, most notably the Department of State, Department of Defense, Department of Homeland Security, and Nuclear Regulatory Commission. Internationally, DNN has a strong and long-established partnership with the International Atomic Energy Agency (IAEA) and has active bilateral and multilateral program coordination, through forums such as the Nuclear Security Conference (held biennially by the IAEA), the Global Initiative to Combat Nuclear Terrorism, and the Global Partnership against the Spread of Weapons and Materials of Mass Destruction.

In carrying out nuclear threat reduction, DNN and NCTIR depend on the scientific and technical expertise of the Department and its laboratories, as well as the capacity for international outreach, engagement and project management, implementation, and policy expertise. DNN also relies on competencies of other elements of NNSA and Department of Energy (DOE), particularly the Office of Nuclear Energy, Office of Environmental Management, and Office of Science.

The major elements of the appropriation account include the following:

Material Management and Minimization (M^3)
M^3 programs minimize and, when possible, eliminate weapons-usable nuclear material around the world to achieve permanent threat reduction. The FY 2019 Budget Request funds the conversion or shut-down of research reactors and isotope production facilities that use high enriched uranium (HEU); the removal and disposal of weapons-usable nuclear material; the independent validation of the lifecycle cost estimate and schedule for the dilute and dispose strategy for plutonium disposition; costs to down-blend HEU; and the continued support of non-HEU-based Molybdenum-99 (Mo-99) production facilities in the United States through the Uranium Lease and Take Back (ULTB) program as directed in the American Medical Isotopes Production Act of 2012. In addition, as political and technical challenges have delayed implementation of several removal efforts, prior year uncosted balances will be used to offset costs to support the removal, consolidation, and disposal of excess nuclear material from civilian sites worldwide.

Global Material Security (GMS)
The FY 2019 GMS Program prevents terrorists and other actors from obtaining nuclear and radiological material to use in an improvised nuclear device (IND) or a radiological dispersal device (RDD) by working with partner countries to improve the security of vulnerable materials and facilities and to improve partners' capacity to deter, detect, and investigate illicit trafficking of these materials. GMS works extensively with and through multilateral partners such as the International Atomic Energy Agency (IAEA) and Interpol. As part of an ongoing strategic analysis process, GMS is also exploring innovative approaches, technologies and tools to adapt to emerging threats. GMS supports national security priorities to reduce global nuclear security threats, and is a key component of DOE/NNSA's integrated nonproliferation, counterterrorism, and emergency response strategy.

Nonproliferation and Arms Control (NPAC)
NPAC supports activities to prevent the proliferation of WMD by state and non-state actors. The FY 2019 Budget Request funds efforts to develop and implement programs and strategies to strengthen international nuclear safeguards; control the spread of dual-use WMD material, equipment, technology, and expertise; verify nuclear reductions and compliance with nonproliferation and arms control treaties and agreements; and address enduring and emerging nonproliferation and arms control challenges and opportunities.

Defense Nuclear Nonproliferation Research and Development (DNN R&D)
DNN R&D drives the innovation of U.S. technical capabilities to detect nuclear detonations; foreign nuclear weapons programs' activities; and the presence, movement, or diversion of special nuclear materials. To meet national and departmental nuclear security requirements, DNN R&D leverages the unique facilities and scientific skills of DOE, academia, and industry to perform research, conduct technology demonstrations, develop prototypes, and produce and deliver sensors for integration into operational systems. The FY 2019 Budget Request includes planned activities for early detection of proliferation-related R&D and continued mitigation for supply chain interruptions.

Nonproliferation Construction
Nonproliferation Construction consolidates construction costs for DNN projects. The FY 2019 Budget Request supports the continuation of termination activities for the MOX project and continues to pursue the dilute and dispose strategy. The request will support the continuation of preliminary design for the Surplus Plutonium Disposition (SPD) project, as well as long lead procurements.

Nuclear Counterterrorism and Incident Response Program (NCTIR)
NCTIR sustains the United States' operational nuclear incident and accident response capability, while supporting DOE's all-hazards emergency management capability. Additionally, NCTIR provides the nation's technical capability to understand and defeat Nuclear Threat Devices (NTDs), including INDs and lost or stolen foreign nuclear weapons. In support of this mission, the FY 2019 Request for NCTIR supports programs to strategically manage and deploy expert scientific teams and equipment to provide a technically trained, rapid response to nuclear or radiological incidents and accidents worldwide.

Additionally, NCTIR executes DOE/NNSA's Comprehensive Emergency Management System program that administers implementation and support of emergency management for all DOE/NNSA offices and sites and manages the DOE/NNSA

Consolidated Emergency Operations Center, Emergency Communications Network (ECN), Emergency Management Policy, Training, Exercises, and Continuity Program activities.

Highlights and Major Changes in the FY 2019 Budget
The DNN FY 2019 Budget Request supports the following key priorities:

Defense Nuclear Nonproliferation Programs
- Convert and/or verify the shutdown of three research reactors and isotope production facilities;
- Identify and eliminate excess HEU and plutonium, including removing and/or disposing of 95 kilograms of material;
- Continue to pursue the dilute and dispose strategy to dispose of 34 metric tons of plutonium;
- Support nuclear security best practices exchanges and/or training courses with more than 20 countries in Europe, the Middle East, Africa, Asia, and Latin America;
- Complete security upgrades at an additional 100 buildings with high-priority radioactive sources (55 domestic sites and 45 international sites);
- Deploy mobile detection systems and equip priority border crossing points (mostly in Eastern Europe, Central Asia, and Africa) with radiation detection systems, and provide associated training and maintenance support, to help counter the threat of illicit trafficking of special nuclear material;
- Transfer financial responsibility for training and maintenance of radiation detection systems at 57 overseas locations;
- Provide critical mission support to the IAEA, including strengthening the international nuclear safeguards system and supporting their expanding nuclear security activities;
- Facilitate legitimate U.S. trade by annually providing roughly 6,000 technical reviews of U.S. export license applications, – and technical support and training to U.S. law enforcement to help prevent the exploitation of the U.S. industrial base;
- Work with roughly 35 countries each year to build global export control capacity through training, technical exchanges and train-the-trainer approaches;
- Demonstrate new U.S. capabilities for detecting foreign material and weapons production processes;
- Demonstrate new capabilities for weapons and material security applications, including detecting special nuclear material movement and diversion and nuclear safeguards;
- Sustain and improve U.S. capabilities in nuclear explosion monitoring, including delivering the nation's space-based nuclear detonation detection payloads and related activities that support treaty monitoring and military missions.

Nuclear Counterterrorism and Incident Response Program
- Provide expertise and equipment to 1) detect and identify nuclear or radiological materials during high-profile events or in response to a threat; 2) rapidly respond to disable a potentially yield producing nuclear device; and 3) lead the Federal Government's monitoring and technical assessment efforts after a nuclear or radiological incident or accident, saving lives;
- The DOE/NNSA Aerial Measuring System (AMS) detects, measures, and tracks radioactive material in an emergency to determine contamination levels. The AMS Recapitalization project will procure three fixed-wing aviation platforms to replace the aging fleet and meet the future needs of the AMS Program, in accordance with the conclusions of the Analysis of Alternatives (AoA);
- Provide technical expertise, facilities, and equipment to examine interdicted nuclear devices or materials; collect and process debris samples following an Improvised Nuclear Device (IND) detonation; support device assessment and reverse engineering; and make progress towards establishing the National Nuclear Materials Archive;
- Advance the Nation's technical capability to: understand and defeat nuclear threat devices (NTDs), including Improvised Nuclear Devices (INDs), and last or stolen nuclear weapons; advise on protection requirements for nuclear materials; and, prevent nuclear terrorism through Nuclear Threat Reduction channels with the United Kingdom and France;
- Strengthen U.S. national security by increasing partner capabilities to counter and respond to radiological and nuclear incidents and accidents worldwide through: policy, training, exercises, technical exchanges, and equipment provisioning.

Major Outyear Priorities and Assumptions
Outyear funding levels for the Defense Nuclear Nonproliferation appropriation total $7,839,240,000 for FY 2020 through FY 2023, based on the following priorities and assumptions.

Defense Nuclear Nonproliferation Programs

- Play a key role in the international effort to secure vulnerable nuclear and radiological materials around the world, promote material security best practices, prevent illicit trafficking, and promote long-term risk reduction through alternatives to radioisotopic source-based devices and technologies.
- Cooperate with international partners, such as the Global Partnership, the IAEA, INTERPOL, and the Global Initiative to Combat Nuclear Terrorism, and implement an engagement strategy with partner countries that carefully balances threats and indigenous resources.
- Develop approaches, technology, human capital and international infrastructure to strengthen the international nuclear safeguards system and provide the IAEA with necessary resources to implement the evolving nuclear safeguards regime.
- Work with foreign partners at all stages of nuclear development to enhance their ability to meet their safeguards and security obligations.
- Work domestically and abroad to minimize and, when possible, eliminate nuclear materials and ensure sound management principles for materials that remain.
- Facilitate legitimate nuclear cooperation by building domestic and global capacity to detect and prevent illicit transfers of WMD-related materials, equipment, and technology by providing technical reviews of U.S. export licenses; conducting technical analyses of interdiction cases; providing technical support to multilateral nonproliferation export control regimes (such as the Nuclear Suppliers Group, the Australia Group, and the Missile Technology Control Regime); and working with foreign partners to strengthen their national systems of export control.
- Develop and demonstrate U.S. capabilities in DOE laboratories, academia and industry for detecting nuclear material production and weapons development, monitoring nuclear explosions, preparing for future arms control, supporting nuclear security broadly, and producing the nation's space-based global nuclear detonation detection capability as required by law.

Nuclear Counterterrorism and Incident Response Program

- Maintain and strengthen nuclear/radiological incident response capabilities, Emergency Operations Center, and the Department's capabilities to manage accidents and emergencies at all DOE/NNSA headquarters and field sites, and sustainment of existing deployable capabilities, understanding and adapting to changes in proliferation and nuclear terrorism threats, and sustaining unique modeling and device assessment capabilities.
- Build and sustain classified emergency response communications network for critical real-time operational information sharing.
- Recapitalize emergency response equipment consistent with lifecycle planning to ensure operational readiness is maintained.
- Sustain existing nuclear counterterrorism capabilities in nine cities (Stabilization), and establish the capability in one additional city each year.
- Enhance international nuclear/radiological preparedness and response training programs and support, including implementation of the 2015 Nuclear Threat Reduction (NTR) Work Plan with United Kingdom and France, and sharing of best practices to domestic and foreign partners to reduce terrorism risks to nuclear material and facilities.

FY 2020 - FY 2023 Key Milestones

- (2019) Complete support for Argentina's Nuclear Security Support Center, including a joint commissioning
- (2020) Transition a cumulative total of 786 radiation detection systems to partner country sustainability
- (2023) Complete the conversion of all the major global producers of Mo-99
- (2023) Complete security upgrades at a total of 2,766 buildings that contain radiological material
- (2023) Complete nuclear forensics capacity building engagements to a total of 59 partner countries
- (2023) Complete curriculum development at Kazakhstan's Nuclear Security Training Center
- (2023) Demonstrate new capabilities for early detection of special nuclear material (SNM) production
- (2023) Demonstrate new capabilities for detecting the presence, movement and diversion of SNM, including through remote detection and advanced nuclear safeguards
- Conduct six to eight physical security assessment visits per year for U.S.-obligated nuclear materials at foreign facilities
- Transfer five safeguards tools per year to foreign partners or international organization to meet identified safeguards deficiencies
- In partnership with the Department of State's Export Control and Related Border Security program, engage 25 to 35 foreign partners per year to strengthen national systems of export control and prevent illicit trafficking in nuclear and

dual-use commodities through export licensing and enforcement training programs, and advancing sustainability through train-the-trainer approaches
- Perform approximately 6,000 technical reviews per year of U.S. export licenses for nuclear and dual-use commodities
- Provide approximately 3,000 real time technical analyses to the U.S. enforcement community per year for interdiction cases
- Conduct three monitoring visits per year in Russia under the terms of the Plutonium Production Reactor Agreement (PPRA) to ensure the non-weapons use of Russian plutonium oxide and non-operational status of shutdown Russian plutonium production reactors and host Russian monitors on their annual monitoring visit to U.S. facilities falling under the PPRA
- Process 40 to 50 Part 810 specific authorization applications and requests for amendments per year and review over 100 Part 810 general authorization reports for compliance with Part 810 regulations per year
- Deliver nuclear detonation detection satellite payloads in accordance with the negotiated schedule with the United States Air Force (USAF)

DOE Working Capital Fund (WCF) Support

The NNSA Defense Nuclear Nonproliferation appropriation projected contribution to the DOE WCF for FY 2019 is $5,892,000. This funding covers shared enterprise activities including managing enterprise-wide systems and data, telecommunications, and supporting the integrated acquisition environment.

Legacy Contractor Pensions

Funding provides the annual DNN share of the DOE's reimbursement of payments made to the University of California (UC) Retirement Plan (UCRP) for former UC employees and annuitants who worked at the Lawrence Livermore National Laboratory (LLNL) and Los Alamos National Laboratory (LANL). The UCRP benefit for these individuals is a legacy cost and DOE's annual payment to the UC is required by contract. The amount of the annual payment is based on the actuarial valuation report and is covered by the terms described in the contracts. NNSA's budget request supports a readjusted the split between Weapons and DNN to reflect the changes in relative shares of total NNSA funding in FY 2019. These contracts will be paid through the Legacy Contractor Pension line item.

Entry Level Hires

NNSA supports a variety of programs to help train and recruit the next generation of leaders in managing the nuclear stockpile, nonproliferation, nuclear security, and international security, such as the NNSA Graduate Fellowship Program (NGFP), and, where appropriate, the Presidential Management Fellows (PMF) program. These programs foster the pipeline of qualified professionals who will sustain expertise in these areas through future employment within the nuclear security enterprise. In FY 2019, the DNN appropriation will provide up to $3,300,000 for NGFP support and development activities.

Defense Nuclear Nonproliferation
Funding by Congressional Control

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Defense Nuclear Nonproliferation Appropriation				
Defense Nuclear Nonproliferation				
Material Management and Minimization				
HEU Reactor Conversion	75,615	75,101	98,300	+22,685
Nuclear Material Removal	68,902	68,434	32,925	-35,977
Material Disposition	143,833	142,856	200,869	57,036
Total, Material Management and Minimization	**288,350**	**286,391**	**332,094**	**+43,744**
Global Material Security				
International Nuclear Security	66,027	65,579	46,339	-19,688
Domestic Radiological Security	87,199	86,607	90,764	+3,565
International Radiological Security	68,907	68,439	59,576	-9,331
Nuclear Smuggling Detection and Deterrence	144,975	143,990	140,429	-4,546
International Contributions* [non-add]	[892]	0	0	-[892]
Total, Global Material Security	**367,108**	**364,615**	**337,108**	**-30,000**
Nonproliferation and Arms Control	**124,703**	**123,856**	**129,703**	**+5,000**
Defense Nuclear Nonproliferation R&D	**469,750**	**466,560**	**456,095**	**-13,655**
Nonproliferation Construction				
99-D-143, Mixed Oxide (MOX) Fuel Fabrication Facility, SRS	335,000	332,725	220,000	-115,000
18-D-150, Surplus Plutonium Disposition Project	0	0	59,000	+59,000
Total, Nonproliferation Construction	**335,000**	**332,725**	**279,000**	**-56,000**
Total, Defense Nuclear Nonproliferation Programs	**1,584,911**	**1,574,147**	**1,534,000**	**-50,911**
Nuclear Counterterrorism and Incident Response Program	**271,881**	**270,035**	**319,185**	**+47,304**
Legacy Contractor Pensions	**83,208**	**82,643**	**28,640**	**-54,568**
Subtotal, Defense Nuclear Nonproliferation Appropriation	**1,940,000**	**1,926,825**	**1,881,825**	**-58,175**
Use of Prior Year Balances	**-38,000**	**-37,742**	**-19,000**	**+19,000**
Rescission of Prior Year Balances	**-22,262**	**-3,113**	**0**	**+22,262**
Total, Defense Nuclear Nonproliferation Appropriation	**1,879,738**	**1,885,970**	**1,862,825**	**-16,913**

* The international contributions received by the GMS program shown in the FY 2017 Enacted column are a non-add to the FY 2017 Appropriation. The amount received in FY 2017 totaled $892,463, including $286,523 from Finland, $493,440 from the United Kingdom, and $112,500 from New Zealand.
SBIR/STTR:

- FY 2017 Transferred: SBIR: $7,958; STTR: $1,119
- FY 2018 Annualized CR: SBIR: $7,963; STTR: $1,120
- FY 2019 Request: SBIR: $8,186; STTR: $1,151
- FY 2020 - FY 2023 Request: SBIR: $34,481; STTR: $4,850

Outyears for Defense Nuclear Nonproliferation
Funding by Congressional Control

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Defense Nuclear Nonproliferation				
Material Management and Minimization	**357,333**	**354,300**	**361,371**	**368,146**
Global Material Security	**346,850**	**367,290**	**375,006**	**382,881**
Nonproliferation and Arms Control	**132,267**	**133,700**	**136,508**	**139,374**
Defense Nuclear Nonproliferation R&D	**475,017**	**460,028**	**469,689**	**479,552**
Nonproliferation Construction				
99-D-143, Mixed Oxide (MOX) Fuel Fabrication Facility, SRS	220,000	220,000	204,250	217,000
18-D-150, Surplus Plutonium Disposition Project	59,000	59,000	74,750	62,000
Total, Nonproliferation Construction	**279,000**	**279,000**	**279,000**	**279,000**
Total, Defense Nuclear Nonproliferation Programs	**1,590,467**	**1,594,318**	**1,621,574**	**1,648,953**
Nuclear Counterterrorism and Incident Response Program	**331,893**	**329,503**	**333,853**	**342,331**
Legacy Contractor Pensions	**12,848**	**11,250**	**10,500**	**9,750**
Subtotal, Defense Nuclear Nonproliferation Appropriation	**1,935,208**	**1,935,071**	**1,965,927**	**2,001,034**
Use of Prior Year Balances	**0**	**0**	**0**	**0**
Rescission of Prior Year Balances	**0**	**0**	**0**	**0**
Total, Defense Nuclear Nonproliferation Appropriation	**1,935,208**	**1,935,071**	**1,965,927**	**2,001,034**

Research and Development

The Office of Management and Budget (OMB) Circular No. A-11, "Preparation, Submission, and Execution of the Budget," requires the reporting of research and development (R&D) data. Consistent with this requirement, R&D activities funded by NNSA Weapons Activities programs are displayed below.

	(Dollars in Thousands)			
	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Research and Development (R&D)				
Basic	106,000	107,000	111,000	+5,000
Applied	145,000	147,000	152,000	+7,000
Development	61,000	62,000	62,000	+1,000
Subtotal, R&D	**312,000**	**316,000**	**325,000**	+13,000
Equipment	0	0	0	0
Construction	0	0	0	0
Total, R&D	**312,000**	**316,000**	**325,000**	**+13,000**

Material Management and Minimization

Overview
The Material Management and Minimization (M^3) program aims to minimize and, when possible, eliminate nuclear materials and ensure sound management principles for materials that remain. This includes minimizing the civilian use of highly enriched uranium (HEU); removing or eliminating the world's most vulnerable nuclear weapon materials; and disposing of excess nuclear weapons material in the United States. The M^3 Budget Request presents an integrated approach to addressing the persistent threat posed by the global stockpile of nuclear materials.

M^3 directly contributes to and plays a critical role to reduce global nuclear security threats and promote U.S. national security. The M^3 program is a key component of DOE/NNSA's integrated nonproliferation, counterterrorism, and emergency response strategies. M^3 makes these strategic contributions through the conversion of research reactors and medical isotope production facilities from the use of HEU to the use of low enriched uranium (LEU) fuels and targets, the removal of excess HEU and separated plutonium, and the disposition of HEU and plutonium.

Highlights of the FY 2019 Budget Request
- The Conversion subprogram will continue the pursuit of research reactor and isotope production facility conversions and/or verification of shutdowns. Three facilities will be converted or verified as shutdown in FY 2019.
- The Conversion subprogram will enhance its support of domestic molybdenum-99 (Mo-99) commercial partners to establish a reliable commercial supply of Mo-99 produced without HEU and assist global Mo-99 production facilities to eliminate the use of HEU targets.
- The Conversion subprogram will support the implementation of key international nuclear nonproliferation activities addressing HEU and/or Pu threat reduction.
- The Nuclear Material Removal subprogram will continue to identify and eliminate excess HEU and plutonium, including removing and/or disposing of 95 kilograms of material.
- The Nuclear Material Removal subprogram will conduct an emerging threats mock deployment exercise to ensure a short-term readiness posture to respond to an urgent nuclear material removal mission.
- The Material Disposition subprogram will make efforts to expedite the removal of 1 metric ton (MT) of plutonium from the state of South Carolina and continue the dilute and dispose strategy to fulfill the United States' commitment to dispose of 34 metric tons of surplus plutonium.
- The Material Disposition subprogram will continue to eliminate surplus HEU through down-blending to LEU or direct disposal with a priority on legacy material to reduce risk. During FY 2019, the subprogram will complete the Repurposed Enriched Uranium (REU) down-blending campaign for on-spec HEU.
- The Material Disposition subprogram will continue to implement the Uranium Lease and Take-Back (ULTB) program in accordance with the American Medical Isotopes Production Act of 2012.

Material Management and Minimization
Funding

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Material Management and Minimization				
HEU Reactor Conversion	75,615	75,101	98,300	+22,685
Nuclear Material Removal	68,902	68,434	32,925	-35,977
Material Disposition	143,833	142,856	200,869	+57,036
Total, Material Management and Minimization	**288,350**	**286,391**	**332,094**	**+43,744**

Outyears for Material Management and Minimization
Funding

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Material Management and Minimization				
HEU Reactor Conversion	145,800	121,511	117,712	116,864
Nuclear Material Removal	50,925	62,546	63,860	65,201
Material Disposition	160,608	170,243	179,799	186,081
Total, Material Management and Minimization	**357,333**	**354,300**	**361,371**	**368,146**

Material Management and Minimization
Explanation of Major Changes
(Dollars in Thousands)

	FY 2019 Request vs FY 2017 Enacted
Material Management and Minimization	
HEU Reactor Conversion: The increase in funding primarily reflects the inclusion of the U.S. high performance research reactors (USHPRR) Program in the "HEU Reactor Conversion" line of this budget request rather than in the DNN R&D program as appropriated in FY 2017.	+22,685
Nuclear Material Removal: The decrease in funding reflects the political and technical challenges that have delayed implementation of several removal efforts including those in Belarus, Kazakhstan, and Pakistan. Due to these delays, the program costed less than expected in FY 2017 and will use uncosted balances to continue planning and preparation for these removal efforts under the existing operating paradigm.	-35,977
Material Disposition: The increase in funding primarily reflects the effort to expedite the removal of 1MT of plutonium from the state of South Carolina and transition to the dilute and dispose strategy.	+57,036
Total, Material Management and Minimization	**+43,744**

Material Management and Minimization
HEU Reactor Conversion

Description

The HEU Reactor Conversion subprogram, referred to as the Convert subprogram, supports the conversion of domestic and international civilian research reactors and isotope production facilities to non-weapons usable nuclear materials. These efforts result in permanent threat reduction by minimizing and, to the extent possible, eliminating the use of HEU in civilian applications. This includes working with global Mo-99 producers to convert their existing operations to use LEU targets and accelerating the development of new non-HEU-based Mo-99 production capabilities in the United States.

The Convert subprogram will continue pursuing reactor conversions and verifying shutdowns both domestically and abroad. As of the end of FY 2017, the program has converted or verified the shutdown of 100 HEU research reactors and isotope production facilities worldwide. As part of this effort, the program will continue its work to qualify a high-density LEU fuel and to demonstrate the fabrication capability necessary to convert six U.S. high performance research reactors from HEU to LEU fuel. These high performance research reactors cannot convert with existing LEU fuels. FY 2019 funding will support critical experiments that will allow for the selection of a fuel fabrication process and the demonstration of the ability to fabricate and irradiate prototypic fuel plates using a commercial-scale fabrication process. In addition, the Convert subprogram will monitor and evaluate results from initial tests at the Transient Reactor Test Facility (TREAT) reactor to better understand the reactor's performance requirements prior to conversion to LEU fuel.

FY 2019 funding will allow the Convert subprogram to continue to provide support to accelerate the establishment of new, non-HEU-based Mo-99 production facilities in the United States. Building on prior-year support, the Convert subprogram's cooperative agreement partners continue to make progress toward commercially producing Mo-99 in the United States without the use of HEU.

The Convert subprogram will continue to support the implementation of key international nuclear nonproliferation activities addressing HEU and/or Pu threat reduction. The subprogram has primary responsibility for verifying that the design continues to meet all nonproliferation goals as the design matures.

HEU Reactor Conversion

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
HEU Reactor Conversion $75,615,000	**HEU Reactor Conversion $98,300,000**	**HEU Reactor Conversion +$22,685,000**
• Converted an additional two reactors and one isotope production facility for a total of 100 facilities converted or verified as shutdown. • Provided technical and financial support to the U.S. private sector to accelerate establishment of a reliable domestic production capability for Mo-99 without the use of HEU and to existing global Mo-99 producers to convert from the use of HEU to LEU targets.	• Convert an additional two reactors and one isotope production facility for a total of 106 facilities converted or verified as shutdown. • Provide technical and financial support to the U.S. private sector to accelerate establishment of a reliable domestic production capability for Mo-99 without the use of HEU and to existing global Mo-99 producers to convert from the use of HEU to LEU targets. • Continue irradiation of mini-plate experiment in the Advanced Test Reactor in support of qualifying a new high-density LEU fuel that can convert the U.S. High Performance Research Reactors (USHPRR). • Begin fabrication of key full size irradiation test plates for same new high-density LEU fuel; and continue LEU fuel plate and assembly fabrication demonstration activities.	• The increase in funding primarily reflects the inclusion of the U.S. high performance research reactors (USHPRR) Program in the "HEU Reactor Conversion" line of this budget request rather than in the DNN R&D program as appropriated in FY 2017.

Material Management and Minimization
Nuclear Material Removal

Description

The Nuclear Material Removal subprogram, referred to as the Remove subprogram, supports the removal, consolidation, and disposal of excess nuclear material from civilian sites worldwide. Each kilogram of this material that is removed reduces the risk of a terrorist acquiring the material for use in a nuclear weapon.

This subprogram supports the removal, consolidation, and disposal of U.S.-origin HEU and LEU (from Material Test Reactor (MTR) and Training Research Isotope General Atomics (TRIGA)-type reactors), Russian-origin HEU and plutonium, and other high-risk nuclear materials called “Gap” material because it does not fall under the U.S.- or Russian-origin programs. (Gap material includes U.S.-origin spent HEU other than MTR and TRIGA fuel, HEU of non-U.S. and non-Russian-origin, unirradiated HEU, and separated plutonium.) The program to remove U.S.-origin HEU and LEU spent fuel to the United States will end in May 2019. On a case-by-case basis in support of nonproliferation objectives, some material may still be able to be returned under this program, pending National Environmental Policy Act (NEPA) review. The Remove subprogram will continue to remove Russian-origin HEU and plutonium from third-party countries and support the removal and disposal of vulnerable, high-risk nuclear materials that are not covered by the Russian-origin and U.S.-origin Nuclear Material Removal activities.

The subprogram continues to evaluate all excess nuclear material to identify and prioritize candidates for removal or disposition. The Remove subprogram evaluates material attractiveness, site and country level threats, and other factors to determine materials that are most at-risk and prioritize them for removal or disposal. Furthermore, the subprogram works with foreign partners to obtain regulatory permits; characterize, stabilize, package, and transport material; and provide replacement LEU, or other incentives for other-than-high-income-economy-countries, to encourage elimination of these dangerous materials. The subprogram also coordinates all future U.S. return projects with relevant DOE stakeholders, including the Office of Environmental Management (EM), to enable long-term planning and appropriate resource allocation.

In addition, as part of its mission to address emerging threats, the Remove subprogram will continue to develop the capability to promptly respond, if asked, to support the removal of nuclear material from countries of concern (e.g., Libya 2004). This includes in-country stabilization, packaging, and removal of nuclear materials (focusing on HEU and plutonium) through the deployment of self-sufficient, trained teams and mobile facilities. The Remove subprogram will be conducting a mock deployment of the emerging threats capabilities in late FY 2019. This mock deployment will test equipment capabilities and increase personnel proficiency while working alongside other DOE/NNSA and interagency partners.

Furthermore, the subprogram will focus on the development of international plutonium management strategies with countries other than Russia, by developing bi-lateral and multi-lateral working arrangements. Participating countries will work together at a technical level to support efforts to manage plutonium inventories in a way that minimizes the stockpiles of excess plutonium and maximizes the security and protection of the material.

Nuclear Material Removal

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Nuclear Material Removal $68,902,000	**Nuclear Material Removal $32,925,000**	**Nuclear Material Removal -$35,977,000**
• Removed and/or confirmed the disposition of an additional 268.1 kilograms of HEU and/or plutonium for a cumulative total of 6,372.9 kilograms. • Completed emerging threats mock deployment at Key West.	• Remove and/or confirm the disposition of an additional 95 kilograms of HEU and/or plutonium for a cumulative total of 6,594 kilograms. • Conduct an emerging threats mock deployment exercise to ensure a short-term readiness posture to respond to an urgent nuclear material removal mission.	• The decreased funding reflects the political and technical challenges that have delayed implementation of several removal efforts including those in Belarus, Kazakhstan, and Pakistan. Due to these delays, the program costed less than expected in FY 2017 and will use uncosted balances to continue removal efforts. Therefore, less new budget authority is requested in FY 2019.

Material Management and Minimization
Material Disposition

Description

The Material Disposition subprogram, referred to as the Dispose subprogram, is responsible for disposing of surplus weapon-grade plutonium and HEU in the United States and managing the provision of nuclear material for peaceful uses.

The Dispose subprogram includes activities that are necessary to support the overall program to dispose of surplus weapon-grade plutonium including surplus nuclear weapon pit disassembly and conversion of resultant metal to oxide, which is being conducted in the Advanced Recovery and Integrated Extraction System (ARIES) at LANL and surveillance and monitoring and packaging of surplus pits at Pantex.

In FY 2019, the Dispose subprogram will continue with activities to expedite the removal of 1 MT of plutonium from the state of South Carolina by expanding current down-blending operations, which will require hiring, training and appropriate clearance qualifications of additional employees. Dispose will also continue the dilute and dispose strategy to fulfill the United States' commitment to dispose of 34 metric tons of plutonium. The dilute and dispose strategy consists of blending plutonium with an inert mixture, packaging, and disposing of it in a geologic repository. In FY 2019, the Dispose subprogram will complete an independent validation of a detailed lifecycle cost estimate for the dilute and dispose alternative. The estimate includes all aspects of the program to implement the dilute and dispose strategy, including surveillance and packaging of surplus pits, pit disassembly and oxide conversion, dilution and disposal of the plutonium, all projects at the various sites needed to execute the program, and any other supporting costs required for the program baseline. Furthermore, the DOE/NNSA will continue program management and integration, technology maturation, and the environmental analyses for the disposal of surplus plutonium as required by the National Environmental Policy Act (NEPA). Additionally, in FY 2017, the National Academies of Science began an evaluation of DOE's conceptual plans for disposing of surplus plutonium in the Waste Isolation Pilot Plant (WIPP) to identify gaps and recommend actions that could be taken by DOE and others to address those gaps. This evaluation will be completed in FY 2019.

The Dispose subprogram is also responsible for preparation of the Japan Fast Critical Assembly (FCA) plutonium fuel plates to a form suitable for disposition. In FY 2017, NNSA initiated a programmatic alternatives evaluation to analyze the potential use of existing technologies and facilities across the DOE complex to either prepare and/or dispose of the FCA fuel plates. Four promising technologies are being evaluated and research activities will continue through FY 2018, utilizing the funds provided by Japan. Based on the research results, the alternative evaluation will be updated with refined cost estimates that will support a technology decision in late FY 2018. In FY 2019, NNSA will begin implementation of the selected technology continuing to use the funds provided by Japan.

Over the past decade, NNSA has eliminated more than 158.4 metric tons (MT) of weapons-usable HEU by down-blending it (or shipping it for down-blending) to low enriched uranium (LEU) for use in power and research reactors in the United States and abroad. The program has substantially reduced excess holdings of HEU throughout the DOE/NNSA complex, an amount sufficient to produce 6,336 weapons. The program has down-blended material under the Repurposed Excess Uranium (REU) contract, which will end in FY 2019. The REU contract will be replaced by the Down-blending Offering for Tritium (DBOT) contract, which will run from FY 2019 through FY 2025. Although DBOT is primarily a Weapons Activities contract, the Dispose subprogram is responsible for managing and funding a portion of the DBOT contract to support HEU disposition.

The Dispose subprogram manages enriched uranium supply and demand needs in support of DNN statutory obligations, international commitments or assurances, and mission goals to support the provision of material for Peaceful Uses. This includes oversight of contractor management of LEU fuel for the American Assured Fuel Supply (AAFS), high assay LEU fuel for research reactors that have been converted to use LEU instead of HEU, and high assay LEU targets for medical isotope production.

The Dispose subprogram will disposition legacy material and low equity discards stored at Y-12 in order to reduce risk due to the aging infrastructure and to support the transition to the Uranium Processing Facility (UPF). The Building 9206 discards will be complete by the end of FY 2022, and the Area 5 De-inventory (A5D) and Building 9212 discards will be complete by the end of FY 2025.

The Dispose subprogram will continue the ULTB program that was required by the American Medical Isotopes Production Act of 2012. Under this activity, DOE makes LEU available to commercial entities through lease contracts for the domestic production of Mo-99 and takes back material that does not have a commercial disposition pathway after use by the commercial entities. The Y-12 facility will continue to provide technical assistance and assist in managing the execution of LEU lease contracts under the ULTB Program. NNSA currently supports the program management of the ULTB program with appropriated funds.

Material Disposition

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Material Disposition $143,833,000	**Material Disposition $200,869,000**	**Material Disposition +$57,036,000**
U.S. Plutonium Disposition $88,813,000	**U.S. Plutonium Disposition $158,619,000**	**U.S. Plutonium Disposition +$69,806,000**
• Continued pit disassembly and oxide conversion activities to prepare plutonium for disposition. • Continued to provide surveillance and packaging capabilities for surplus pits and plutonium at Pantex. • Completed conceptual design activities for the dilute and dispose alternative to support a CD-1 for surplus plutonium disposition. • Continued the development of the lifecycle cost estimate for the dilute and dispose program for surplus plutonium disposition. • Initiated the NEPA process for the dilute and dispose alternative. • Maintained the Waste Solidification Building (WSB) facility in a lay-up configuration while the Department determines options for future use. • Evaluated options for the de-cladding and conversion project to ensure the approach pursued for the Japan FCA fuel plates is the lowest cost possible for disposition. • Supported the ongoing maintenance of critical programmatic documents including the Program Execution Plan, integrated schedules, performance measures, NEPA documentation, memoranda of agreement, analysis for plutonium disposition, and interface control documents; minimal required infrastructure and erosion control maintenance required to comply with safety and environmental standards; and DNN's portion of the SRS-wide common infrastructure maintenance activities including	• Continue pit disassembly and oxide conversion activities to prepare plutonium for disposition. • Continue to provide surveillance and packaging capabilities for surplus pits and plutonium. • Complete an independent validation of the lifecycle estimate for the dilute and dispose program for surplus plutonium disposition. • Continue activities associated with expediting the removal of 1MT of plutonium from the state of South Carolina. • Continue transition to the dilute and dispose strategy, including technical development and analysis. • Continue the NEPA process for the dilute and dispose program. • Maintain the WSB facility in a lay-up configuration while the Department determines options for future use. • Pursue selected technology for the disposition of Japan FCA fuel plates, utilizing funds from Japan, as appropriate. • Support the ongoing maintenance of critical programmatic documents including the Program Execution Plan, integrated schedules, performance measures, memoranda of agreement, analysis for plutonium disposition, and interface control documents; minimal required infrastructure and erosion control maintenance required to comply with safety and environmental standards; and DNN's portion of the SRS-wide common infrastructure	• The increase in funding is attributed to the continuation to expedite the removal of 1MT of plutonium from the state of South Carolina and transition to the dilute and dispose strategy for surplus plutonium disposition.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
site roads, bridges, barricades, and utility distribution systems.	maintenance activities including site roads, bridges, barricades, and utility distribution systems.	
U.S. Uranium Disposition $55,020,000	**U.S. Uranium Disposition $42,250,000**	**U.S. Uranium Disposition -$12,770,000**
• Down-blended or shipped for down-blending HEU to produce LEU consistent with specifications. • Continued to down-blend HEU into high assay LEU metal for research reactor fuel and Mo-99 targets, in support of replacing current HEU demand for research reactor fuel and medical isotope production with LEU-based solutions. • Continued cleanup of legacy material in Y-12's Building 9206 to reduce risk. • Supported tracking and analyzing enriched uranium supply and demand needs and commitments of DNN mission goals.	• Down-blend or ship for down-blending HEU to produce LEU consistent with specifications. • Continue to down-blend HEU into high assay LEU metal for research reactor fuel and for Mo-99 targets, in support of replacing current HEU demand for research reactor fuel and medical isotope production with LEU-based solutions. • Continue implementing the ULTB program. • Continue cleanup of legacy material in Y-12's Building 9206, Building 9212 and the Area 5 De-inventory (A5D) to reduce risk. • Support tracking and analyzing enriched uranium supply and demand needs and commitments of DNN mission goals.	• The decrease reflects the completion of the REU contract for down-blending.

Material Management and Minimization
Performance Measures

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Highly Enriched Uranium (HEU) Reactors Converted or Shutdown - Cumulative number of HEU reactors and isotope production facilities converted or verified as shutdown prior to conversion.							
Target	101 facilities	103 facilities	106 facilities	112 facilities	117 facilities	121 facilities	123 facilities
Result	**Not Met** - 100						
Endpoint Target	By 2035, convert or verify the shutdown prior to conversion of 156 HEU reactors and isotope production facilities.						
Nuclear Material Removed – Cumulative number of kilograms of vulnerable nuclear material (HEU and plutonium) removed or disposed.							
Target	6,285 kg	6,499 kg	6,594 kg	6,629 kg	6,800 kg	6,833 kg	7,000 kg
Result	**Exceeded** - 6,372.9						
Endpoint Target	By 2027, remove or dispose of 7,680 kilograms of vulnerable nuclear material (HEU and plutonium), enough for approximately 300 nuclear bombs.						
U.S. Highly Enriched Uranium (HEU) Down-blended - Cumulative amount of surplus U.S. highly enriched uranium (HEU) down-blended or shipped for down-blending.							
Target	157 MT	160 MT	162 MT	N/A	N/A	N/A	N/A
Result	**Exceeded** - 157.9						
Endpoint Target	By the end of FY 2019, complete disposition of 162 MT of HEU. The overall amount of HEU available for down-blending and the rate at which it will be down-blended is dependent upon decisions regarding the U.S. nuclear weapons stockpile, the pace of warhead dismantlement and receipt of HEU from research reactors, as well as other considerations, such as decisions on processing of additional HEU through H-Canyon, disposition paths for weapons containing HEU, etc.						
U.S. Surplus Plutonium Disposition - Cumulative kilograms of plutonium metal converted to oxide converted to oxide in preparation for final disposition.							
Target	767 kg	867 kg	967 kg	1,067 kg	1,167 kg	1,267 kg	1,367 kg
Result	**Not Met** - 688.6						
Endpoint Target	By FY 2028, convert 2 MT (2000 kg) of surplus plutonium to oxide.						

Material Management and Minimization
Capital Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2017 Current	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted	Outyears to Completion
Capital Operating Expenses Summary (including Major Items of Equipment (MIE))								
Capital Equipment >$500K (including MIE)	N/A	12,554	8,913	8,913	9,109	9,309	+396	N/A
Plant Projects (GPP and IGPP)	N/A	4,001	0	0	0	0	0	N/A
Total, Capital Operating Expenses	**N/A**	**16,555**	**8,913**	**8,913**	**9,109**	**9,309**	**+396**	N/A
Capital Equipment > $500K (including MIE)								
Total Non-MIE Capital Equipment	N/A	12,554	8,913	8,913	9,109	9,309	+396	N/A
Total, Capital Equipment (including MIE)	N/A	**12,554**	**8,913**	**8,913**	**9,109**	**9,309**	**+396**	**0**
Plant Projects (GPP and IGPP)								
Total Plant Projects (GPP/IGPP)	N/A	4,001	0	0	0	0	0	0
Total, Plant Projects (GPP/IGPP)	**N/A**	**4,001**	**0**	**0**	**0**	**0**	**0**	**0**
Total, Capital Summary	**N/A**	**16,555**	**8,913**	**8,913**	**9,109**	**9,309**	**+396**	**0**

Outyears for Material Management and Minimization

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Capital Operating Expenses Summary (including MIE)				
Capital Equipment >$500K (including MIE)	9,514	9,723	9,937	10,156
Plant Projects (GPP)	0	0	0	0
Total, Capital Operating Expenses	**9,514**	**9,723**	**9,937**	**10,156**

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Global Material Security

Overview

The FY 2019 Global Material Security (GMS) Program prevents terrorists and other actors from obtaining nuclear and radiological material to use in an improvised nuclear device (IND) or a radiological dispersal device (RDD). GMS works with partner countries to improve the security of vulnerable materials and facilities and to improve partners' capacity to deter, detect, and investigate illicit trafficking of these materials. GMS works extensively with and through multilateral partners such as the IAEA and Interpol. As part of an ongoing strategic analysis process, GMS is also exploring innovative approaches, technologies and tools to adapt to emerging threats. GMS supports national security priorities to reduce global nuclear security threats, and GMS is a key component of DOE/NNSA's integrated nonproliferation, counterterrorism, and emergency response strategy.

GMS consists of three subprograms: International Nuclear Security, Radiological Security, and Nuclear Smuggling Detection and Deterrence.

GMS provides support to strengthen partner country capacity for physical protection and detection, as well as sustainability support for partner countries to continue securing, reducing, and interdicting nuclear and radioactive materials. GMS seeks to ensure that US-provided equipment and upgrades are sustained (with minimal additional U.S. investment) through enhancing areas such as regulations and inspections, training infrastructure, maintenance, exercises, performance testing, life-cycle planning, and nuclear security culture. To enhance its reach and effectiveness, GMS provides technical and policy support to multilateral organizations, including the International Atomic Energy Agency (IAEA) and the International Criminal Police Organization (INTERPOL).

Highlights of the FY 2019 Budget Request

- Support joint development and execution of nuclear security best practices exchanges and training courses at partner countries' nuclear security training centers including India, China, Japan, South Korea, and Kazakhstan. These training venues address domestic nuclear security training requirements, and provide for bilateral and regional best practice exchanges.
- Support nuclear security best practices exchanges and/or training courses with more than 35 countries in Europe, the Middle East, Africa, Asia, and Latin America.
- Continue cooperation with Ukraine to include training for the National Guard, nuclear power plant physical protection upgrades, nuclear security degree program curriculum development, and nuclear security culture enhancement.
- Support IAEA guidance document development, training courses, advisory missions, and subject matter expert assistance to build sustainable, effective nuclear security worldwide furthering U.S. national security objectives.
- Prioritize efforts to ensure effective security for cesium-based devices worldwide; by 2020, secure the most at-risk radiological material in U.S. high-threat urban areas by enhancing local law enforcement response and encouraging the use of technologies reducing potential radiological dispersal device (RDD) risk.
- Complete security upgrades at an additional 100 buildings with high-priority radioactive sources (55 domestic sites and 45 international sites).
- Recover an additional 1,100 disused and unwanted radioactive sealed sources from locations throughout the United States.
- Replace 44 devices that use high-activity radioactive sources with non-radioisotopic alternative technologies. Expand education and outreach to encourage a broader adoption of technologies that do not use high activity radioactive sources.
- Deploy mobile detection systems and equip priority border crossing points with radiation detection systems, and provide associated training and maintenance support, to help counter the threat of illicit trafficking of special nuclear material. The bulk of these systems will be deployed in countries in Eastern Europe, Central Asia, and Africa.
- Deploy flexible radiation detection capabilities at strategic airports in the Middle East, the Caucasus, and Southeast Asia. These systems are used to perform targeted screening of commercial air traffic arriving from countries of concern.
- Build capacity and transfer full financial responsibility for training and maintenance of radiation detection systems at 57 international locations bringing the cumulative number of indigenously sustained systems to 741.

Global Material Security
Funding

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Global Material Security				
International Nuclear Security	66,027	65,579	46,339	-19,688
Radiological Security				
Domestic Radiological Security	87,199	86,607	90,764	3,565
International Radiological Security	68,907	68,439	59,576	-9,331
Nuclear Smuggling Detection and Deterrence	144,975	143,990	140,429	-4,546
International Contributions [non-add][a]	[892]	0	0	[-892]
Total, Global Material Security	**367,108**	**364,615**	**337,108**	**-30,000**

Outyears for Global Material Security
Funding

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Global Material Security				
International Nuclear Security	46,339	50,391	51,449	52,529
Radiological Security				
Domestic Radiological Security	92,513	96,000	98,016	100,074
International Radiological Security	60,827	65,340	66,712	68,113
Nuclear Smuggling Detection and Deterrence	147,171	155,559	158,829	162,165
Total, Global Material Security	**346,850**	**367,290**	**375,006**	**382,881**

[a] The international contributions received by the GMS program shown in the FY 2017 Enacted column are a non-add to the FY 2017 Appropriation. The amount received in FY 2017 totaled $892,463, including $286,523 from Finland, $493,440 from the United Kingdom, and $112,500 from New Zealand.

Global Material Security
Explanation of Major Changes
(Dollars in Thousands)

	FY 2019 Request vs FY 2017 Enacted
Global Material Security:	
International Nuclear Security: The decrease reflects a commitment to reduce prior year carryover balances.	-19,688
Domestic Radiological Security: The increase reflects an acceleration of efforts under the Cesium Irradiator Replacement Project (CIRP).	+3,565
International Radiological Security: The decrease reflects funding shifts to prioritize increased scope under CIRP, as well as an increasing number of sites transitioning from the program's support to self-sustainment.	-9,331
Nuclear Smuggling Detection and Deterrence: The decrease reflects decreased support for the maritime vectors program.	-4,546
Total, Global Material Security	**-30,000**

Global Material Security
International Nuclear Security

Description

The International Nuclear Security (INS) subprogram works with partner countries and multilateral organizations to enhance security of nuclear material at facilities and during transport through training, development of regulations, technical exchanges to share best practices, and equipment upgrades.

INS assists partner countries in developing and maintaining a national-level nuclear security infrastructure that improves security practices and supports sustainability of U.S.-funded security upgrades. These collaborative projects contribute to U.S. national security interests by strengthening partners' ability to prevent theft or sabotage of nuclear material through: effective nuclear security regulations, training and educational programs, secure transportation, protective force capabilities, material accounting and measurement capabilities, cyber security programs, and strong nuclear security culture. INS also partners to develop nuclear security support centers that help maintain expertise and serve as regional resources for nuclear security capacity building.

INS also directly supports IAEA's Division of Nuclear Security by contributing to the development of IAEA nuclear security guidance documents and associated curricula. INS supplies subject matter experts to support IAEA training, International Physical Protection Advisory Service (IPPAS) missions, technical and other consultancy meetings, and senior advisory committees. INS assists the IAEA in establishing and implementing programs to improve physical protection, nuclear material accounting and control, insider threat mitigation, nuclear security culture, transportation security, and cyber security for nuclear materials and nuclear facilities. INS works bilaterally to train foreign partners on physical protection and implementation of the nuclear security recommendations in IAEA Information Circular (INFCIRC) 225/Revision 5.

International Nuclear Security

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
International Nuclear Security $66,027,000	**International Nuclear Security $46,339,000**	**International Nuclear Security -$19,688,000**
• Conducted technical exchanges and workshops on MPC&A topics with Belarus, India, Israel, Japan, South Korea, Jordan, Vietnam, and other international partners. • Supported courses at partner country training facilities on nuclear security topics. • Continued ongoing capacity building cooperation on the new physical protection security recommendations in INFCIRC 225/Rev 5. • Continued to support the IAEA in the furtherance of nuclear security initiatives, including development of Nuclear Security Series documents, International Physical Protection Advisory Service Missions, and strengthening of nuclear facility best practices, including cybersecurity best practices and capacity building with international partners. • Continued providing limited sustainability support to nuclear sites with MPC&A upgrades, including support for training, procedures, maintenance, equipment repair, critical spare parts, performance testing, and other activities.	• Support courses at partner country nuclear security support centers. • Continue ongoing capacity building cooperation on the nuclear security recommendations in INFCIRC 225/Rev 5. • Continue to support the IAEA to further nuclear security initiatives, such as development of Nuclear Security Series documents, IPPAS missions, and strengthening of nuclear facility best practices, including cybersecurity best practices and capacity building with international partners. • Continue providing limited sustainability support to nuclear sites with nuclear security upgrades including support for training, procedures, maintenance, equipment repair, critical spare parts, performance testing, and other activities. • Continue support for enhanced nuclear security culture, promoting the importance of personal responsibility for nuclear security with bilateral partner countries and in cooperation with the IAEA.	• The decrease reflects a commitment to reduce prior year carryover balances.

Global Material Security
Radiological Security

Description
The Radiological Security (RS) subprogram supports U.S. national security through the protection, removal, and reduction of high-activity radiological materials domestically and internationally. The RS subprogram reduces the risk of a terrorist acquiring the radiological material necessary for a radiological dispersal device (RDD) or "dirty bomb."

RS protects radioactive sources used for vital medical, research, and commercial purposes; removes and disposes disused radioactive sources; and reduces the global reliance on radioactive sources by promoting the adoption and development of non-radioisotopic alternative technologies.

RS works to enhance the security of high-activity radiological materials located at soft targets (e.g. hospitals, universities, etc.) in the United States and in other high priority countries. RS works in close cooperation with national, regional, and local partners and the IAEA. RS implements state-of-the art security solutions to protect radiological material at volunteer sites.

RS supports the removal and disposal of vulnerable excess and abandoned radiological materials by working to accelerate consolidation and disposal of excess, disused, or orphaned radioactive sources and to secure and repatriate high-risk U.S.-origin sources.

RS works to reduce this risk of radiological terrorism by promoting the transition to alternative non-radioisotopic technologies where possible. This permanently reduces risk either by eliminating high activity sources or by obviating the need to introduce sources in the first place. Technologies for alternatives are maturing, and new technologies are entering the market. RS works to disseminate information on these alternative technologies and provide cost-sharing incentives to volunteer organizations willing to transition cesium irradiators to non-radioisotopic technologies.

In 2019, RS will continue efforts to secure, by 2020, the most at-risk radiological material in U.S. high-threat urban areas by enhancing local law enforcement response and by encouraging the use of technologies that do not pose a dirty bomb risk. In addition, RS will prioritize efforts to ensure effective security for cesium-based devices worldwide. RS will continue to prioritize activities to protect, remove, and reduce radioactive sources by considering the most cost effective risk reduction strategies. Where possible, RS will prioritize permanent risk reduction efforts.

Radiological Security

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Radiological Security $156,106,000	**Radiological Security $150,340,000**	**Radiological Security -$5,766,000**
Domestic Radiological Security $87,199,000 **International Radiological Security $68,907,000** • Completed security upgrades at an additional 49 domestic buildings and 47 international buildings containing radiological material. • Removed an additional 2,119 excess and unwanted sealed sources from locations in the United States. • Recovered and disposed or securely stored disused or orphaned radiological sources in other countries. • Worked with appropriate authorities and sites to sustain previously installed security upgrades domestically and internationally. • Furthered the transition to non-isotopic, alternative technologies and replaced 16 high activity, radioactive source-based devices in the United States with non-isotopic technologies.	**Domestic Radiological Security $90,764,000** **International Radiological Security $59,576,000** • Under the Global Cesium Security Initiative, focus on securing and eliminating cesium-based devices in priority countries worldwide through tailored protect, remove or reduce strategies. • Replace 44 cesium devices in the U.S., which use high-activity radioactive sources, with those that use alternative non-radioisotopic technologies. • Under the 2020 Cities Initiative, secure by 2020 the remaining buildings with high risk quantities of cesium-137 and cobalt-60 in major metropolitan areas of the United States. • Expand education and outreach to encourage a broader adoption of alternative non-radioisotopic technologies. • Continue to support the deployment of mobile source tracking systems for field deployed sources. • Secure 100 additional buildings that contain high priority radiological material including 55 buildings in the United States and 45 buildings in other high priority countries. • Continue to collaborate with industry on “security by design” to make source-based devices inherently more secure in the manufacturing process. • Work with appropriate authorities and sites to sustain previously installed security upgrades domestically and internationally.	**Domestic Radiological Security +$3,565,000** **International Radiological Security -$9,331,000** • The increase in the domestic radiological security program reflects an acceleration of efforts under the Cesium Irradiator Replacement Project (CIRP). • The decrease reflects funding shifts to prioritize increased scope under CIRP, as well as an increasing number of sites transitioning from the program’s support to self-sustainment.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
	• Remove an additional 1,100 excess and unwanted sealed sources from locations throughout the United States. • Recover and dispose or securely store disused or orphaned radioactive sources in other countries. • Domestically, in the top 20 highest priority areas, increase coordination between sites that have high-priority radiological material and local law enforcement agencies responsible for protecting those sites.	

Global Material Security
Nuclear Smuggling Detection and Deterrence

Description

The Nuclear Smuggling Detection and Deterrence (NSDD) subprogram works with partners to deter, detect, and investigate nuclear and radiological trafficking. NSDD provides partners with tailored radiation detection systems based on assessments of high risk smuggling pathways and operational environments. NSDD partners include international law enforcement, intelligence, and border security. To facilitate long term use of systems, NSDD works with partners to indigenize capabilities in the areas of operation and management, training, and maintenance. NSDD coordinates closely with other U.S. government agencies (e.g. Departments of Homeland Security, State, Defense, and Justice) to maximize the impact of U.S. government resources, and collaborates with international organizations such as INTERPOL, IAEA, and the Global Initiative to Combat Nuclear Terrorism (GICNT) to promote consistency in global efforts to counter nuclear smuggling.

Going forward, NSDD will address remaining gaps in detection capabilities in the Global Nuclear Detection Architecture (GNDA), expand flexible detection capabilities for targeted screening at airports and continue to improve partner country skills. NSDD will conduct operator trainings; technical training on equipment maintenance repair; and topical workshops, drills, exercises, and similar events designed to test, evaluate, and improve system performance and effectiveness.

NSDD will continue to work to transition responsibility for operation and maintenance to host country partner organizations and maintain existing relationships with partners, sharing best practices related to operation and maintenance.

NSDD will continue efforts to strengthen foreign partner nuclear forensics analytical capability and best practices, to give partners the tools to identify interdicted materials. These tools are integral to a robust program to deter illicit trafficking. NSDD will also work multilaterally with the IAEA and the GICNT on the development of international guidance documents and events to advance partner country technical expertise in nuclear forensics.

Nuclear Smuggling Detection and Deterrence

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Nuclear Smuggling Detection and Deterrence $144,975,000	**Nuclear Smuggling Detection and Deterrence $140,429,000**	**Nuclear Smuggling Detection and Deterrence -$4,546,000**
• Provided 26 additional mobile and man-portable systems for use by law enforcement at internal checkpoints in countries of strategic interest. • Completed fixed radiation detection systems at 30 sites, focusing on key gaps in the global nuclear detection architecture. • Provided flexible radiation detection capabilities for targeted screening of maritime small vessels and for high-priority airports in the Middle East, Eastern Europe, Africa and Asia. • Transitioned 92 radiation detection systems to indigenous sustainment. • Continued to support capacity building activities in countries where systems have been installed but are not indigenously sustained. • Continued connecting sites to national communications systems in seven countries. • Conducted approximately 47 events, workshops or exercises to advance partner country capabilities in radiation detection, equipment maintenance, and forensics capabilities.	• Provide ten additional mobile and man-portable systems for use by law enforcement at internal checkpoints in countries along known smuggling routes. • Establish ten new bilateral partner country engagements to strengthen nuclear forensics capabilities, bringing total nuclear forensics engagement count to 39 partner countries. • Equip an additional 28 official crossing points to close key gaps in the global nuclear detection architecture. • Provide flexible radiation detection capabilities for targeted screening at high-priority airports in the Middle East, the Caucasus, and Southeast Asia. • Continue connecting radiation detection sites to national communications systems in six countries. • Continue to support capacity building activities in countries where systems have been installed but are not indigenously sustained. • Transition 57 radiation detection systems to indigenous sustainment. • Maintain engagements to encourage continued commitment, maintain visibility, and share best practices. • Conduct approximately 50 events, workshops, or exercises to advance partner country capabilities in radiation detection, equipment maintenance, and forensics.	• The decrease reflects decreased support for the maritime vectors program.

Global Material Security
Performance Measures

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Sites - Cumulative number of sites with radiation detection systems deployed.							
Target	618 cumulative sites	634 cumulative sites	639 cumulative sites	N/A	N/A	N/A	N/A
Result	**Exceeded** - 636						
Endpoint Target	By the end of FY 2019, provide radiation detection systems to approximately 639 cumulative sites.						
Sustainability - Cumulative number of radiation detection systems being indigenously sustained.							
Target	620 cumulative radiation detection systems	684 cumulative radiation detection systems	741 cumulative radiation detection systems	786 cumulative radiation detection systems	N/A	N/A	N/A
Result	**Exceeded** - 630						
Endpoint Target	By the end of FY 2020, transfer 786 radiation detection systems to indigenous sustainment.						
Mobile Detection System (MDS): Cumulative number of Mobile Detection Systems deployed.							
Target	137 MDS	157 MDS	167 MDS	N/A	N/A	N/A	N/A
Result	**Exceeded** - 143						
Endpoint Target	By the end of FY 2019, deploy 167 Mobile Detection Systems.						
Radiological Buildings Protected - Cumulative number of buildings with high-priority radiological materials secured.							
Target	2,116 buildings	2,206 buildings	2,306 buildings	2,411 buildings	2,516 buildings	2,641 buildings	2,766 buildings
Result	**Exceeded** - 2,196						
Endpoint Target	4,394 buildings secured by 2033						

Global Material Security
Capital Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2017 Current	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted	Outyears to Completion
Capital Operating Expenses Summary (including Major Items of Equipment (MIE))								
Capital Equipment >$500K (including MIE)	N/A	N/A	2,604	2,604	2,661	2,720	+116	N/A
Plant Projects (GPP and IGPP)	N/A	N/A	0	0	0	0	0	N/A
Total, Capital Operating Expenses	**N/A**	**N/A**	**2,604**	**2,604**	**2,661**	**2,720**	**+116**	N/A
Capital Equipment > $500K (including MIE)								
Total Non-MIE Capital Equipment	N/A	N/A	2,604	2,604	2,661	2,720	+116	N/A
Total, Capital Equipment (including MIE)	N/A	**N/A**	**2,604**	**2,604**	**2,661**	**2,720**	**+116**	**0**
Plant Projects (GPP and IGPP)								
Total Plant Projects (GPP/IGPP)	N/A	N/A	0	0	0	0	0	0
Total, Plant Projects (GPP/IGPP)	**N/A**	**N/A**	**0**	**0**	**0**	**0**	**0**	**0**
Total, Capital Summary	**N/A**	**N/A**	**2,604**	**2,604**	**2,661**	**2,720**	**+116**	**0**

Outyears for Global Material Security

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Capital Operating Expenses Summary (including MIE)				
Capital Equipment >$500K (including MIE)	2,780	2,841	2,904	2,968
Plant Projects (GPP)	0	0	0	0
Total, Capital Operating Expenses	**2,780**	**2,841**	**2,904**	**2,968**

Nonproliferation and Arms Control

Overview

The Nonproliferation and Arms Control (NPAC) program is critical to U.S. Government efforts to enhance U.S. national security and facilitate legitimate nuclear cooperation by reducing global nuclear security threats. Specifically, NPAC supports U.S. nonproliferation and arms control efforts and objectives by applying its unique expertise to: strengthen international nuclear safeguards; control the spread of nuclear material, equipment, technology, and expertise; verify nuclear reductions and compliance with nonproliferation and arms control treaties and agreements; and develop programs and strategies to address nuclear nonproliferation and arms control challenges and opportunities. The NPAC program pursues these objectives through four subprograms: (1) International Nuclear Safeguards; (2) Nuclear Export Controls; (3) Nuclear Verification; and (4) Nonproliferation Policy.

Highlights of the FY 2019 Budget Request

- Meet standing DOE/NNSA statutory and treaty/agreement obligations and authorities, including: (a) Physical security assessment visits for U.S.-obligated materials at foreign facilities; (b) Implementing U.S. safeguards obligations under the U.S. Voluntary Offer Agreement/Additional Protocol; (c) U.S. nonproliferation and export control activities (license application and interdiction case technical reviews, 123 Agreements, 10 CFR Part 810 authorizations); (d) Safeguards training; and (e) Implementing DOE obligations under the Plutonium Production Reactor Agreement (PPRA), Chemical Weapons Convention and Biological and Toxin Weapons Convention, and the Nuclear Non-Proliferation Treaty.
- Support U.S. participation in the Nuclear Suppliers Group (NSG) through the provision of technical expertise to ensure NSG controls keep pace with technological, industry, and proliferation developments.
- Support compliance analysis and implementation of the New START Treaty, the Intermediate-Range Nuclear Forces (INF) Treaty, and the Open Skies Treaty.
- Support the implementation of high-level Administration initiatives that address pressing proliferation concerns, including the effective implementation of the Nuclear Non-Proliferation Treaty and related elements of the nonproliferation regime.
- Support effective International Atomic Energy Agency (IAEA) safeguards of Iran's nuclear program and export control activities with Iran in accordance with applicable United Nations Security Council resolutions.
- Strengthen the U.S. safeguards technology and human capital base to meet projected U.S. and IAEA resource requirements.
- Promote universal adherence to the international standard of IAEA Safeguards Agreements: a Comprehensive Safeguards Agreements, an Additional Protocol, and a modified Small Quantities Protocol (where applicable).
- Field test and finalize advanced safeguards approaches for the IAEA for Gas Centrifuge Enrichment Plants (GCEPs).
- Engage approximately 35 foreign partners to strengthen national systems of export control and prevent illicit trafficking in nuclear and dual-use commodities through export licensing and enforcement training programs.
- Facilitate legitimate nuclear cooperation and minimize the proliferation risks of the expansion of civil nuclear power through international outreach and capacity building in nuclear safeguards and export controls.
- Provide nonproliferation assessments of emerging nuclear technologies.
- Maintain technical and manpower readiness for future U.S.-led monitoring and verification of denuclearization activities.

Nonproliferation and Arms Control
Funding

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Nonproliferation and Arms Control				
International Nuclear Safeguards	52,429	52,073	52,429	0
Nuclear Export Controls	32,634	32,412	34,134	+1,500
Nuclear Verification	28,773	28,578	32,273	+3,500
Nonproliferation Policy	10,867	10,793	10,867	0
Total, Nonproliferation and Arms Control	**124,703**	**123,856**	**129,703**	**+5,000**

Outyears for Nonproliferation and Arms Control
Funding

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Nonproliferation and Arms Control				
International Nuclear Safeguards	53,462	54,042	55,173	56,335
Nuclear Export Controls	34,812	35,190	35,927	36,683
Nuclear Verification	32,908	33,265	33,961	34,676
Nonproliferation Policy	11,085	11,203	11,447	11,680
Total, Nonproliferation and Arms Control	**132,267**	**133,700**	**136,508**	**139,374**

Nonproliferation and Arms Control
Explanation of Major Changes
(Dollars in Thousands)

	FY 2019 Request vs FY 2017 Enacted
Nonproliferation and Arms Control	
International Nuclear Safeguards: No significant change.	0
Nuclear Export Controls: Increase is to enhance export control nuclear and dual-use license and interdiction reviews.	+1,500
Nuclear Verification: Increase is to enhance training and deployment readiness of the U.S. Uranium and Plutonium Verification Teams required to verify disablement, dismantlement, or other negotiated nonproliferation activities in foreign nuclear facilities.	+3,500
Nonproliferation Policy: No significant change.	0
Total, Nonproliferation and Arms Control	**+5,000**

Nonproliferation and Arms Control
International Nuclear Safeguards

Description

The International Nuclear Safeguards (NS) subprogram strengthens the international nuclear safeguards regime and the IAEA's ability to detect non-compliance. NS manages the Next Generation Safeguards Initiative (NGSI), oversees support for the U.S. Support Program (USSP) to IAEA Safeguards, collaborates with the IAEA and other partners to enhance the implementation of safeguards norms and best practices, oversees implementation of U.S. Additional Protocol (AP) and Voluntary Offer Agreement (VOA) safeguards activities at DOE sites and facilities, and assesses the physical protection of U.S.-obligated nuclear materials overseas. NS also provides support to the IAEA to monitor Iran's compliance with applicable United Nations Security Council resolutions.

International Nuclear Safeguards

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
International Nuclear Safeguards $52,429,000	**International Nuclear Safeguards $52,429,000**	**International Nuclear Safeguards $0**
• Implemented U.S.-IAEA safeguards obligations at DOE facilities including annual reporting requirements as required by U.S. law and treaty obligations. • Cooperated with Department of State, Department of Defense, the Nuclear Regulatory Commission and the IAEA to develop guidelines and policies to help prioritize the allocation of limited safeguards resources in ways that will strengthen the IAEA's ability to detect, deter, and investigate undeclared nuclear activities. • Developed safeguards concepts and approaches for new facilities and fuel cycles; promoted Safeguards by Design directly with designers and industry; analyze the implications of emerging technology to international safeguards applications. • Continued field testing advanced safeguards approaches for GCEPs for transfer to the IAEA. • Developed safeguards technologies to: (1) address electrochemical processing based on R&D conducted with international partners; (2) improve efficiencies of safeguards; and (3) enhance inspector capabilities in high-priority areas such as enhanced in-field collection analysis and detection of undeclared activities at declared facilities. • Maintained qualified and knowledgeable safeguards staff at the U.S. National Laboratories and IAEA through nonproliferation curriculum development in nuclear engineering programs,	• Develop safeguards technologies and approaches to: (1) address electrochemical processing based on R&D conducted with international partners; (2) improve efficiencies of safeguards; and (3) enhance inspector capabilities in high-priority areas such as enhanced in-field collection analysis and detection of undeclared activities at declared facilities. • Transfer five safeguards tools to foreign partners or international organization to meet identified safeguards deficiencies. • Continue field testing of advanced safeguards approaches for GCEPs for transfer to the IAEA. • Improve safeguards concepts and approaches for new facilities and fuel cycles; strengthen Safeguards by Design approaches directly with designers and nuclear industry; analyze the implications of emerging technology to international safeguards applications. • Implement a safeguards experimental laboratory at a U.S. nuclear facility to serve as a safeguards training and education center for U.S. Government staff and graduate students, and a proving ground for nascent safeguards technologies and concepts. • Partner with the IAEA and advanced nuclear partners to field test advanced safeguards technologies to enhance state declarations and optimize safeguards resource allocations.	• No significant change.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
internships and post-graduate research positions at U.S. National Laboratories, and safeguards training courses. • Transferred 5 safeguards tools to foreign partners or international organization to meet identified safeguards deficiencies. • Maintained support for accredited IAEA Network of Analytical Laboratories at U.S. National Laboratories. • Partnered with the IAEA and advanced nuclear partners to field test advanced safeguards technologies to enhance state declarations and optimize safeguards resource allocations. • Promoted universal adherence to IAEA safeguards agreements and good practices in safeguards implementation by providing customized training and outreach to 61 countries. • Led eight U.S. Government assessments of the physical protection of U.S.-obligated nuclear materials at foreign facilities.	• Promote universal adherence to IAEA safeguards agreements and modified Small Quantities Protocols (where applicable), and good practices in safeguards implementation by providing customized training and outreach to more than 45 countries. • Maintain support for accredited IAEA Network of Analytical Laboratories at U.S. National Laboratories. • Maintain qualified and knowledgeable safeguards staff at the U.S. National Laboratories and IAEA through early and mid-career safeguards positions at U.S. National Laboratories, and safeguards training courses. • Increase availability of reference materials for U.S. and IAEA analytical services for evaluations of safeguards samples. • Cooperate with Department of State, Department of Defense, the Nuclear Regulatory Commission and the IAEA to develop guidelines and policies to help prioritize the allocation of limited safeguards resources in ways that will strengthen the IAEA's ability to detect, deter, and investigate undeclared nuclear activities. • Continue to provide, on an as requested basis, technical and technology assistance to the IAEA to monitor Iran’s nuclear program. • Implement U.S.-IAEA safeguards obligations at DOE facilities including annual reporting requirements as required by U.S. law and treaty obligations. • Lead six to eight U.S. Government assessments of the physical protection of U.S.-obligated nuclear materials at foreign facilities.	

Nonproliferation and Arms Control
Nuclear Export Controls

Description

The Nuclear Export Controls (NC) subprogram facilitates peaceful nuclear cooperation by strengthening domestic and global capacity to detect and prevent the illicit transfer of nuclear and dual-use materials, equipment, and technology. NC implements and oversees programs that: provide technical and end-user evaluations of U.S. export license applications; provide technical support that enhances the U.S. Government's capacity to detect and interdict illicit nuclear and dual-use commodity technology transfers to foreign programs of concern; provide technical support to the multilateral nonproliferation export control regimes; and strengthen foreign partner national systems of export control consistent with U.S. policy and the multilateral supplier regimes.

Nuclear Export Controls

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Nuclear Export Controls $32,634,000	**Nuclear Export Controls $ 34,134 ,000**	**Nuclear Export Controls +$1,500,000**
• Engaged 37 foreign partners to strengthen national systems of export control and prevent illicit trafficking in WMD-related commodities through export licensing and enforcement training programs, as part of the International Nonproliferation Export Control Program (INECP). • Trained U.S. export enforcement officials in partnership with the Export Enforcement Coordination Center (E2C2) established under the Export Control Reform Initiative and collaborate with the CBP's National Targeting Center. • Performed 5,998 technical reviews of U.S. export licenses for nuclear and dual-use commodities, provide state-of-the-art technology assessments to the multilateral control regimes, and provide training courses for DOE and other U.S. Government officials regarding changing export controlled technologies and proliferation concerns. • Supported the U.S. Government enforcement community by providing 2,985 real-time technical analyses for interdiction cases per year and unique analytical products regarding proliferation trends and commodity gaps through the Interdiction Technical Analysis Group. • Maintained and supported information technology systems to support export control licensing, interdiction analysis, and the	• Engage approximately 35 foreign partners on a bilateral and regional basis to strengthen their national export control systems to help prevent illicit trafficking in WMD-related commodities, exchange best practices, and build the capacity of key countries to serve as trainers for their region, as part of INECP. • Train U.S. export enforcement officials in partnership with the E2C2 to familiarize them with controlled nuclear and dual-use material, equipment, and technology, which could be used for WMD purposes, and collaborate with the CBP's National Targeting Center. E2C2 was established under the Export Control Reform Initiative to advance U.S. foreign policy and protect the national and economic security of the United States through strengthened and coordinated enforcement of the nation's export control laws and enhanced intelligence exchange in support of such enforcement efforts. • Perform approximately 6,000 technical reviews of U.S. export licenses for nuclear and dual-use commodities, continue to provide state-of-the-art technology assessments to the multilateral control regimes, and provide training courses for DOE and other U.S. Government officials regarding evolving export controlled technologies and proliferation concerns. • Continue to support the U.S. Government enforcement community by providing approximately 3,000 technical analyses for interdiction cases per year and unique analytical	• Increase is to enhance export control nuclear and dual-use license and interdiction reviews.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
multilateral nonproliferation export control regimes.	products regarding proliferation trends and commodity gaps through the Interdiction Technical Analysis Group. • Maintain and support information technology systems to support export control licensing, interdiction analysis, and the multilateral nonproliferation export control regimes. • Continue to provide technical review of proposed transfers of items, materials, goods, and technology to Iran in accordance with applicable United Nations Security Council resolutions and implement the information technology tracking system for all such requests.	

Nonproliferation and Arms Control
Nuclear Verification

Description
The Nuclear Verification (NV) subprogram reduces and eliminates proliferation concerns by enabling transparent arms reductions, including through support for negotiation and implementation of U.S. nonproliferation and arms control treaties and agreements. The NV subprogram conducts applied technology development, testing, evaluation, and deployment of monitoring technologies and develops verification approaches including analysis of the impact of initiatives on DOE and NNSA sites. Additionally, the NV subprogram maintains technical readiness to negotiate and implement future nuclear fuel cycle transparency agreements and conducts U.S.-led missions to monitor and verify, dismantle, and disable proliferant nuclear fuel cycle programs around the world. The subprogram performs monitoring activities under existing agreements and supports U.S. Government review of other countries' compliance with their treaty and agreement obligations. The subprogram also contributes to U.S. policy development for treaty and agreement implementation while ensuring the U.S. requirements for maintaining a safe, secure, and reliable nuclear weapons stockpile are met.

Nuclear Verification

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Nuclear Verification $28,773,000	**Nuclear Verification $32,273,000**	**Nuclear Verification +$3,500,000**
• Developed and assessed advanced technical capabilities for warhead and fissile material monitoring and verification regimes, and supported implementation of the New START Treaty and other existing arms control agreements. • Collaborated with the United Kingdom under the 1958 Mutual Defense Agreement and other partner countries to develop potential common approaches to verification issues. • Conducted three monitoring visits in Russia under the terms of the Plutonium Production Reactor Agreement (PPRA) to ensure that Russian plutonium oxide is stored securely and that shutdown Russian plutonium production reactors remain in a non-operational status. Hosted Russian monitors on annual PPRA monitoring visit to shutdown U.S. plutonium production reactors at the Savannah River and Hanford Sites. • Continued activities related to nuclear testing limitations, including those that support monitoring and verification capabilities under the Comprehensive Nuclear-Test-Ban Treaty and International Monitoring System that complement and may strengthen U.S. nuclear explosion monitoring and verification capabilities. • Under the Seismic Cooperation Program, provided capacity-building training in seismology to foreign partner institutions to enhance their abilities to detect and analyze possible nuclear	• Support U.S. implementation and compliance analyses for the New START Treaty, Intermediate-Range Nuclear Forces Treaty, and the Open Skies Treaty, and ensure DOE/NNSA equities and interests are protected. • Under the terms of the PPRA, conduct three monitoring visits in Russia to ensure that Russian plutonium oxide is stored securely and that shutdown Russian plutonium production reactors remain in a non-operational status, and host Russian monitors on annual PPRA monitoring visit to shutdown U.S. plutonium production reactors at the Savannah River and Hanford Sites. • Continue national security and nuclear nonproliferation activities related to nuclear testing limitations, including those that support monitoring and verification capabilities under the Comprehensive Nuclear-Test-Ban Treaty and its International Monitoring System to complement and strengthen U.S. nuclear explosion monitoring and verification capabilities. • Provide capacity-building training under the Seismic Cooperation Program in seismology to foreign partner institutions to enhance their abilities to detect and analyze possible nuclear explosions, as well as mitigate geophysical hazards. • Develop, test, and evaluate warhead and weapons material verification procedures and technologies; develop operations planning and	• Increase is to enhance training and deployment readiness of the U.S. Uranium and Plutonium Verification Teams required to verify disablement, dismantlement, or other negotiated nonproliferation activities in foreign nuclear facilities.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
explosions, as well as mitigate geophysical hazards. • Provided operations planning and maintained short-notice readiness of technologies and capabilities to support U.S.-led nuclear fuel cycle monitoring and verification missions around the world. • Developed, tested, and evaluated verification procedures and technologies for U.S.-led verifiable monitoring and dismantlement of nuclear programs in countries of concern. • Trained and exercised specialized U.S. verification teams for short-notice deployments to monitor and verify nuclear fuel cycle programs around the world. • Implemented DOE obligations under the Chemical Weapons Convention, including maintaining accreditation of the OPCW laboratory at LLNL.	maintain short-notice readiness of technologies and capabilities; and train and exercise U.S. technical teams for U.S.-led monitoring and verification of nuclear weapons programs in partner countries. • Develop advanced technical capabilities for warhead and fissile material monitoring and verification regimes, and prepare DOE and NNSA sites for the implementation of such initiatives. • Continue collaboration with the United Kingdom under the 1958 Mutual Defense Agreement and with other partner countries to develop potential common approaches to nuclear verification issues. • Implement U.S. and DOE legal obligations under the Chemical Weapons Convention, including maintaining accreditation of the Organization for the Prohibition of Chemical Weapons (OPCW) laboratory at LLNL.	

Nonproliferation and Arms Control
Nonproliferation Policy

Description

The Nonproliferation Policy (NP) subprogram develops and implements programmatic efforts, including strategies, policies, and analyses that address enduring and emerging nonproliferation challenges and opportunities. NP supports the negotiation and implementation of nonproliferation agreements and requirements set forth in the Atomic Energy Act of 1954, as amended, and stemming from national nonproliferation initiatives, agreements, and treaties, including the Nuclear Non-Proliferation Treaty. In addition, the NP subprogram provides DOE/NNSA nonproliferation policy guidance on nuclear technology transfer and nuclear fuel cycle issues, undertakes activities to improve and update multilateral nuclear supplier arrangements, and identifies supplier vulnerabilities and potential gaps in supplier arrangements, including specific analysis and implementation of 10 CFR Part 810 – Assistance to Foreign Atomic Energy Activities. The Part 810 regulations implement section 57 b (2) of the Atomic Energy Act of 1954, as amended by section 302 of the Nuclear Nonproliferation Act of 1978, and control the export of unclassified nuclear technology and assistance. These regulations enable civil nuclear trade by ensuring that nuclear technologies and assistance exported from the United States will be used for peaceful purposes. The NP subprogram supports a small program focused on reducing the danger of nuclear war and preventing the spread of nuclear weapons in critical regions, and undertakes studies and analyses to identify evolving proliferation challenges, including their implications for the Office of Nonproliferation and Arms Control.

Nonproliferation Policy

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Nonproliferation Policy $10,867,000	**Nonproliferation Policy $10,867,000**	**Nonproliferation Policy $0**
• Provided technical assistance to the negotiation of Section 123 Agreements for Cooperation with Mexico and the United Kingdom. • Continued work with the 48-member NSG to strengthen controls on nuclear technology transfers, including amending the NSG Guidelines and ensuring the NSG control lists remain up to date with advancing technologies. • Supported implementation of industry self-regulation concept with the NSG Guidelines. • Maintained the NSG Information-Sharing System (NISS) and the NISS Forum and continued work to develop and deploy the NISS app. • Processed 38 Part 810 specific authorization applications and requests for amendments, including end-use and technical reviews. Reviewed specific authorization reports and notification for compliance with Part 810 and the scope of the existing license. • Reviewed 645 Part 810 general authorization reports for compliance with Part 810 regulations and responded to requests for determination. • Conducted analyses of the impact of NPT-related developments, and Nuclear Weapons Ban Treaty developments on NNSA weapons and nonproliferation work and promoted DOE/NNSA interests in NPT. • Considered implications for DOE/NNSA complex of a potential FMCT verification regime. • Expanded cooperation with P3 and P5 countries on fissile material transparency.	• Provide technical assistance to the negotiation of potential Section 123 Agreements for Cooperation and their corresponding administrative arrangements. • Develop the Nuclear Proliferation Assessment Statement that is submitted by the President along with each new 123 Agreement for congressional review. • Support the implementation of the U.S.-Republic of Korea 123 Agreement under the High Level Bilateral Commission's Nuclear Exports and Export Control Cooperation Working Group. • Support the technical assessment of the IAEA Technical Cooperation projects. • Conduct analyses of accountancy information in support of the implementation of 23 123 Agreements. • Continue work with the 48-member NSG to strengthen controls on nuclear exports, including amendment of the NSG Guidelines and ensuring the NSG control lists remain up to date with advancing technologies. • Support the NSG Consultative Group Chair's implementation and industry outreach agenda through sustained dialog with industry, events, and targeted guidance products. • Conclude work on and deploy version 1.1-1.2 of the new NISS app. • Process 40-50 Part 810 specific authorization applications and requests for amendments, including end-use and technical reviews. Review specific authorization reports and notification for	• No significant change.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
• Conducted Track 1.5 engagements with India, Pakistan, Egypt, Myanmar, and China, and leveraged these efforts to build U.S. engagement and influence in nonproliferation and regional stability. • Grew South Asia-focused social media and web presence to promote U.S. nonproliferation priorities in the region.	compliance with Part 810 and the scope of the existing license. • Review hundreds of Part 810 general authorization reports for compliance with Part 810 regulations and respond to requests for determination. • Continue to develop the e-810 system by adding robust reporting capability and improving integration with other data sources. • Continue Part 810 Process Improvement procedures, focusing on expanding external outreach and reducing processing times. • Conduct analyses of the impact of NPT-related developments, promote DOE/NNSA interests in NPT, and support U.S. deliverables for the 2020 NPT Review Conference and 50th Anniversary of the NPT entry into force. • Consider implications for DOE/NNSA complex of a potential Fissile Material Cut-off Treaty verification regime. • Conduct Track 1.5 engagements with India, Pakistan, Saudi Arabia, Egypt, Burma, and China, to reduce the danger of nuclear war and dissuade the spread of nuclear weapons in critical regions. • Grow South Asia-focused social media and web projects to promote U.S. interests in the region. • Conduct long-term analyses of evolving and emerging proliferation threats and their implications for the DNN mission.	

Nonproliferation and Arms Control
Performance Measures

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
International Nonproliferation Export Control Program - Cumulative number of countries where International Nonproliferation Export Control Program (INECP) is engaged that have export control systems that meet critical requirements.							
Target	37 countries	38 countries	N/A	N/A	N/A	N/A	N/A
Result	**Met** - 37						
Endpoint Target	By the end of FY 2025, 45 countries where INECP is engaged will have export control systems that meet critical requirements, defined as having: (1) control lists consistent with the WMD regimes; (2) initiated outreach to producers of WMD-related commodities; (3) developed links between technical experts and license reviewers and front-line enforcement officers; and (4) begun customization of educational materials and technical guides.						
FY 2019 Note:	This performance Measure is being replaced with the Export Control Review & Compliance/Interdiction Program (ECRC/I) measure which has been identified as a more qualitative and quantitative measure.						
Export Control Review and Compliance/Interdiction Program (ECRC/I) - Submit initial DOE positions on dual-use export license applications to DOC within 25 days of receipt.							
Target	N/A	N/A	80%	85%	85%	85%	85%
Result	N/A						
Endpoint Target	Achieve an annual success rate of at least 85% or greater of all initial DOE positions on dual-use export license applications submitted to the Department of Commerce within 25 days of receipt (i.e., 5 days fewer than required).						
FY 2019 Note:	This measure replaces the International Nonproliferation Export Control Program Performance Measure.						
Safeguards Tools - Transfer tools to international regimes and other countries to address identified safeguards deficiencies.							
Target	5 tools	5 tools	5 tools	5 tools	5 tools	5 tools	5 tools
Result	**Exceeded** - 7						
Endpoint Target	Annually transfer tools to international regimes and other countries to address identified safeguards deficiencies.						

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Reduce Nuclear Terrorism Threat - Evaluate the adequacy of existing physical security measures of U.S. obligated nuclear material located at foreign facilities.							
Target	6 assessments	6 assessments	6 assessments	6 assessments	6 assessments	6 assessments	6 assessments
Result	**Exceeded** - 8						
Endpoint Target	Annually review the physical security of U.S.-obligated nuclear material located at foreign facilities in order to reduce the threat of nuclear terrorism.						

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Defense Nuclear Nonproliferation Research and Development

Overview

The Defense Nuclear Nonproliferation Research and Development (DNN R&D) program directly contributes to nuclear security by developing U.S. capabilities to detect and characterize global nuclear security threats in full coordination with the goals and priorities of U.S. Government mission stakeholders. Specifically, the DNN R&D program makes these strategic contributions through the innovation of U.S. technical capabilities to detect, identify, locate, and characterize: 1) foreign nuclear material production and weapons development activities; 2) movement and illicit diversion of special nuclear materials; and 3) global nuclear detonations. These foundational capabilities are either advanced to higher maturities, transitioned to stakeholders for further development for mission-specific applications, or transferred to operational performers. The DNN R&D program also supports foundational capabilities that can be leveraged across nonproliferation, counterterrorism, and emergency response mission areas.

To meet national and Departmental nuclear security requirements, DNN R&D leverages the unique facilities and scientific skills of DOE, academia, and industry to perform research and demonstrate advances in capabilities, develop prototypes, and produce sensors for integration into operational systems.

Highlights of the FY 2019 Budget Request

Discrete, multi-year DNN R&D goals to be achieved in FY 2019 include:

- Advance U.S. detection and characterization capabilities of foreign nuclear weapons production activities through 2026;
- Achieve improvements in U.S. capabilities in nuclear weapons and material security applications, including detecting special nuclear material (SNM) and its movement, incident response, and nuclear safeguards; and,
- Deliver nuclear detonation detection satellite payloads in accordance with the negotiated schedule with the United States Air Force (USAF).
- Continue programmatic activities for nonproliferation and foreign weapons program activity monitoring through continued execution and development of national test beds for validation of new sensors, equipment, and capabilities.
- Provide a broad, underlying set of technical capabilities that support nuclear nonproliferation and nuclear security, including those for addressing counterterrorism/incident response requirements.
- Support the payload-side technical integration, pre-launch, and on-orbit testing activities for previously delivered payloads in accordance with host satellite schedules.
- Continue to align with the developing interagency requirements for early detection of nuclear proliferation, including low-yield nuclear explosion monitoring, SNM production, and cross-cutting data science.
- Conduct research in seismic, radionuclide, and detonation forensics, at lower nuclear yield levels, to support national capability in terrestrial and airborne monitoring and analysis methods.

Defense Nuclear Nonproliferation Research and Development (DNN R&D)

Funding

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Defense Nuclear Nonproliferation R&D				
Proliferation Detection	251,558	249,850	273,200	+21,642
Nuclear Detonation Detection	165,448	164,324	182,895	+17,447
LEU Fuels Development	52,744	52,386	0	-52,744
SBIR/STTR [non-add]	[9,077]	[9,083]	[9,337]	[-260]
Total, Defense Nuclear Nonproliferation R&D	**469,750**	**466,560**	**456,095**	**-13,655**

Outyears for Defense Nuclear Nonproliferation Research and Development (DNN R&D)

Funding

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Defense Nuclear Nonproliferation R&D				
Proliferation Detection	288,568	274,368	281,824	290,810
Nuclear Detonation Detection	186,449	185,660	187,865	188,742
SBIR/STTR [non-add]	[9,974]	[9,529]	[9,772]	[10,056]
Total, Defense Nuclear Nonproliferation R&D	**475,017**	**460,028**	**469,689**	**479,552**

Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR):

- FY 2017 Transferred: SBIR: $7,958; STTR: $1,119
- FY 2018 Annualized CR: SBIR: $7,963; STTR: $1,120
- FY 2019 Request: SBIR: $8,186; STTR: $1,151
- FY 2020 - FY 2023 Request: SBIR: $34,481; STTR: $4,850

Defense Nuclear Nonproliferation Research and Development
Explanation of Major Changes
(Dollars in Thousands)

	FY 2019 Request vs FY 2017 Enacted
Defense Nuclear Nonproliferation Research and Development	
Proliferation Detection (PD): Increase supports development and demonstration of advanced testbeds for early detection of proliferation activities and in weapons and material security.	+21,642
Nuclear Detonation Detection (NDD): Increase reflects long-lead procurements to mitigate potential impacts of microelectronics supply-chain interruptions and for sensor integration costs in meeting schedule of deliveries of space-based sensors to USAF.	+17,447
LEU Fuels Development: Decrease reflects transfer of United States High Performance Research Reactor Program (USHPRR) to the Material Management and Minimization program.	-52,744
Total, Defense Nuclear Nonproliferation Research and Development	**-13,655**

Defense Nuclear Nonproliferation Research and Development
Proliferation Detection

Description

The Proliferation Detection (PD) R&D subprogram develops technologies to: detect foreign nuclear weapons programs; support nuclear arms control treaty verification by improving compliance monitoring capabilities; and supports national nuclear security, nuclear counterterrorism, incident response, and interdiction of nuclear materials outside of regulatory control. PD efforts are aligned along these major functional areas: (1) Nuclear Weapons Development and Material Production Detection efforts targeted towards the detection, identification, location, and characterization of foreign nuclear weapons program activities; (2) Nuclear Weapons and Material Security efforts targeted toward nuclear security and nuclear arms control treaty monitoring and verification tools and applications, operational interdiction, radiological source replacement, and nuclear security efforts across NNSA; and (3) Nonproliferation Enabling Capabilities efforts supporting a broad R&D base to bring new, cross-cutting technologies to multi-use applications across NNSA and the interagency community including a field experiment and demonstration program and university research program. The field demonstration program integrates research and experimental test bed activities to advance technology in support of the Nation's treaty verification and monitoring needs. This R&D subprogram also supports the nuclear counterterrorism and incident response mission area. PD's university program is comprised of three consortia which link universities and DOE national laboratories to address basic research gaps in nuclear nonproliferation and security and treaty compliance monitoring.

Proliferation Detection

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Proliferation Detection $251,558,000	**Proliferation Detection $273,200,000**	**Proliferation Detection +$21,642,000**
• Strengthened U.S. capabilities to detect and characterize foreign nuclear programs, especially in denied areas as follows: advanced sensor and algorithm development and demonstrate technologies and methods in operational test bed environments for SNM production detection; advanced stand-off detection methods for weaponization activities to monitor the potential technical breakout of foreign weapons programs; innovated new analytic approaches to move proliferation detection to earlier timelines and close information gaps in denied areas. • Advanced U.S. capabilities to strengthen nuclear security across the threat spectrum as follows: advanced detection and imaging for SNM detection, weapons monitoring, search, interdiction, and incident response, including device diagnostics and stabilization tools with improved understanding of improvised nuclear device performance; addressed nuclear data gaps in support of nuclear security. • Developed new technologies and methods to detect, identify, locate, and characterize nuclear explosions as follows: executed Phase II of seismic source physics experiments; advanced low-yield nuclear explosion monitoring through development of new signatures, local sensors, and dynamic network analysis; completed underground nuclear explosion signatures experiment addressing non-prompt and persistent nuclear testing signatures.	• Demonstrate advances in U.S. capabilities to detect and characterize foreign nuclear programs, especially in denied areas as follows: advance sensor and algorithm development and demonstrate technologies and methods in operational test bed environments for SNM production detection, including the development of a new reactor monitoring testbed; advance stand-off detection methods for weaponization activities to monitor the potential technical breakout of foreign weapons programs; innovate new analytic approaches to move proliferation detection to earlier timelines and close information gaps in denied areas. • Demonstrate advances in U.S. capabilities to strengthen nuclear security across the threat spectrum as follows: advance detection and imaging for SNM detection, and incident response, including device diagnostics and stabilization tools with improved understanding of improvised nuclear device performance; address nuclear data gaps in support of nuclear security. • Develop test beds and demonstrate new predictive capabilities to detect, identify, locate, and characterize nuclear explosions as follows: complete execution of remaining Phase II of seismic source physics experiments; advance low yield nuclear explosion monitoring through development of new signatures, local sensors, and dynamic network analysis; and begin development of final (Phase III) testbed for field experiments.	• Increase supports development and demonstration of advanced testbeds for early detection of proliferation activities and in material security.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
• Supported the NNSA's portion of the Integrated University Program to address basic gaps in nuclear nonproliferation and treaty compliance monitoring.	• Support the NNSA's portion of the Integrated University Program to address basic gaps in nuclear nonproliferation and treaty compliance monitoring.	

Description

The Nuclear Detonation Detection (NDD) subprogram develops and builds space sensors for the nation's operational nuclear test treaty monitoring and Integrated Threat Warning/Attack Assessment capabilities; conducts R&D to advance analytic forensic capabilities related to nuclear detonations and interdicted samples; and produces and updates the regional geophysical datasets and analytical understanding of waveform and radionuclide signatures to enable operation of the nation's ground-based nuclear detonation monitoring networks.

Nuclear Detonation Detection

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Nuclear Detonation Detection $165,448,000	**Nuclear Detonation Detection $182,895,000**	**Nuclear Detonation Detection +$17,447,000**
• Delivered additional GBD nuclear detonation detection payloads for GPS block III satellites (GBD III-6 and GBD III-7) in accordance with the negotiated schedule with the USAF. Supported payload-side technical integration, pre-launch, and on-orbit testing activities for previously delivered payloads. Continued development and production of sensor-laden payloads for launch into geosynchronous orbit. Continued required engineering development work and satellite interface coordination to support payload design updates for future satellite blocks for GBDs and other U.S. Nuclear Detonation Detection System payloads. • Improved pre- and post-detonation technical nuclear forensic capabilities, including the technical means to assess bulk samples of SNM. Addressed research priorities that undergird the technical capability of operational assets. • Improved capabilities of geophysical models of seismic signals from underground detonations and improve technologies to detect radionuclide releases, including integrating products of field and laboratory test campaigns into methods to improve event discrimination.	• Design and fabricate GBD nuclear detonation detection payloads for GPS block III satellites in accordance with the negotiated schedule with the USAF. Support payload-side technical integration, pre-launch, and on-orbit testing activities for previously delivered payloads. Continues development and production of sensor-laden payloads for launch into geosynchronous orbit. Continue required engineering development work and satellite interface coordination to support payload design updates for future satellite blocks for GBDs and other U.S. Nuclear Detonation Detection System payloads. • Improve pre- and post-detonation technical nuclear forensic capabilities, including the technical means to assess bulk samples of SNM. Address research priorities that undergird the technical capability of operational assets and that support verification and validation activities. • Improve capabilities of geophysical models of seismic signals from underground detonations and improve technologies to detect radionuclide releases, including integrating products of field and laboratory test campaigns into methods to improve event discrimination and yield estimation.	• Increase reflects long-lead procurements to mitigate potential impacts of supply-chain interruptions and for sensor integration costs in meeting schedule of deliveries of space-based sensors to USAF.

Description

The LEU Fuels Development subprogram, including the USHPRR efforts, is transferred to the Material Management and Minimization program within DNN.

LEU Fuels Development

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
LEU Fuels Development $52,744,000	**LEU Fuels Development $0**	**LEU Fuels Development -$52,744,000**
• Continued to develop, qualify, and fabricate a new high-density low enriched uranium fuel that will allow for the conversion of the highest performance, and highest HEU-consuming, research reactors in the United States and around the world	• Transfer USHPRR program back to DNN's Material Management and Minimization program.	• Decrease reflects transfer to the Material Management and Minimization program.

Defense Nuclear Nonproliferation Research and Development
Performance Measures

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Nuclear Detonation Detection - Annual index that summarizes the status of all NNSA nuclear detonation detection R&D deliveries that improve the nation's ability to detect nuclear detonations.							
Target	90% index	90% index	90% index	90% index	90% index	90% index	90% index
Result	**Met** - 90						
Endpoint Target	Annually achieve timely delivery of NNSA nuclear detonation detection products (90% target reflects good on-time delivery. Index considers factors beyond NNSA's control and impact on customer schedules.)						
Nuclear Weapons and Material Security - The cumulative percentage of progress towards demonstrating improvements in Special Nuclear Material detection, warhead monitoring, chain-of-custody monitoring, safeguards, and characterization capabilities.							
Target	90% of progress	100% of progress	N/A	N/A	N/A	N/A	N/A
Result	**Met** - 90						
Endpoint Target	By the end of FY 2018, achieve 100% cumulative progress toward demonstrating new capabilities for warhead monitoring, warhead chain-of-custody, Special Nuclear Material movement detection, and nuclear safeguards.						

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Nuclear Weaponization and Material Production Detection - Cumulative percentage of progress toward demonstrating improvements in detection and characterization capabilities of nuclear weapons production activities.							
Target	90% of progress	100% of progress	N/A	N/A	N/A	N/A	N/A
Result	**Met** - 90						
Endpoint Target	By the end of FY 2018, achieve 100% cumulative progress toward demonstrating new capabilities detecting uranium and plutonium production and nuclear weaponization processes.						
Nuclear Security - Demonstrate advancements in nuclear weapons and material security by achieving the baseline Technology Readiness Level (TRL) targets at project completion, as set in those projects' Life Cycle Plans.							
Target	N/A	N/A	80% of completed projects	80% of completed projects	80% of completed projects	80% of completed projects	80% of completed projects
Result	N/A	N/A					
Endpoint Target	Annually, achieve baseline TRL targets on 80% of completing projects.						
Early Proliferation Detection - Demonstrate advancements in material production and weaponization detection by achieving the baseline Technology Readiness Level (TRL) targets at project completion, as set in those projects' Life Cycle Plans.							
Target	N/A	N/A	80% of completed projects	80% of completed projects	80% of completed projects	80% of completed projects	80% of completed projects
Result	N/A	N/A					
Endpoint Target	Annually, achieve baseline TRL targets on 80% of completing projects						

Defense Nuclear Nonproliferation Research and Development
Capital Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2017 Current	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted	Outyears to Completion
Capital Operating Expenses Summary (including Major Items of Equipment (MIE))								
Capital Equipment >$500K (including MIE)	N/A	89,876	28,432	28,432	29,058	29,697	+1,265	N/A
Plant Projects (GPP and IGPP)	N/A	0	0	0	0	0	0	N/A
Total, Capital Operating Expenses	**N/A**	**89,876**	**28,432**	**28,432**	**29,058**	**29,697**	**+1,265**	N/A
Capital Equipment > $500K (including MIE)								
Total Non-MIE Capital Equipment	N/A	89,876	28,432	28,432	29,058	29,697	+1,265	N/A
Total, Capital Equipment (including MIE)	N/A	**89,876**	**28,432**	**28,432**	**29,058**	**29,697**	**+1,265**	**0**
Plant Projects (GPP and IGPP)								
Total Plant Projects (GPP/IGPP)	N/A	0	0	0	0	0	0	0
Total, Plant Projects (GPP/IGPP)	**N/A**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total, Capital Summary	**N/A**	**89,876**	**28,432**	**28,432**	**29,058**	**29,697**	**+1,265**	**0**

Outyears for Defense Nuclear Nonproliferation Research and Development

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Capital Operating Expenses Summary (including MIE)				
Capital Equipment >$500K (including MIE)	30,350	31,018	31,700	32,397
Plant Projects (GPP)	0	0	0	0
Total, Capital Operating Expenses	**30,350**	**31,018**	**31,700**	**32,397**

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Nonproliferation Construction

Overview

The Nonproliferation Construction Program consolidates construction projects that directly contribute to reducing global nuclear security threats and is a key component of DOE/NNSA's integrated nonproliferation, counterterrorism, and emergency response strategies.

Highlights of the FY 2019 Budget Request

In FY 2019, the Administration is continuing termination activities for the Mixed Oxide Fuel Fabrication (MFFF) project and continuing to pursue a dilute and dispose strategy to fulfill the United States' commitment to dispose of 34 metric tons of plutonium. The dilute and dispose strategy consists of blending plutonium with an inert mixture, packaging for safe storage and transport, and disposing of it in a geologic repository.

Nonproliferation Construction
Funding

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Nonproliferation Construction				
U.S. Construction				
18-D-150, Surplus Plutonium Disposition Project (SPD), SRS				
SPD Other Project Costs (OPC)	0	0	10,000	+10,000
SPD Total Estimated Cost (TEC)	0	0	49,000	+49,000
Subtotal, 18-D-150, Surplus Plutonium Disposition Project (SPD), SRS	**0**	**0**	**59,000**	**+59,000**
99-D-143 Mixed Oxide (MOX) Fuel Fabrication Facility, SRS				
MFFF Other Project Costs (OPC)	5,000	4,966	150,000	+145,000
MFFF Total Estimated Cost (TEC)	330,000	327,759	70,000	-260,000
Subtotal, 99-D-143 Mixed Oxide (MOX) Fuel Fabrication Facility, SRS	**335,000**	**332,725**	**220,000**	**-115,000**
Subtotal, U.S. Construction	**335,000**	**332,725**	**279,000**	**-56,000**
Total, Nonproliferation Construction	**335,000**	**332,725**	**279,000**	**-56,000**

Outyears for Nonproliferation Construction
Funding

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Nonproliferation Construction				
U.S. Construction				
18-D-150, Surplus Plutonium Disposition Project (SPD), SRS				
SPD Other Project Costs (OPC)	6,000	4,000	5,000	7,000
SPD Total Estimated Cost (TEC)	53,000	55,000	69,750	55,000
Subtotal, 18-D-150, Surplus Plutonium Disposition Project (SPD), SRS	**59,000**	**59,000**	**74,750**	**62,000**
99-D-143 Mixed Oxide (MOX) Fuel Fabrication Facility, SRS				
MFFF Other Project Costs (OPC)	150,000	220,000	204,250	217,000
MFFF Total Estimated Cost (TEC)	70,000	0	0	0
Subtotal, 99-D-143 Mixed Oxide (MOX) Fuel Fabrication Facility, SRS	**220,000**	**220,000**	**204,250**	**217,000**
Subtotal, U.S. Construction	**279,000**	**279,000**	**279,000**	**279,000**
Total, Nonproliferation Construction	**279,000**	**279,000**	**279,000**	**279,000**

Nonproliferation Construction Projects
Explanation of Major Changes
(Dollars in Thousands)

	FY 2019 Request vs FY 2017 Enacted
Nonproliferation Construction Projects	
U.S. Construction:	
18-D-150, Surplus Plutonium Disposition (SPD) Project: Increase supports preliminary design and the initiation of long-lead procurements.	+59,000
99-D-143, Mixed Oxide (MOX) Fuel Fabrication Facility: Decrease reflects the termination of construction activities.	-115,000
Total, Nonproliferation Construction Projects	**-56,000**

Nonproliferation Construction
U.S. Construction

Description

The Nonproliferation Construction program will continue termination activities of the Mixed Oxide Fuel Fabrication (MFFF) facility and continue to pursue the dilute and dispose strategy to fulfill the United States' commitment to dispose of 34 metric tons of plutonium. The dilute and dispose strategy consists of blending plutonium with an inert mixture, packaging it for safe storage and transport, and disposing of it in a geologic repository.

In FY 2017, an Analysis of Alternatives and conceptual design was completed to support a CD-1 Approve Alternative Selection and Cost Range for the Surplus Plutonium Disposition (SPD) project. In FY 2019, the project will complete the final design activities required to support a CD-3A, *Approve Long Lead Procurements*. The long lead procurements are for equipment required to meet nuclear quality assurance standards, plutonium processing gloveboxes and specialized engineered electrical control. There are a limited number of glovebox vendors supplying multiple nuclear construction projects in the department which increases the risk of schedule impacts. The project will be the first time application of seismically qualified specialized engineered electrical control equipment for a gaseous fire suppression system. Because of this, additional time is required for the procurement and manufacturing process. The FY 2019 scope continues the development of the preliminary design for the major systems supporting the plutonium processing gloveboxes (i.e., ventilation, electrical, security, etc.), structural analysis, design safety analysis, and security vulnerability assessment. The project will also continue supporting National Environmental Policy Act (NEPA) requirements, technology maturation, risk management, project management, and baseline development.

Other Project Cost (OPC)

This activity supports all other costs related to a project that are not included in the total estimated cost (TEC). OPCs include, but are not limited to: research and development, conceptual design and conceptual design report, cold start-up and commissioning costs, NEPA documentation, project data sheet preparation, siting, and permitting requirements. These costs are part of the approved baseline and the total project cost (TPC) of the project.

Total Estimated Costs (TEC)

This activity supports the design, long-lead equipment procurement, site preparation, and construction of the project.

U.S. Construction

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
U.S. Construction $335,000,000	**U.S. Construction $279,000,000**	**U.S. Construction -$56,000,0000**
18-D-150, Surplus Plutonium Disposition (SPD) Project $0	**18-D-150, Surplus Plutonium Disposition (SPD) Project $59,000,000**	**18-D-150, Surplus Plutonium Disposition (SPD) Project +$59,000,000**
SPD OPC $0 •	***SPD OPC $10,000,000*** • Funds project and design support activities such as project management and project controls support; procurement support, design authority activities, operations and security support, and start-up planning. • Supports an Independent Cost Estimate External Independent Review and Technical Independent Project Reviews in support of CD-3A.	***SPD OPC +$10,000,000*** • Increase supports the ramp up of design support activities and initiation of long-lead procurements.
SPD TEC $0	***SPD TEC $49,000,000***	***SPD TEC +$49,000,000***
•	• Preliminary Design • Complete design of gloveboxes and specialized engineered electrical equipment. • Initiate long-lead procurements of gloveboxes and specialized engineered electrical equipment upon CD-3A approval.	• Increase supports the ramp up of design activities and initiation of long-lead procurements.
MOX Fuel Fabrication Facility (MFFF) $335,000,000	**MOX Fuel Fabrication Facility (MFFF) $220,000,000**	**MOX Fuel Fabrication Facility (MFFF) -$115,000,000**
MFFF OPC $5,000,000 • Continued construction activities.	***MFFF OPC $150,000,000*** • Support termination activities.	***MFFF OPC +$145,000,000*** • Increase supports the termination activities. As the project progresses in the termination plan, more OPC funds are required.
MFFF TEC $330,000,000	***MFFF TEC $70,000,000***	***MFFF TEC -$260,000,000***
• Continued construction activities.	• Approve and initiate the termination plan.	• Decrease reflects the termination of construction activities.

Nonproliferation Construction
Performance Measures

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Mixed Oxide (MOX) Fuel Fabrication Facility - Cumulative percentage of the design, construction, and cold start-up activities completed for the Mixed Oxide (MOX) Fuel Fabrication Facility.							
Target	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Result	N/A						
Endpoint Target	Performance measure targets will be adjusted to reflect the decision of the path forward for plutonium disposition						
Surplus Plutonium Disposition (SPD) Project - Complete the design, construction, and cold start-up activities for the Surplus Plutonium Disposition (SPD) project.							
Target	N/A	Complete Critical Decision (CD) - 1 Approve Alternative Selection	Complete 35% of detailed design; Complete 100% final design for long lead procurements, site preparation, and security modifications.	Complete 60% of final design; initiate long lead procurements and construction activities for site preparation and security modifications upon approval of CD-3A	Complete 80% of final design	Complete 100% of final design; initiate construction	Complete 30% of construction
Result	N/A						
Endpoint Target	By the end of FY 2027, complete design, construction, and cold start-up activities for the SPD project.						

Nonproliferation Construction
Construction Projects Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
18-D-150, Surplus Plutonium Disposition Project, SR						
Total Estimated Cost (TEC)	0	0	0	0	49,000	+49,000
Other Project Cost (OPC)	0	0	0	0	10,000	+10,000
Total, 18-D-150, Surplus Plutonium Disposition Project, SR	**0**	**0**	**0**	**0**	**59,000**	**+59,000**
99-D-143, MOX Fuel Fabrication Facility (MFFF), SR						
Total Estimated Cost (TEC)	0	5,258,520	330,000	327,759	70,000	-260,000
Other Project Cost (OPC)	0	336,333	5,000	4,966	150,000	+145,000
Total Project Cost, 99-D-143, MOX Fuel Fabrication Facility (MFFF), SR[a]	**17,169,258**	**5,594,853**	**335,000**	**332,725**	**220,000**	**-115,000**
Total All Construction Projects						
Total Estimated Cost (TEC)	0	5,258,520	330,000	327,759	119,000	-211,000
Other Project Cost (OPC)	0	336,333	5,000	4,966	160,000	+155,000
Total Project Cost (TPC) All Construction Projects	**17,169,258**	**5,594,853**	**335,000**	**332,725**	**279,000**	**-56,000**

[a] Total amount shown for the MOX project ($17.2 billion) reflects the 2016 updated performance baseline.

Outyears to Completion for Nonproliferation Construction

	(Dollars in Thousands)			
	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
18-D-150, Surplus Plutonium Disposition Project, SR				
Total Estimated Cost (TEC)	53,000	55,000	69,750	55,000
Other Project Cost (OPC)	6,000	4,000	5,000	7,000
Total, 18-D-150, Surplus Plutonium Disposition Project, SR	**59,000**	**59,000**	**74,750**	**62,000**
99-D-143, MOX Fuel Fabrication Facility (MFFF), SR				
Total Estimated Cost (TEC)	70,000	0	0	0
Other Project Cost (OPC)	150,000	220,000	204,250	217,000
Total Project Cost, 99-D-143, MOX Fuel Fabrication Facility (MFFF), SR	**220,000**	**220,000**	**204,250**	**217,000**
Total All Construction Projects				
Total Estimated Cost (TEC)	123,000	55,000	69,750	55,000
Other Project Cost (OPC)	156,000	224,000	209,250	224,000
Total Project Cost (TPC) All Construction Projects	**279,000**	**279,000**	**279,000**	**279,000**

18-D-150, Surplus Plutonium Disposition (SPD)
Savannah River Site, Aiken, South Carolina
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary: The FY 2019 Request for the Surplus Plutonium Disposition project is $59,000K. The preliminary cost range for this project is $200,000K - $500,000K, with Critical Decision 4 (CD-4) projected for FY 2026 to FY 2027, based on the conceptual design cost and schedule range. The most recent Department of Energy (DOE) approved CD for the project is CD-0[a], Approve Mission Need, which was approved on October 31, 1997. The SPD Program mission need was to be implemented utilizing the Mixed Oxide (MOX) Fuel approach. In FY 2018, the Administration proposed to terminate the Mixed Oxide Fuel Fabrication (MFFF) project and pursue the dilute and dispose strategy to fulfill the United States' commitment to dispose of 34 metric tons of plutonium. The dilute and dispose strategy will support the expedited removal of plutonium from the State of South Carolina, and is therefore a key objective of the program. The dilute and dispose strategy requires a capital asset, designated the SPD Project, to accomplish the mission.

Funding for this project is controlled at the Total Project Cost (TPC) level. All appropriations may be used for either design, construction, or other project costs.

Significant Changes[b]
This Construction Project Data Sheet (CPDS) is an update of the Fiscal Year (FY) 2018 CPDS; assumes FY 2018 appropriations for the project; and, therefore, is not a new start for the budget year.

The project requests funds in FY 2019 to support activities such as long-lead procurements and demolition and removal of existing, unnecessary equipment in the K-Area Reactor Facility. In order to achieve plutonium disposition mission needs and remove plutonium from South Carolina as quickly as possible, the project must capitalize on opportunities to reduce the construction schedule. This necessitates receipt and installation of long lead procurements early in construction. It also requires security modifications to the facility to allow construction forces access, upon CD-3A approval.

A Federal Project Director (FPD) has not been assigned to this project, but an FPD will be assigned prior to CD-1 approval.

The dilute and dispose strategy utilizes mature plutonium processing technologies currently in use at DOE facilities. However in order to disposition 34 metric tons of plutonium in a timely manner as well as expedite the removal of plutonium from the State of South Carolina, additional throughput capacity to dilute the plutonium oxide with an inhibitor material is required. This project will install new gloveboxes, associated process and process support equipment, security upgrades, and additional interim storage capacity for the diluted plutonium product until characterization, packaging, and shipment for final disposal.

As required by DOE Order 413.3B, an independent Analysis of Alternatives (AoA) was completed. Based on the results, the Department Project Management Executive, with concurrence from the SPD AoA Steering Committee, selected the preferred location for the Project to be the K-Area Reactor Facility at the Savannah River Site (SRS), Aiken, South Carolina. A CD-1 package is expected to be completed in the 4th quarter of FY 2018.

In FY 2019, the project will complete the final design activities required to support a CD-3A, *Approve Long Lead Procurements*. The long lead procurements are for equipment required to meet nuclear quality assurance standards, plutonium processing gloveboxes, and specialized engineered equipment. There are a limited number of glovebox vendors supplying multiple nuclear construction projects, which increases risk to the schedule if NNSA is unable to secure the

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[a] The Department confirmed that the existing CD-0 milestone approving mission need for plutonium disposition would apply to the Surplus Plutonium Disposition (SPD) Project.
[b] Costs and schedules shown throughout the CPDS are estimates and consistent with the high end of the cost range. No construction will be performed beyond approved CD-3A scope until the project performance baseline has been validated and CD-3 has been approved.

necessary procurement and timely delivery. The project will also seismically qualify specialized engineered equipment for a gaseous fire suppression system. For both of these reasons, it is estimated that 36 months are required for the procurement and manufacturing process. The CD-3A will include the final design documents, equipment specifications, all required project management documentation, and a baseline estimate and schedule for the early construction activities. The approval process will include an Independent Project Review (IPR), an Independent Cost Estimate (ICE), and a Technical Independent Project Review (TIPR), as required by DOE Order 413.3B.

The FY 2019 work scope continues the development of the preliminary design for the major systems supporting the plutonium processing gloveboxes (i.e., ventilation, electrical, security, etc.), structural analysis, design safety analysis, and security vulnerability assessment. The project will also continue supporting National Environmental Policy Act (NEPA) requirements, technology maturation, risk management, project management, and baseline development.

The funding profile for future years will be updated when the estimates are validated and a baseline has been approved as part of the critical decision process.

Critical Milestone History

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2018	10/31/1997	2/2/2017	3QFY2018	1QFY2022	4QFY2021	1QFY2022	N/A	4QFY2027
FY 2019	10/31/1997	2/2/2017	4QFY2018	4QFY2022	4QFY2021	4QFY2022	N/A	4QFY2027

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete (d)
CD-3 – Approve Start of Construction
D&D Complete – Completion of D&D work
CD-4 – Approve Start of Operations or Project Closeout

Fiscal Quarter or Date

Fiscal Year	Performance Baseline Validation	CD-3A	CD-3B
FY 2018	1QFY2022	1QFY2019	N/A
FY 2019	4QFY2022	4QFY2019	N/A

CD-3A – Long Lead procurement for glovebox and specialized engineered equipment.

Project Cost History

Fiscal Quarter or Date

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2018	165,000	255,000	420,000	80,000	N/A	80,000	500,000
FY 2019	154,820	261,780	416,600	83,400	N/A	83,400	500,000

2. Project Scope and Justification

Scope

The SPD Project will implement the dilute and dispose strategy in the K-Area Facility at SRS. New gloveboxes and associated process and process support equipment for dilution of plutonium oxide will be provided in the K-Area Facility. Containers of plutonium oxide will be opened in the new gloveboxes; the oxide will be size reduced as necessary and then measured into a blend can to a prescribed amount. Inhibitor material will be added to the blend cans to dilute the plutonium oxide. The inhibitor is an inert powder mixture utilized to make the recovery of plutonium more difficult and allowing for the termination of safeguards. The blend cans will be mechanically manipulated to homogenize the content. The blend cans will be removed from the glovebox, assayed, and packaged into a Criticality Control Overpack (CCO). The project will install additional interim storage for the diluted plutonium product as well as characterization and packaging equipment to enable certification and shipment for final disposal.

Approximately 7,000 -10,000 ft^2 of processing space in the existing Hazard Category 2 K-Area Facility and 45,000 - 60,000 ft^2 of interim storage and processing space will be required for the project. To increase dilution throughput capacity, gloveboxes, equipment, and support systems (i.e., glovebox ventilation, fire suppression, glovebox rooms with airlocks, material control and accountability equipment, monitoring equipment, lag storage, etc.) will be installed in the K-Area Facility.

Justification

The mission of the dilute and dispose strategy is to provide processing, characterization, and storage capabilities to efficiently and permanently dispose of 34 metric tons of plutonium, thereby eliminating excess nuclear weapons materials.

It is a Departmental priority to remove certain inventories of plutonium from the State of South Carolina. Therefore, expediting removal of plutonium from SRS for final disposition is a key objective of the program. Although the dilute and dispose strategy utilizes mature technologies currently in use at DOE facilities, additional capacity is required to increase throughput in order to disposition 34 metric tons of plutonium in a timely manner as well as expedite removal of plutonium from SRS. The additional capacity will be provided by the SPD Project. The project will include new gloveboxes and associated process and process support equipment as well as additional interim storage capacity and security features for the diluted plutonium product until eventual characterization, packaging, and shipment for disposal.

A pre-conceptual risk analysis was completed to inform the cost range, and another was conducted during the AoA. A Risk Management Plan and a Risk and Opportunity Assessment Report will be included at CD-1. The contingency included in this data sheet is consistent with the criteria found in the Association for Advancement of Cost Engineering International recommended practices to be used for concept screening for a Class 5 estimate and DOE Cost Estimating Guide DOE G 413.3-21. The level of project definition for engineering is less than one percent complete.

The SPD project is being conducted in accordance with the project management requirements in DOE O 413.3B, Program and Project Management for the Acquisition of Capital Assets, and all appropriate project management requirements have been met.

The decision to implement the dilute and dispose strategy for the SPD Program would be made pursuant to the National Environmental Protection Act.

Key Performance Parameters (KPPs)
The Threshold KPPs represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion. The Objective KPPs represent the desired project performance.

Performance Measure	Threshold	Objective
N/A	N/A	N/A

3. Project Cost and Schedule

Financial Schedule

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2018	N/A	N/A	750
FY 2019	N/A	N/A	20,990
FY 2020	N/A	N/A	41,060
FY 2021	N/A	N/A	48,720
FY 2022	N/A	N/A	43,300
Total Design	N/A	N/A	**154,820**
Construction			
FY 2019	N/A	N/A	6,010
FY 2020	N/A	N/A	10,940
FY 2021	N/A	N/A	13,280
FY 2022	N/A	N/A	37,700
FY 2023	N/A	N/A	55,000
FY 2024	N/A	N/A	55,000
FY 2025	N/A	N/A	45,000
FY 2026	N/A	N/A	25,000
FY 2027	N/A	N/A	13,850
Total, Construction	N/A	N/A	261,780
Total Estimated Costs (TEC)			
FY 2018	N/A	N/A	750
FY 2019	N/A	N/A	27,000
FY 2020	N/A	N/A	52,000
FY 2021	N/A	N/A	62,000
FY 2022	N/A	N/A	81,000
FY 2023	N/A	N/A	55,000
FY 2024	N/A	N/A	55,000
FY 2025	N/A	N/A	45,000
FY 2026	N/A	N/A	25,000
FY 2027	N/A	N/A	13,850

	Budget Authority (Appropriations)	Obligations	Costs
Total TEC	N/A	N/A	**416,600**
Other Project Costs			
FY 2017	5,750	5,750	4,045
FY 2018	N/A	N/A	7,000
FY 2019	N/A	N/A	5,000
FY 2020	N/A	N/A	3,000
FY 2021	N/A	N/A	5,000
FY 2022	N/A	N/A	5,000
FY 2023	N/A	N/A	7,000
FY 2024	N/A	N/A	14,000
FY 2025	N/A	N/A	14,000
FY 2026	N/A	N/A	14,000
FY 2027	N/A	N/A	5,355
Total OPC	N/A	N/A	**83,400**
Total Project Costs (TPC)			
FY 2017	5,750	5,750	4,045
FY 2018	9,000	9,000	7,750
FY 2019[a]	59,000	59,000	32,000
FY 2020	59,000	59,000	55,000
FY 2021	59,000	59,000	67,000
FY 2022	74,750	74,750	86,000
FY 2023	62,000	62,000	62,000
FY 2024	60,000	60,000	69,000
FY 2025	59,000	59,000	59,000
FY 2026	35,000	35,000	39,000
FY 2027	17,500	17,500	19,205
Grand Total	**500,000**	**500,000**	**500,000**

[a] Includes funds for early procurement of engineered equipment.

Details of Project Cost Estimate

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	102,000	88,517	N/A
Contingency	52,820	76,483	N/A
Total, Design[a]	**154,820**	**165,000**	**N/A**
Construction			
Site Work	5,000	1,000	N/A
Long Lead Equipment	20,000	20,000	N/A
Equipment	17,000	17,000	N/A
Other Construction	115,050	134,413	N/A
Contingency	104,730	82,587	N/A
Total, Construction	**261,780**	**255,000**	**N/A**
Other TEC (if any)			
Cold Startup	N/A	N/A	N/A
Contingency	N/A	N/A	N/A
Total, Other TEC	**N/A**	**N/A**	**N/A**
Total Estimated Cost	**416,600**	**420,000**	**N/A**
Contingency, TEC	**157,550**	**159,070**	**N/A**
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	0
Conceptual Planning	2,340	2,340	N/A
Conceptual Design	10,000	10,000	N/A
Other OPC Costs	49,455	40,000	N/A
Contingency	21,605	27,660	N/A
Total, OPC	**83,400**	**80,000**	**N/A**
Contingency, OPC	21,605	27,660	N/A
Total Project Cost	**500,000**	**500,000**	**N/A**
Total Contingency (TEC+OPC)	**179,155**	**186,730**	**N/A**

[a] For a typical nuclear construction project at SRS, design costs are roughly 40 percent of the TPC.

Schedule of Appropriations Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	Total
FY 2018	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	15,000	47,000	46,000	56,000	85,000	62,000	500,000
FY 2019	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	14,750	59,000	59,000	59,000	74,750	62,000	500,000

4. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2027
Expected Useful Life	20 years
Expected Future Start of D&D of this capital asset	4Q FY 2047

Related Funding Requirements
(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance[a]	122.1	122.1	2,441.2	2,441.2

5. D&D Information

The new area being constructed in this project is within existing facilities.

	Square Feet
New area being constructed by this project at Savannah River Site (K-Area).	10,000
Area of D&D in this project at Savannah River Site (K-Area).	N/A
Area at Savannah River Site (K-Area)to be transferred, sold, and/or D&D outside the project, including area previously "banked"	N/A
Area of D&D in this project at other sites	N/A
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	N/A
Total area eliminated	N/A

[a] The rough order of magnitude is based on estimates developed for the AoA. It does not include future capital investment. These are estimates and will be updated once the LCCE is validated and CD-1 is approved. The annual amount was developed by taking the escalated LCCE and divided by the projected 20 years of operation.

6. Acquisition Approach

The Acquisition strategy will be developed as part of the CD-1 development scheduled to be completed by the end of FY 2018.

99-D-143, Mixed Oxide (MOX) Fuel Fabrication Facility,
Savannah River Site (SRS), Aiken, South Carolina
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary: DOE approved Order 413.3B's Critical Decision (CD) -3, Start of Construction on April 11, 2007, with a Total Project Cost (TPC) of $4,814,329K and CD-4 of FY 2016. Construction began on August 1, 2007, as directed by the Revised Continuing Resolution, 2007, Public Law 110-5. A revised baseline change was approved on December 17, 2008, with a TPC of $4,857,129K and CD-4 of FY 2017. The project cost has exceeded the 2008 TPC and has not been re-baselined. Since 2012, the Department has requested multiple independent cost estimates. The most recent Performance Baseline update was completed in 2016 by the DOE Office of Project Management Oversight in partnership with the U.S. Army Corps of Engineers (USACE). This update, determined reliable by the GAO, estimated a TPC of $17,169,258K and CD-4 of FY 2048.

Significant Changes:

This construction Project Data Sheet (CPDS) is an update of the Fiscal Year (FY) 2018 CPDS and does not include a new start for the budget year.

In FY 2018, the Department proposed termination of the MOX project in accordance with DOE Order 413.3B. The FY 2018 Continuing Resolution (CR) directs the Department to continue construction activities. During the CR in FY 2018, the project will focus on completion of design and in-progress construction, and development of a detailed integrated project plan and schedule. Upon approval from Congress in FY 2018, the Department will direct the MOX prime contractor to develop a plan within 90 days to terminate the project and begin to secure information, materials, and equipment at the job site to protect government assets and ensure the safety of workers. The disposition of certain temporary and permanent facilities will be planned; equipment will be prepared for storage or disposition as appropriate. In general, the contractor will begin termination of the sub-contracts and leases. Where cost effective, the MOX prime contractor will be directed to complete existing subcontracts and leases but refrain from beginning any new procurements without government approval. DOE will also begin discussions to negotiate the final costs to terminate the contract. Notification of personnel actions will be made as required by applicable law. A final estimate to complete the project shutdown and contract termination is expected to be produced during late calendar year 2018, with final termination completed in FY 2021. In FY 2019, the Administration will continue with termination activities for the MOX project and will continue to pursue the dilute and dispose strategy for plutonium disposition.

A Federal Project Director (FPD) has been assigned to this project and has approved this CPDS.

Critical Milestone History

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2000	N/A		2QFY1999	N/A	4QFY2001	1QFY2002	N/A	4QFY2005
FY 2001	N/A		2QFY1999	N/A	3QFY2002	4QFY2002	N/A	1QFY2006
FY 2002	N/A		2QFY1999	N/A	4QFY2002	2QFY2003	N/A	1QFY2007
FY 2003	N/A		2QFY1999	N/A	4QFY2003	2QFY2004	N/A	4QFY2007
FY 2004	N/A		2QFY1999	N/A	1QFY2004	2QFY2004	N/A	4QFY2007
FY 2005	N/A		2QFY1999	N/A	3QFY2004	3QFY2005	N/A	2QFY2009
FY 2006	N/A		2QFY1999	N/A	1QFY2005	3QFY2005	N/A	TBD
FY 2007 PB	N/A		2QFY1999	N/A	4QFY2009	2QFY2007	N/A	4QFY2014
FY 2008	1QFY1997		2QFY1999	2QFY2007	2QFY2011	2QFY2007	N/A	4QFY2013
FY 2009	1QFY1997		03/22/1999	04/11/2007	2QFY2013	04/11/2007[a]	N/A	4QFY2016
FY 2010	1QFY1997		03/22/1999	04/11/2007	2QFY2013	04/11/2007	N/A	1QFY2017
FY 2011	1QFY1997		03/22/1999	04/11/2007	2QFY2013	04/11/2007	N/A	1QFY2017
FY 2012	1QFY1997		03/22/1999	04/11/2007	2QFY2013	04/11/2007	N/A	1QFY2017
FY 2013	1QFY1997		03/22/1999	04/11/2007	2QFY2013	04/11/2007	N/A	1QFY2017
FY 2014	1QFY1997		03/22/1999	04/11/2007	4QFY2014	04/11/2007	N/A	TBD
FY 2015	1QFY1997		03/22/1999	04/11/2007	4QFY2016	04/11/2007	N/A	TBD
FY 2016	1QFY1997	10/31/1997	03/22/1999	04/11/2007	4QFY2016	04/11/2007	N/A	4QFY2031
FY 2017	1QFY1997	10/31/1997	03/22/1999	04/11/2007	4QFY2016	04/11/2007	N/A	N/A
FY 2018	1QFY1997	10/31/1997	03/22/1999	04/11/2007	TBD[b]	04/11/2007	N/A	4QFY2048
FY 2019	1QFY1997	10/31/1997	03/22/1999	04/11/2007	TBD[b]	04/11/2007	N/A	4QFY2048

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete (d)
CD-3 – Approve Start of Construction
D&D Complete – Completion of D&D work
CD-4 – Approve Start of Operations or Project Closeout

Fiscal Quarter or Date

Fiscal Year	Performance Baseline Validation	CD-2A/3A	CD-2B/3B
FY 2005	N/A	09/30/2005	N/A
FY 2006	07/07/2006	N/A	N/A
FY 2007	N/A	N/A	04/06/2006

CD 2A/3A - Approval to start Site Preparation
CD 2B/3B - Approval to begin long lead procurements ("trapped" tanks, steel embeds, reinforcing steel, barrier doors)

[a] The Department approved CD-3 (Start of Construction) on April 11, 2007; however, as directed by the Revised Continuing Resolution, 2007, Public Law 110-5, construction began on August 1, 2007.
[b] The project is proposed for termination.

Project Cost History

Fiscal Quarter or Date

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2000	TBD	TBD	383,186	0	N/A	TBD	N/A
FY 2001	TBD	TBD	383,186	0	N/A	TBD	N/A
FY 2002	TBD	TBD	TBD	TBD	N/A	TBD	N/A
FY 2003	TBD	TBD	TBD	TBD	N/A	TBD	N/A
FY 2004	TBD	TBD	TBD	TBD	N/A	TBD	N/A
FY 2005	TBD	TBD	TBD	TBD	N/A	TBD	N/A
FY 2006	TBD	TBD	TBD	TBD	N/A	TBD	N/A
FY 2007 PB	TBD	TBD	3,277,984	354,108	N/A	354,108	3,632,092
FY 2008	TBD	TBD	3,868,628	830,701	N/A	830,701	4,699,329
FY 2009	TBD	TBD	3,938,628	875,701	N/A	875,701	4,814,329
FY 2010	TBD	TBD	3,975,828	881,301	N/A	881,301	4,857,129
FY 2011	960,925	3,014,903	3,975,828	881,301	N/A	881,301	4,857,129
FY 2012	978,073	2,997,755	3,975,828	881,301	N/A	881,301	4,857,129
FY 2013	994,073	2,981,755	3,975,828	881,301	N/A	881,301	4,857,129
FY 2014	TBD	TBD	TBD	TBD	N/A	TBD	TBD
FY 2015	TBD	TBD	TBD	TBD	N/A	TBD	TBD
FY 2016	1,072,430	9,179,089	10,251,519	2,439,333	N/A	2,439,333	12,690,852
FY 2017	TBD[a]	TBD[a]	TBD[a]	TBD[a]	N/A	TBD[a]	TBD[a]
FY 2018[a]	TBD[a]	TBD[a]	TBD[a]	TBD[a]	N/A	TBD[a]	17,169,258[b]
FY 2019[a]	TBD[a]	TBD[a]	TBD[a]	TBD[a]	N/A	TBD[a]	17,169,258[b]

2. Project Scope and Justification

Scope

The MOX Fuel Fabrication Facility (MFFF) project is being terminated in FY 2018, and termination activities will continue in FY 2019.

Justification

The MOX Fuel Fabrication Facility (MFFF) project is being terminated in FY 2018, and termination activities will continue in FY 2019.

[a] The MFFF project is proposed for termination and scope, schedule, and costs will be refined in subsequent budget submissions upon the Department's approval of the termination plan for the MFFF project.
[b] This updated TPC reflects the 2016 updated performance baseline developed by the DOE Office of Project Management Oversight in partnership with USACE.

Key Performance Parameters (KPPs)
The Threshold KPPs represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion. The Objective KPPs represent the desired project performance.

Performance Measure	Threshold	Objective
Project being proposed for termination in FY 2018		

3. Project Cost and Schedule

Financial Schedule

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 1999	N/A	N/A	2,545
FY 2000	N/A	N/A	33,512
FY 2001	N/A	N/A	29,938
FY 2002	N/A	N/A	52,513
FY 2003	N/A	N/A	82,022
FY 2004	N/A	N/A	93,457
FY 2005	N/A	N/A	216,801
FY 2006	N/A	N/A	165,618
FY 2007	N/A	N/A	62,342
FY 2008[a]	N/A	N/A	58,958
FY 2009[b]	N/A	N/A	68,395
FY 2010	N/A	N/A	65,056
FY 2011	N/A	N/A	50,757
FY 2012	N/A	N/A	34,642
FY 2013	N/A	N/A	24,445
FY 2014 Reprogramming	N/A	N/A	0
FY 2014	N/A	N/A	19,789
FY 2015	N/A	N/A	24,895
FY 2016	N/A	N/A	14,758
FY 2017	N/A	N/A	13,623

[a] Includes $31M for long-lead procurements.
[b] Includes $37.6M for long-lead procurements.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2018	N/A	N/A	25,984
FY 2019	N/A	N/A	0
Total Design	N/A	N/A	1,140,050
Construction			
FY 2004	N/A	N/A	0
FY 2005	N/A	N/A	0
FY 2006	N/A	N/A	15,210
FY 2007	N/A	N/A	115,065
FY 2008[a]	N/A	N/A	209,174
FY 2008 (rescinded PY unobligated balance)	N/A	N/A	0
FY 2009[b]	N/A	N/A	301,323
FY 2010	N/A	N/A	429,326
FY 2011	N/A	N/A	482,330
FY 2012	N/A	N/A	671,212
FY 2013	N/A	N/A	476,204
FY 2014 Reprogramming	N/A	N/A	0
FY 2014	N/A	N/A	301,777
FY 2015	N/A	N/A	309,403
FY 2016	N/A	N/A	323,048
FY 2017	N/A	N/A	277,219
FY 2018	N/A	N/A	290,000
FY 2019	TBD	TBD	TBD
FY 2020	TBD	TBD	TBD
FY 2021	TBD	TBD	TBD
FY 2022	TBD	TBD	TBD
FY 2023	TBD	TBD	TBD
Total Construction	TBD	TBD	TBD
TEC			
FY 1999	28,000	9,600	2,545
FY 2000	12,375	30,775	33,512

[a] Includes $31M for long-lead procurements.

[b] Includes $37.6M for long-lead procurements.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2001	25,943	25,943	29,938
FY 2002	65,993	65,993	52,513
FY 2003	92,088	92,088	82,022
FY 2004	360,274	81,081	93,457
FY 2005	365,087	295,295	216,801
FY 2006	217,800	337,322	180,828
FY 2007	262,500	262,500	177,407
FY 2008	231,721	346,184	268,132
FY 2008 (rescinded PY unobligated balance)	-115,000	0	0
FY 2009	467,808	467,808	369,718
FY 2010	504,238	504,238	494,382
FY 2011	501,788	501,788	533,087
FY 2012	435,172	435,172	705,854
FY 2013	400,990	400,990	500,649
FY 2014 Reprogramming	59,242	59,242	0
FY 2014	343,500	343,500	321,566
FY 2015	335,000	335,000	334,298
FY 2016	334,000	334,000	337,806
FY 2017	320,000	320,000	290,842
FY 2018	255,000	255,000	315,984
FY 2019	70,000	70,000	TBD
FY 2020	70,000	70,000	TBD
FY 2021	TBD	TBD	TBD
FY 2022	TBD	TBD	TBD
FY 2023	TBD	TBD	TBD
Total TEC	**TBD**	**TBD**	**TBD**
Other Project Costs			
FY 1999	5,000	5,000	4,500
FY 2000	5,000	5,000	4,500
FY 2001	5,000	5,000	5,000
FY 2002	5,000	5,000	5,000
FY 2003	8,000	8,000	5,000

	Budget Authority (Appropriations)	Obligations	Costs
FY 2004	9,292	9,292	11,500
FY 2005	9,357	9,357	3,749
FY 2006	28,200	21,300	7,023
FY 2007	915	7,792	9,278
FY 2008[a]	47,068	47,068	15,746
FY 2009[b]	0	0	21,451
FY 2010	56,466	56,466	19,344
FY 2011	4,000	4,000	50,211
FY 2012	47,035	47,035	33,142
FY 2013	40,000	40,000	35,065
FY 2014	40,000	40,000	34,582
FY 2015	10,000	10,000	15,463
FY 2016	6,000	6,000	22,296
FY 2017	15,000	15,000	18,270
FY 2018	15,000	15,000	24,000
FY 2019	150,000	150,000	TBD
FY 2020	150,000	150,000	TBD
FY 2021	TBD	TBD	TBD
FY 2022	N/A	N/A	TBD
FY 2023	N/A	N/A	TBD
Total OPC	TBD	TBD	TBD
Total Project Costs (TPC)			
FY 1999	33,000	14,600	7,045
FY 2000	17,375	35,775	38,012
FY 2001	30,943	30,943	34,938
FY 2002	70,993	70,993	57,513
FY 2003	100,088	100,088	87,022
FY 2004	369,566	90,373	104,957
FY 2005	374,444	304,652	220,550
FY 2006	246,000	358,622	187,851

[a] Includes $31M for long-lead procurements.
[b] Includes $37.6M for long-lead procurements.

	Budget Authority (Appropriations)	Obligations	Costs
FY 2007[a]	263,415	270,292	186,685
FY 2008[bc]	278,789	393,252	283,878
FY 2008 (rescinded PY unobligated balance)	-115,000	0	0
FY 2009[de]	467,808	467,808	391,169
FY 2010[f]	560,704	560,704	513,726
FY 2011[g]	505,788	505,788	583,298
FY 2012	482,207	482,207	738,996
FY 2013	440,990	440,990	535,714
FY 2014 Reprogramming	59,242	59,242	0
FY 2014	383,500	383,500	356,148
FY 2015	345,000	345,000	349,761
FY 2016	340,000	340,000	360,102
FY 2017	335,000	335,000	309,112
FY 2018	270,000	270,000	339,984
FY 2019	220,000	220,000	TBD
FY 2020	220,000	220,000	TBD
FY 2021	TBD	TBD	TBD
FY 2022	TBD	TBD	TBD
FY 2023	TBD	TBD	TBD
Grand Total[h]	TBD	TBD	TBD

[a] Includes $31M for long-lead procurements.
[b] Includes $37.6M for long-lead procurements.
[c] MOX funded within the Nuclear Energy appropriation.
[d] MOX funded within the Other Defense Activities appropriation.
[e] Includes $177.4M for long-lead procurements.
[f] Includes $167.9M for long-lead procurements.
[g] Includes $67.1M for long-lead procurements.
[h] Scope, schedule and costs will be refined in subsequent budget submissions upon the Department's approval of the termination plan for the MFFF project.

Details of Project Cost Estimate

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate[a]	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	TBD	1,072,430	916,148
Contingency	0	0	0
Total, Design	TBD	1,072,430	916,148
Construction			
Site Work	TBD	39,957	39,929
Equipment	TBD	800,000	251,791
Construction	TBD	7,209,398	2,067,639
Other, as needed	TBD	0	0
Contingency	TBD	1,129,734	663,121
Total, Construction	TBD	9,179,089	3,022,480
Other TEC (if any)			
Cold Startup	N/A	N/A	N/A
Contingency	N/A	N/A	N/A
Total, Other TEC	N/A	N/A	N/A
Total Estimated Cost	TBD	10,251,519	3,938,628
Contingency, TEC	TBD	1,129,734	663,121

[a] Scope, schedule and costs will be refined in subsequent budget submissions upon the Department's approval of the termination plan for the MFFF project. The current total estimate shown reflects the high end range from the USACE estimate.

	Current Total Estimate	Previous Total Estimate[a]	Original Validated Baseline
Other Project Cost (OPC)			
OPC except D&D			
R&D	0	0	0
Conceptual Planning	TBD	37,723	37,723
Conceptual Design	0	0	0
Other OPC Costs	TBD	1,931,344	650,468
Contingency	TBD	470,266	187,510
Total, OPC	TBD	2,439,333	875,701
Contingency, OPC	TBD	470,266	187,510
Total Project Cost	17,169,258[a]	12,690,852	4,814,329
Total Contingency (TEC+OPC)	TBD	1,600,000	850,631

[a] This updated TPC reflects the 2016 updated performance baseline developed by the DOE Office of Project Management Oversight in partnership with USACE.

Schedule of Appropriations Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2015 [a]	FY 2016 [b]	FY 2017 [b]	FY 2018 [b]	FY 2019 [b]	FY 2020 [b]	FY 2021 [b]	Outyears [b]	Total
FY 2009	TEC	3,512,050	125,611	300,967	0	0	0	0	0	0	3,938,628
	OPC	781,998	85,771	7,932	0	0	0	0	0	0	875,701
	TPC	4,294,048	211,382	308,899	0	0	0	0	0	0	4,814,329
FY 2010	TEC	3,812,250	125,773	37,805	0	0	0	0	0	0	3,975,828
	OPC	783,699	91,603	5,999	0	0	0	0	0	0	881,301
	TPC	4,595,949	217,376	43,804	0	0	0	0	0	0	4,857,129
FY 2011 [c d]	TEC	3,812,250	125,773	37,805	0	0	0	0	0	0	3,975,828
	OPC	783,699	91,603	5,999	0	0	0	0	0	0	881,301
	TPC	4,595,949	217,376	43,804	0	0	0	0	0	0	4,857,129
FY 2012	TEC	3,812,250	125,773	37,805	0	0	0	0	0	0	3,975,828
	OPC	783,699	91,603	5,999	0	0	0	0	0	0	881,301
	TPC	4,595,949	217,376	43,804	0	0	0	0	0	0	4,857,129
FY 2013	TEC	3,963,250	9,773	2,805	0	0	0	0	0	0	3,975,828
	OPC	632,699	207,603	40,999	0	0	0	0	0	0	881,301
	TPC	4,595,949	217,376	43,804	0	0	0	0	0	0	4,857,129
FY 2014	TEC	4,213,622	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	310,333	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	TPC	4,523,955	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
FY 2014 Reprogramming	TEC	3,916,020	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
	OPC	270,333	0	0	0	0	0	0	0	0	270,333
	TPC	4,186,353	0	0	0	0	0	0	0	0	TBD
FY 2015	TEC	4,259,520	196,000	196,000	196,000	196,000	196,000	196,000	196,000	TBD	TBD
	OPC	310,333	25,000	25,000	25,000	25,000	25,000	25,000	25,000	TBD	TBD
	TPC	4,569,853	221,000	221,000	221,000	221,000	221,000	221,000	221,000	TBD	TBD
FY 2016	TEC	4,259,520	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10,251,519
	OPC	310,333	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2,439,333
	TPC	4,569,853	345,000	345,000	221,000	221,000	221,000	221,000	221,000	6,891,999	12,690,852
FY 2017	TEC	4,259,520	335,000	330,000	255,000	171,000	71,000	0	0	0	TBD
	OPC	310,333	10,000	10,000	15,000	50,000	150,000	221,000	221,000	TBD	TBD
	TPC	4,569,853	345,000	340,000	270,000	221,000	221,000	221,000	221,000	TBD	TBD
FY 2018	TEC	4,259,520	335,000	334,000	310,000	255,000	TBD	TBD	TBD	TBD	TBD
	OPC	310,333	10,000	6,000	25,000	15,000	TBD	TBD	TBD	TBD	TBD
	TPC	4,569,853	345,000	340,000	335,000	270,000	TBD	TBD	TBD	TBD	TBD
FY 2019	TEC	4,259,520	335,000	334,000	320,000	255,000	70,000	70,000	TBD	TBD	TBD
	OPC	310,333	10,000	6,000	15,000	15,000	150,000	150,000	TBD	TBD	TBD
	TPC	4,569,853	345,000	340,000	335,000	270,000	220,000	220,000	TBD	TBD	TBD

[a] These numbers reflect the slow-down of the current plutonium disposition strategy while assessing alternative strategies.

[b] Scope, schedule and costs will be refined in subsequent budget submissions upon the Department's approval of the termination plan for the MFFF project.

[c] FY 2011 OPC appropriations were only $4 million vs. $30 million planned.

[d] FY 2011 TEC appropriations were increased by $26 million.

4. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy ~~(fiscal quarter or date)~~	N/A[a]
Expected Useful Life ~~(number of years)~~	N/A[a]
Expected Future Start of D&D of this capital asset ~~(fiscal quarter)~~	N/A[a]

Related Funding Requirements

(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Security	0	543.2	0	8,209.3

Lifecycle cost estimate shown has not been updated since the FY 2014 budget submittal. The MOX project is proposed for termination in FY 2018.

5. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project	N/A
Area of D&D in this project	N/A
Area to be transferred, sold, and/or D&D outside the project, including area previously "banked"	N/A
Area of D&D in this project at other sites	N/A
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	N/A
Total area eliminated	N/A

[a] Project is being terminated.

6. Acquisition Approach

The procurement strategy for the MOX facility involved awarding a base contract to Duke Cogema Stone & Webster (now MOX Services) in March 1999 for design, licensing, and irradiation services associated with fuel qualification activities and reactor licensing. Three options were included in the base contract for: (1) construction and management oversight; (2) hot start-up, operations, and irradiation services; and (3) deactivation—which can be awarded separately. Option 1 was exercised by DOE in May 2008. In January 2009, an Early Option 2 proposal was submitted to NNSA for consideration. The proposed work scope included the fabrication of eight fuel assemblies as a part of the facility hot start-up plan.

CB&I AREVA MOX Services (MOX Services) is a Limited Liability Company (LLC) comprised of Chicago Bridge and Iron (CB&I) Company and the French company, AREVA. In February 2013 CB&I completed its acquisition of the previous LLC member, The Shaw Group. Since CB&I is a foreign-based company, a proxy company has been formed to address U.S. government foreign ownership and control regulations. As a result, a proxy company under CB&I named CB&I Project Services Group, LLC, was formed to oversee CB&I's security-sensitive work such as the MFFF Project.

Construction of the MOX facility is being performed through a combination of fixed-price/cost-plus sub-contracts and MOX Services' direct managed construction craft personnel. A combination of award fees and incentive fees are included in the overall contract with MOX Services to reward performance within established project baselines.

Upon approval from Congress in FY 2018, DOE will issue contract direction to MOX Services as early as practicable to halt construction activities. To guide the termination activities, the Department will utilize lessons learned captured by the Defense Acquisition University Smart ShutDown Guidebook and other lessons learned from termination of other Major System Acquisition Projects. The agreed upon termination plan will support the Department's negotiation of the final costs to terminate the contract. Notification of personnel actions will be made as required by applicable law. A final estimate to complete the shutdown of the project and contract termination is expected to be completed during late calendar year 2018, with final termination completed in FY 2021. The Department will brief the details of the termination plan to the cognizant Congressional committees.

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Nuclear Counterterrorism and Incident Response Program

Overview

One of NNSA's enduring missions is to help protect our nation and its citizens from the threat of nuclear terrorism or an accident or incident involving the release of nuclear or radiological material. The NNSA Nuclear Counterterrorism and Incident Response (NCTIR) Program evaluates and assesses nuclear or radiological threats and leverages that knowledge to support interagency policy, contingency planning, training, and capacity building in order to strengthen national and international radiological and nuclear counterterrorism, counterproliferation, and incident response capabilities. NCTIR also executes DOE/NNSA's Comprehensive Emergency Management System that administers implementation and support of emergency management for all DOE/NNSA offices and sites. The NCTIR Program includes the subprograms noted below:

- The **Emergency Operations** (EO) subprogram administers the Continuity Program, develops all-hazards emergency management policy, provides incident management training and exercise planning, and manages the Emergency Communications Network (ECN) capability for the Department. EO assists NNSA and DOE sites and deployable teams with implementation of emergency management policies, practices, and technical support. EO develops and manages the Department's Continuity of Operations and Continuity of Government training and plans and oversees the annual Continuity of Government exercise program.

- The **Counterterrorism and Counterproliferation** (CTCP) subprogram reduces the threat of nuclear proliferation and nuclear and radiological terrorism through innovative science, technology, and policy solutions. Further, CTCP maintains the capability to respond to, manage, avert, and mitigate the consequences of nuclear and radiological incidents in the United States and elsewhere in the world; and provide technical forensics capability to support material and attack attribution. The following subprograms support CTCP:

  - The Emergency Response/Nuclear Incident Response subprogram provides a flexible, efficient, and effective response capability for any nuclear/radiological incident in the United States or abroad by applying the unique technical expertise within NNSA's nuclear security enterprise. This is accomplished by ensuring appropriately trained personnel and specialized technical equipment are ready to deploy to provide an integrated response for radiological search, render safe, and consequence management for nuclear/radiological emergencies, national exercises, and security operations for National Security Special Events and other large special events.

  - The National Technical Nuclear Forensics (NTNF) subprogram maintains the operational capability for pre-detonation device disassembly and examination, provides operational support for post-detonation events, and coordinates the analysis of Special Nuclear Materials. The mission maintains a readiness posture to deploy device disposition and device assessment teams, conduct laboratory operations in support of analysis of bulk actinide forensics, and to deploy subject matter expertise and operational capabilities in support of ground sample collections that contribute to conclusions in support of attribution.

  - The Counterterrorism Response and Capacity Building subprogram leverages NCTIR's technical expertise to strengthen preparedness and capabilities to respond to all radiological or nuclear incidents, accidents, and terror threats posing a potential risk to the United States, its citizens, or its interests. These activities exercise and expand state and local radiological and nuclear incident response capabilities and enable key international partners to effectively address radiological or nuclear incidents in their region--with or without U.S. involvement--as far from U.S. territory as possible.

  - The Nuclear Counterterrorism (NCT) Assessment subprogram provides the nation's technical capability to understand and defeat nuclear threat devices (NTD), including Improvised Nuclear Devices (INDs) and lost or stolen foreign nuclear weapons; and to develop foundational technologies supporting nuclear counterproliferation efforts. NCT advances and maintains this technical capability by 1) assessing nuclear threat device concepts; 2) assessing protection requirements for nuclear materials; 3) implementing the classified Nuclear Threat Reduction (NTR) channels; and 4) improving predictive Render Safe capabilities. Technical work on device assessment also supports the Department of Defense (DOD), Federal Bureau of Investigation (FBI), and Intelligence Community in policy, planning, and operational capabilities.

- The DOE/NNSA Aerial Measuring System (AMS) detects, measures, and tracks radioactive material in an emergency to determine contamination levels. The AMS mission has two operational modes with unique requirements: 1) rapid On-Call Response to provide coarse characterization of contamination; and 2) Radiation Mapping, to provide detailed mapping of the contamination. The AMS Recapitalization subprogram will procure aviation platforms that meet the future needs of the AMS Program. In accordance with the conclusions of the completed Analysis of Alternatives (AoA), three fixed-wing aircraft will be procured in FY 2019 and two rotary-wing aircraft will be procured in FY 2020 to recapitalize the current AMS fleet.

Highlights of the FY 2019 Budget Request

The FY 2019 Budget Request sustains Nuclear Counterterrorism and Incident Response and includes additional funding to provide technical equipment and training to address the increasing demands to counter the threat of nuclear terrorism and associated nuclear threat devices, including sustaining and enhancing the Stabilization program by providing quarterly training and equipment maintenance to regional teams, and developing additional technical capabilities in accordance with the joint DOE-FBI plan. The Request provides funding for communications and IT infrastructure improvements for both emergency management needs as well as the National Assets who deploy in support of a national or international incident; and additional improvements as required to meet national cyber security standards. The Request enables procurement of mission critical equipment to recapitalize equipment that has exceeded its useful life, including recapitalization of the three fixed-wing aircraft in FY 2019 and the two rotary-wing aircraft in FY 2020 for the Aerial Measuring System. Finally, the request allows further development of operational capabilities for the post-detonation technical nuclear forensics program to strengthen USG capabilities to support attack attribution.

Proposed FY 2019 Budget Structure
Nuclear Counterterrorism and Incident Response Program

	Proposed FY 2019 Budget Structure		
	Emergency Operations	**Counterterrorism/ Counterproliferation**	**Total**
FY 2018 Budget Structure			
Defense Nuclear Nonproliferation			
Nuclear Counterterrorism and Incident Response Program			
Emergency Operations	35,574		**35,574**
Emergency Response/Nuclear Incident Response		162,570	**162,570**
National Technical Nuclear Forensics		15,181	**15,181**
Counterterrorism Response & Capacity Building		8,210	**8,210**
Nuclear Counterterrorism Assessment		65,150	**65,150**
AMS Recapitalization [a]		32,500	**32,500**
Total, Nuclear Counterterrorism and Incident Response Program	**35,574**	**283,611**	**319,185**

[a] AMS Recapitalization was not part of the FY 2018 budget structure. New in FY 2019 structure under Counterterrorism and Counterproliferation.

Nuclear Counterterrorism and Incident Response Program
Funding (Non-Comparable)[a]

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Nuclear Counterterrorism and Incident Response Program				
Emergency Operations	0	0	35,574	+35,574
Counterterrorism and Counterproliferation				
Emergency Response	0	0	162,570	+162,570
National Technical Nuclear Forensics	0	0	15,181	+15,181
Counterterrorism Response & Capacity Building	0	0	8,210	+8,210
Nuclear Counterterrorism Assessment	0	0	65,150	+65,150
AMS Recapitalization [a]	0	0	32,500	+32,500
Total Counterterrorism and Counterproliferation	0	0	283,611	+283,611
Total, Nuclear Counterterrorism and Incident Response Program	**0**	**0**	**319,185**	**+319,185**

Nuclear Counterterrorism and Incident Response Program
Funding (Comparable)

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Nuclear Counterterrorism and Incident Response Program				
Emergency Operations	34,775	34,539	35,574	+799
Emergency Response	156,955	155,889	162,570	+5,615
National Technical Nuclear Forensics	11,400	11,323	15,181	+3,781
Counterterrorism Response & Capacity Building	7,500	7,449	8,210	+710
Nuclear Counterterrorism Assessment	61,251	60,835	65,150	+3,899
AMS Recapitalization [a]	0	0	32,500	+32,500
Total, Nuclear Counterterrorism and Incident Response Program	**271,881**	**270,035**	**319,185**	**+47,304**

[a] AMS Recapitalization was not part of the FY 2018 budget structure. The subprogram is new in FY 2019.

Outyears for Nuclear Counterterrorism and Incident Response Program
Funding

	(Dollars in Thousands)			
	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Nuclear Counterterrorism and Incident Response Program				
Emergency Operations	35,574	36,000	36,500	37,000
Counterterrorism and Counterproliferation				
Emergency Response	167,754	174,803	177,350	182,281
National Technical Nuclear Forensics	16,610	18,150	18,650	18,650
Counterterrorism Response & Capacity Building	9,105	10,750	11,100	11,100
Nuclear Counterterrorism Assessment	67,350	89,800	92,253	93,300
AMS Recapitalization	35,500	0	0	0
Total Counterterrorism and Counterproliferation	296,319	293,503	299,353	305,331
Total, Nuclear Counterterrorism and Incident Response Program	**331,893**	**329,503**	**335,853**	**342,331**

Nuclear Counterterrorism and Incident Response Program
Explanation of Major Changes
(Dollars in Thousands)

	FY 2019 Request vs FY 2017 Enacted
Nuclear Counterterrorism and Incident Response Program	
Emergency Operations: No significant change.	+799
Counterterrorism and Counterproliferation: Consolidates Emergency Response, National Technical Nuclear Forensics, Counterterrorism Response and Capacity Building, and Nuclear Counterterrorism and Assessment subprograms and adds AMS Recapitalization under Counterterrorism and Counterproliferation. Increase will replace the three fixed wing Aerial Measuring Systems (AMS) aircraft (+32.5M); support incremental recapitalization of incident response equipment to ensure operational readiness is maintained; enhance the Stabilization program by developing additional technical capabilities in accordance with joint DOE-FBI plans;, support further development of operational capabilities for post-detonation device assessment, and provide training for new personnel on deployable teams.	+46,505
Total, Nuclear Counterterrorism and Incident Response Program	**+47,304**

Nuclear Counterterrorism and Incident Response Program
Emergency Operations

Description

The Emergency Operations subprogram is focused on emergency preparedness, emergency management policy, and incident response to sustain the DOE/NNSA mission, maintain readiness, and to ensure a fully implemented and integrated comprehensive emergency management enterprise system throughout the Department.

The FY 2019 Budget Request will continue to focus on complex wide integration and enhancement of Emergency Operations activities.

To strengthen emergency preparedness across DOE/NNSA, this subprogram develops and implements specific programs, processes, and concepts to minimize the impacts of emergencies on worker and public health and safety, the environment, and national security. This is accomplished by promulgating appropriate departmental policies and implementing requirements and guidance; developing and conducting training and other emergency preparedness activities; supporting DOE/NNSA readiness assurance activities and participating in interagency emergency planning and coordination activities. EO will also develop standards for exercises and provide training to support an all hazards emergency management capability.

This subprogram operates the DOE/NNSA Consolidated Emergency Operations Center (CEOC) and manages the Emergency Communications Network (ECN). The DOE/NNSA CEOC provides the core functions of supporting department command, control, communications, Geographic Information System (GIS) data, and situational intelligence requirements for all categories of DOE emergency response situations at all times. The DOE/NNSA CEOC will broaden and strengthen all its hazards incident support effectiveness through training, exercises, improvements and efficiencies.

The ECN is the Department's high-reliability communication system that supports collecting, processing, and disseminating emergency related information from multiple internal and external sources. The ECN ensures DOE/NNSA decision-makers have a common operating picture for real time situation awareness during the management and support of operational emergencies, energy emergencies, and emergency assistance including national and international counterterrorism and COOP related events. The network supports classified and unclassified voice, video, and data transmissions. The system is expected to grow to over 110 nodes by end of FY 2020, a 16% increase over nodes installed at the end of FY 2017. .ECN provides support for the Legacy and COOP missions and the Response/Render Safe, Forensics, and Counterterrorism missions. The expansion has included the installation of nodes into other government agencies and other countries.

The Continuity of Operations Program (COOP), supports all aspects identified in: Presidential Policy Directive 40 (PPD-40), *National Continuity Policy;* Federal Continuity Directive (FCD) 1, Federal Executive Branch National Continuity Program Requirements; FCD 2 Federal Executive Branch Mission Essential National Continuity Program Requirements; and Office of Science and Technology Policy (OSTP)/OMB D-16-1, Minimum Requirements for Federal Executive Branch Continuity Communications Capabilities. The Emergency Operations subprogram supports training and exercises, equipment, maintenance and upgrades to classified facilities along with a Headquarters continuity facility and a devolution facility outside of the National Capital Region.

Emergency Operations

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Emergency Operations **$34,775,000**	**Emergency Operations** **$35,574,000**	**Emergency Operations** **+$799,000**
• Administer the Department's Comprehensive Emergency Management System. • Manage the Department's Continuity Programs. • Manage contract support and technical assistance support for implementing actions from DNFSB Recommendation 2014-01. • Provide for program's share of support to the Department's emergency operations. • Provide for required contract support, ensure adequate training, and support NEP exercises needed to support emergency operations at full capacity. • Manage the Department's CEOC and ECN.	• Administer the Department's Comprehensive Emergency Management System. • Manage the Department's Continuity Programs. • Provide for program's share of support to the Department's emergency operations. • Provide for required contract support, ensure adequate training, and support NEP exercises needed to support emergency operations at full capacity. • Manage the Department's CEOC and ECN.	• No significant change.

Nuclear Counterterrorism and Incident Response Program
Counterterrorism and Counterproliferation

Description
The Counterterrorism and Counterproliferation subprogram is focused on providing expertise, practical tools, and technically informed policy recommendations required to advance U.S. nuclear counterterrorism and counterproliferation objectives. Counterterrorism and Counterproliferation focuses on nuclear and radiological incidents and accidents, with the core mission to prepare for, respond to and successfully resolve such events.

The **Emergency Response/Nuclear Incident Response** subprogram serves as the last line of national defense in the face of a nuclear or radiological incident or accident. The mission is to apply the unique technical expertise within NNSA's nuclear security enterprise to prepare, prevent, mitigate, and respond to a nuclear or radiological incident domestically or abroad with responsive, flexible, efficient, and effective nuclear/radiological incident response capabilities. The strategic approach for incident response activities is to ensure a central point of contact and an integrated response to all emergencies involving radionuclides. This is accomplished by ensuring the appropriate infrastructure is in place to provide command, control, coordination, and communications of the NNSA nuclear incident response teams. It is also essential that response personnel are properly organized, trained, and equipped to rapidly deploy and successfully resolve an incident.

Nuclear Emergency Support Team (NEST)
This activity provides the FBI, DOD, and the Department of Homeland Security (DHS) with technical assistance to respond domestically or abroad to incidents, including terrorist threats, involving nuclear materials. The primary missions of the specialized assets Accident Response Group (ARG), Radiological Assistance Program (RAP), Nuclear/Radiological Advisory Team (NRAT) and Joint Technical Operations Team (JTOT) are to search for, identify, characterize, render safe, and take possession of any nuclear device and support efforts to recover nuclear material outside of regulatory control. These assets also provide preventive radiological and nuclear detection support to federal, state, and local public safety organizations for major public events.

Other Assets
Additional assets provide assistance to federal, state and local entities to respond to accidents and incidents involving the potential or actual release of nuclear or radiological materials and advise on actions to reduce radiation exposure. These DOE/NNSA teams work closely with other DOE elements as well as other federal organizations, including DHS, Federal Emergency Management Agency (FEMA), Environmental Protection Agency (EPA), Nuclear Regulatory Commission (NRC) and DOD and FBI. The DOE/NNSA teams conduct exercises and provide support to the NEST programs to ensure safe incident resolution and the protection of public safety and the environment.

Stabilization Operations
This activity provides technical assistance to the FBI to respond to nuclear threat devices by providing specialized technology and training for regional teams to locate and identify radiological/nuclear devices and to prevent these devices from detonating.

The **National Technical Nuclear Forensics (NTNF)** subprogram maintains the operational capability for the pre-detonation device technical nuclear forensics program and provides operational support to the post-detonation and Bulk Special Nuclear Materials (SNM) Analysis technical nuclear forensics programs. The NTNF subprogram is an HSC/NSC sponsored policy initiative, which aims to establish missions, institutionalize roles and responsibilities, and enable operational support for pre-detonation and post-detonation nuclear forensics and attribution programs. This support includes training and exercises, equipment procurement, maintenance, logistics, technical integration, readiness to deploy pre- and post-detonation response teams, and readiness to conduct bulk actinide laboratory analysis.

The **Counterterrorism Response and Capacity Building** subprogram mission is to strengthen preparedness for all radiological or nuclear incidents, accidents, and terror threats posing a potential risk to the United States territory, citizens, or its interests. To execute this mission, this sub-program works domestically with federal, state, and local officials to expand their capabilities to contribute to the National response to a radiological or nuclear terrorist threat or incident in the United States. As part of a robust strategy to protect America from potential radiological or nuclear threats, this program also cooperates with key international partners to strengthen their ability to effectively address radiological or nuclear incidents in their region—with or without U.S. involvement—as far from U.S. territory as possible.

The Counterterrorism Response and Capacity Building sub-program activities include technical exchanges, joint technical experiments, workshops, exercises, technical assistance and training with partners. These activities address the full range of potential radiological or nuclear threats. This sub-program annually assesses global security trends, risks, and requirements in order to plan, prioritize, and implement radiological/nuclear counterterrorism and incident response joint activities.

The **Nuclear Counterterrorism (NCT) Assessment** subprogram provides the nation's technical capability to understand and defeat nuclear threat devices (NTD) including, Improvised Nuclear Devices (INDs), and lost or stolen foreign nuclear weapons. NCT maintains and advances this technical capability through partnerships with the NNSA nuclear weapons design laboratories and production facilities and through technically-informed exchanges with the United Kingdom and France. Collectively, this work shapes our understanding of nuclear terrorism threats. This understanding is used to support policies and procedures to improve nuclear material protection, and the technical capabilities available for crisis operations. The NCT Assessment subprogram informs policies and procedures across multiple departments and agencies; and is coordinated within NNSA, and within the U.S. interagency process, to ensure maximum alignment with agreed-upon joint goals and ongoing programs.

This FY 2019 Budget Request sustains NNSA's laboratory capabilities (modeling/simulation, tools, expertise) for highly specialized nuclear threat science assessments, while incrementally improving predictive capabilities in support of crisis operations. NCT Assessment will support a requirement to perform technical assessments in support of the 2016 Design Basis Threat (DBT) that governs DOE's nuclear material security posture. Similar technical expertise will continue to support international nuclear security engagements. This budget Request also enables implementation of the technical work plans under the bilateral and trilateral classified channels that enable the sharing of best practices with foreign partners to reduce nuclear terrorism risks; and will provide funding to use current capabilities to develop innovative defeat technologies to address emerging nuclear threats.

The **AMS Recapitalization** subprogram will procure aviation platforms that meet the future needs of the AMS Program. In February 2016, a mission needs statement identified the current aging fleet of aircraft as a capability gap because 1) the current fleet has surpassed optimum economic and operational cost-effectiveness, based on OMB standards, 2) increased incidence of age-related unscheduled maintenance and reduced availability of parts is materially impacting readiness to respond, 3) recurring findings in Office of Aviation Management audits express age-related safety and human factors concerns with sustained operations with these aircraft, and 4) obsolete avionics will require complete and costly replacement by January 1, 2020 to remain compliant with FAA regulations.

An Analysis of Alternatives (AoA) conducted in 2016 evaluated a broad set of alternatives that could resolve the gap and meet program requirements for the aerial radiological measurement capability. Sensor technologies were not part of this AoA, as the existing sensor package meets all mission requirements. After screening and evaluation, the top rated alternatives were 1) a larger manned platform based on the Beechcraft King Air 350ER to meet the On-Call Response mission and 2) a replacement manned platform based on the Bell 412EPi to meet the Radiation Mapping mission. The NNSA Office of Cost Estimating and Program Evaluation (CEPE) assessed that the AoA met all of the GAO best practices; determined that it was well documented, comprehensive, unbiased, and credible; and affirmed the sufficiency of this AoA.

Counterterrorism and Counterproliferation

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Counterterrorism and Counterproliferation $237,106,000	**Counterterrorism and Counterproliferation $283,611,000**	**Counterterrorism and Counterproliferation +$46,505,000**
Emergency Response/Nuclear Incident Response $156,955,000	**Emergency Response/Nuclear Incident Response $162,570,000**	**Emergency Response/Nuclear Incident Response +$5,615,000**
Nuclear Emergency Support Team	***Nuclear Emergency Support Team***	***Nuclear Emergency Support Team***
• Provided technical assistance to federal, state, tribal, local, and international government agencies to deal with incidents, including terrorist threats that involve potential use of nuclear materials. • Provided technical assistance to a Lead Federal Agency to search for or detect illicit radiological or nuclear material. • Continued collection and expert analysis of radiological material signatures through DOE Radiological Triage Program. • Supported lead federal agencies to address threats posed by domestic and foreign terrorists likely to have both the will and means to employ nuclear devices and weapons-usable nuclear materials. • Sustained Render Safe capabilities for an identified critical mission area. This effort includes predictive capability. • Provided DOE/NNSA technical assistance for the planning, execution, and evaluation of national level exercises, including but not limited to: Marble Challenge, Nuclear Weapons Accident/Incident Exercises (NUWAIX), and other DOD-led exercises.	• Provide technical assistance to federal, state, tribal, local, and international government agencies to deal with incidents, including terrorist threats that involve potential use of nuclear materials. • Provide technical assistance to a Lead Federal Agency to search for or detect illicit radiological or nuclear material. • Continue collection and expert analysis of radiological material signatures through DOE Radiological Triage Program. • Support lead federal agencies to address threats posed by domestic and foreign terrorists likely to have both the will and means to employ nuclear devices and weapons-usable nuclear materials. • Sustain Render Safe capabilities for an identified critical mission area. This effort includes predictive capability. • Provide DOE/NNSA technical assistance for the planning, execution, and evaluation of national level exercises, including but not limited to: Marble Challenge, NUWAIX, and other DOD-led exercises in which DOE/NNSA is not the lead.	• The request increases funding for highly secure communications capabilities and associated personnel required to support response to a potential weapon of mass destruction (WMD) device. The mobile communications platform is already employed by DOE mission partners at DOD and FBI, and will allow seamless communications between the operational team at an incident site, scientific technical reachback advice at the National Laboratories, law enforcement, and the Intelligence Community. • The request increases funding for procurement of mission critical equipment that has exceeded its useful life. In order to continue to provide best available technology to response teams in the field and home teams, NNSA plans to address its extensive list of high-to-medium priority equipment recapitalization needs including: high resolution spectroscopic identification systems; radiography equipment; and the next generation neutron multiplicity detector.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Other Assets	***Other Assets***	***Other Assets***
• Maintained training for the Consequence Management response teams and home teams. • Sustained data communications systems for communications between the field teams and home teams. • Facilitated radiological response and recovery efforts in the event of the intentional or accidental release of radiological or nuclear material. • Informed public health officials on evacuation guidance and health effects from the accidental or intentional release of radiological materials. • Worked jointly with the federal coordinating agency, which is usually DHS/FEMA, during any radiological accident or incident. • Coordinated with the EPA/NRC and other elements within DOE, and provide support to the NEST programs to safeguard the public and environment to ensure the successful resolution of an accident or incident. • Continued recapitalization efforts for critical incident response equipment that is beyond its planned life cycle.	• Implement advanced training for consequence management response teams and home teams based on requirements of updated mission analyses that reflect lessons from responses and exercises. Sustain data communications systems for communications between the field teams and home teams. • Provide continued decision support tools to radiological response efforts, in the event of the intentional or accidental release of radiological or nuclear material, as well as, informing recovery planning efforts. • Improve clarity of guidance provided to public health officials on evacuation recommendations and health effects from the accidental or intentional release of radiological materials based on the latest science. • Work jointly with the federal coordinating agency, which is usually DHS/FEMA, during any radiological accident or incident. • Coordinate with the EPA/NRC and other elements within DOE, to provide support to safeguard the public and environment and mitigate the effects of a nuclear or radiological accident or incident. • Continue recapitalization efforts for critical incident response equipment that is beyond its planned life cycle.	• The Request increases funding for procurement of mission critical equipment that has exceeded its useful life. In order to continue to provide best available technology to field response teams and home teams, NNSA plans to address its extensive list of medium-to-high priority equipment recapitalization needs, including Consequence Management survey equipment.

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
National Technical Nuclear Forensics $11,400,000	**National Technical Nuclear Forensics $15,181,000**	**National Technical Nuclear Forensics +$3,781,000**
• Provided technical and operational capabilities in support of the U.S. Government interagency NTNF program. • Maintained readiness to respond to pre- and post- detonation nuclear events. • Participated in two Ground Collection Task Force field exercises and one training event. • Fully supported two Post-Detonation device reconstruction training and exercises. • Conducted two Disposition & Forensic Evidence Analysis Team (DFEAT) exercises. • Continued preventative and corrective facility maintenance at P-Tunnel, NNSS for support to the Pre-Detonation Device Program. Continue to address broader infrastructure improvements at the NNSS. • Continued LANL PF4/TA-55 plans and procedure development in support of Pre-Detonation Device Program requirements. • Maintained an objective operational capability for Bulk SNM Analysis Program (BSAP). • Led U.S. support in the US/UK Joint Working Group (JOWOG) 29 Nuclear Forensics User Group.	• Provide technical and operational capabilities in support of the U.S. Government interagency NTNF program. Improving efficiencies and oversight by consolidating all NCTIR forensics activities. • Maintain readiness to respond to pre- and post-detonation nuclear events. • Participate in two Ground Collection Task Force field exercises and one training event. • Fully support two Post-Detonation device reconstruction training and exercises. • Conduct two DFEAT exercises. • Continue preventative and corrective facility maintenance at P-Tunnel, NNSS for support to the Pre-Detonation Device Program. Continue to address broader infrastructure improvements at the NNSS. • Continue LANL PF4/TA-55 plans and procedure development in support of Pre-Detonation Device Program requirements. • Enhance operational capability for BSAP and begin planning for the National Nuclear Materials Archives. • Lead U.S. support in the US/UK JOWOG 29 Nuclear Forensics User Group.	• Funding increase reflects an internal realignment consolidating all nuclear forensics activities across NCTIR. This funding will enhance the post-detonation device assessment capability by improving readiness developing plans and procedures, and executing drills and training. • Funding also supports enhancement of the Bulk SNM Analysis capability and initial planning efforts for the National Nuclear Materials Archives. • Provides additional funding for training new personnel on deployable teams.

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Stabilization Operations	***Stabilization Operations***	***Stabilization Operations***
• Sustained capability for existing stabilization cities including training and equipment maintenance. • Deployed to one additional city and upgraded specialized technical equipment, as needed in existing cities, according to the joint DOE-FBI plan.	• Sustain capability for existing stabilization cities including training and equipment maintenance. • Deploy to additional cities and upgrade infrastructure and specialized technical equipment, as needed, according to the joint DOE-FBI plan.	• Deploy capability to additional cities and upgrade specialized technical equipment, as needed, according to the joint DOE-FBI plan. • Sustainment of capabilities (training, and equipment maintenance and upgrades) continues to increase as the number of cities increases.

Counterterrorism Response and Capacity Building

Activities and Explanation of Changes

<table>
<tr><th>FY 2017 Enacted</th><th>FY 2019 Request</th><th>Explanation of Changes
FY 2019 Request vs FY 2017 Enacted</th></tr>
<tr><td>Counterterrorism Response and Capacity Building $7,500,000</td><td>Counterterrorism Response and Capacity Building $8,210,000</td><td>Counterterrorism Response and Capacity Building +$710,000</td></tr>
<tr><td>• Executed planned base program activities including strategic partnerships; improving international partners’ incident preparedness and response capabilities; highest priority multilateral engagements; equipment loans; exercises; and technical exchanges including:
○ Eight Silent Thunder domestic WMD counterterrorism tabletop exercises;
○ Four Eminent Discovery international radiological/nuclear terrorism interdiction response tabletop exercises;
○ Four bilateral incident preparedness and response workshops;
○ One Technical Exchange Forum with domestic and international responders, to identify emerging global requirements;
○ One joint technical experiment with a key foreign partner; and
○ Four joint IAEA workshops on incident and nuclear security preparedness and response.</td><td>• Design and conduct seven Silent Thunder domestic WMD counterterrorism tabletop exercises with additional seminars.
• Design and conduct seven Eminent Discovery international radiological/nuclear terrorism interdiction response tabletop exercises.
• Conduct four international incident preparedness and response technical exchange workshops
• Conduct four joint IAEA training courses on incident and nuclear security preparedness and response.
• Support international policy development and execution with IAEA to strengthen global harmonization and coordination on nuclear and radiological incident preparedness and response.</td><td>• No major changes.</td></tr>
</table>

Nuclear Counterterrorism Assessment

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Nuclear Counterterrorism Assessment $61,251,000	**Nuclear Counterterrorism Assessment $65,150,000**	**Nuclear Counterterrorism Assessment +3,899,000**
• Complete major experimental work in support of the initial three-year standoff disablement assessment campaign. • Perform high-precision threat device modeling and experiments. • Continue a series of major experiments in support of the Tier Threat Modeling Archive Validation project. • Conduct technical assessments in support of USG nuclear material security efforts.	• Perform high-precision threat device modeling and experiments. • Continue Tier Threat Modeling Archive Validation project. • Conduct technical assessment in support of USG nuclear material security efforts.	• Increase will allow for the use of current capabilities to develop innovative defeat technologies to address emerging nuclear threats.
AMS Recapitalization $0	**AMS Recapitalization $32,500,000**	**AMS Recapitalization +$32,500,000**
• None.	• Commence targeted recapitalization efforts for the three Aerial Measuring Systems (AMS) aircraft that are near the end of their effective life cycle in accordance with completed Analysis of Alternatives.	• Increase reflects procurement of three fixed-wing aircraft.

Nuclear Counterterrorism and Incident Response Program
Performance Measures

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Incident Response Readiness Index (IRRI) - Annual overall organizational readiness to respond to and mitigate radiological or nuclear incidents worldwide.							
Target	91 IRRI	91 IRRI	91 IRRI	91 IRRI	91 IRRI	91 IRRI	91 IRRI
Result	**Not Met** - 89						
Endpoint Target	Annually, maintain a Readiness Index of 91 or higher.						
WMD Counterterrorism Expertise - Cumulative number of officials trained in Weapons of Mass Destruction (WMD) Counterterrorism (CT) prevention and response via Office of Counterterrorism Policy and Cooperation exercises.							
Target	12,500 trained personnel	13,300 trained personnel	N/A	N/A	N/A	N/A	N/A
Result	**Exceeded** - 12,982						
Endpoint Target	By the end of FY 2020, train 14,800 officials in WMD CT prevention and response. FY 2019 Note: This Performance Measure is being replaced by the WMD Counterterrorism Expertise Performance Measure.						
WMD Counterterrorism Expertise - Percentage of responding Silent Thunder participants who report a solid understanding of the response requirements for a radiological incident at the completion of the exercise.							
Target	N/A	N/A	70%	70%	70%	70%	70%
Result	N/A						
Endpoint Target	Annually maintain a percentage of 70% across all participants reporting a solid understanding at the *strongly agree* or *agree* level at the completion of the exercise on required survey.						
Tier Threat Modeling Archive - Validation (TTMA-V) - Percent complete toward validating national 3-D predictive modeling capability using four different experimental series designed to produce data needed to reconstruct nuclear threat device emergency disablement scenarios.							
Target	50% Complete	65% Complete	75% Complete	85% Complete	100% Complete	N/A	N/A
Result	**Met** – 50%						
Endpoint Target	By the end of FY 2020, complete the validation of the national 3-D predictive modeling capability using four different experimental series designed to produce data needed to reconstruct nuclear threat device emergency disablement scenarios.						

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023

Emergency Operations Compliance Rate (EOCR) - Emergency Operations Compliance Rate (EOCR) measures the annual percentage of Defense Nuclear Facility (DNF) sites in full compliance with DOE Order 151.1D.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Target	75%	80%	NA	NA	NA	NA	NA
Result	**Met** – 75%						

Endpoint Target: Maintain an annual rate of 95% of DNF sites in full compliance with DOE O 151.1D.

Note: The FY 2018 target reported for EOCR in the FY 2018 Budget Request as well as the "Fiscal Year (FY) 2016 DOE Annual Performance Report / FY 2018 Annual Performance Plan" was an error. The FY 2018 Request level target should have been reported as 80%, with 95% compliance rate to be achieved by FY 2021 and sustained thereafter. However since implementing this measure, DOE/NNSA considers the new Response Support Coordination Team Readiness measure beginning in FY 2019 to be more appropriate to the Continuity of Operations mission clearly showing DOE's response capability to all-hazards emergencies, incidents, and events. The EOCR measure will be discontinued after FY 2018 and replaced with the Response Support Coordination Team Readiness measure through FY 2023.

Response Support Coordination Team Readiness - Measures the readiness of three fully staffed and trained emergency operations response support coordination teams.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
Target	N/A	N/A	1 team	2 teams	3 teams	3 teams	
Result	N/A						

Endpoint Target: Three support coordination teams that are trained and prepared for immediate activation in support of DOE/NNSA complex wide/cascading emergencies, incidents, and events by FY 2022.

Nuclear Counterterrorism and Incident Response Program
Capital Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2017 Current	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted	Outyears to Completion
Capital Operating Expenses Summary (including Major Items of Equipment (MIE))								
Capital Equipment >$500K (including MIE)	N/A	0	1,548	1,548	1,582	1,617	+69	N/A
Plant Projects (GPP and IGPP)	N/A	0	0	0	0	0	0	N/A
Total, Capital Operating Expenses	**N/A**	**0**	**1,548**	**1,548**	**1,582**	**1,617**	**+69**	N/A
Capital Equipment > $500K (including MIE)								
Total Non-MIE Capital Equipment	N/A	0	1,548	1,548	1,582	1,617	+69	N/A
Total, Capital Equipment (including MIE)	N/A	**0**	**1,548**	**1,548**	**1,582**	**1,617**	**+69**	**0**
Plant Projects (GPP and IGPP)								
Total Plant Projects (GPP/IGPP)	N/A	0	0	0	0	0	0	0
Total, Plant Projects (GPP/IGPP)	**N/A**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Total, Capital Summary	**N/A**	**0**	**1,548**	**1,548**	**1,582**	**1,617**	**+69**	**0**

Outyears for Nuclear Counterterrorism and Incident Response Program

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Capital Operating Expenses Summary (including MIE)				
Capital Equipment >$500K (including MIE)	1,653	1,689	1,726	1,764
Plant Projects (GPP)	0	0	0	0
Total, Capital Operating Expenses	**1,653**	**1,689**	**1,726**	**1,764**

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Naval Reactors

Naval Reactors

Naval Reactors
Proposed Appropriation Language

For Department of Energy expenses necessary for Naval Reactors' activities to carry out the Department of Energy Organization Act (42 U.S.C. 7101 et seq.), including the acquisition (by purchase, condemnation, construction, or otherwise) of real property, plant, and capital equipment, facilities, and facility expansion, $1,788,618,000 to remain available until expended: Provided, that $48,709,000 shall be available until September 30, 2020 for program direction.

Note: A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for FY 2018 reflect the annualized level provided by the Continuing Resolution.

Explanation of Changes

Change from the language proposed in FY 2018 consists of a change to the requested funding amount and time availability of program direction funding.

Public Law Authorizations

- P.L. 83-703, "Atomic Energy Act of 1954"
- Executive Order 12344 (42 U.S.C. 7158), "Naval Nuclear Propulsion Program"
- P.L. 106-65, National Nuclear Security Administration Act, as amended
- P.L. 115-31, Consolidated Appropriations Act, 2017
- Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended)
- P.L. 115-91, National Defense Authorization Act for Fiscal Year 2018

Naval Reactors

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Naval Reactors[a]	1,420,120	1,410,476	1,788,618	+368,498
Rescission of Prior Year Balances	-328	-21	0	+328
Total, Naval Reactors	**1,419,792**	**1,410,455**	**1,788,618**	**+368,826**

Overview

The Naval Reactors (NR) appropriation includes funding for activities that respond directly to the National Security Strategy of the United States, and are central to the Department of Energy's pursuit of its Strategic Plan goal of Nuclear Security, playing a critical role in meeting DOE's Strategic Objective 7 to provide safe and effective integrated nuclear propulsion systems for the U.S. Navy. Specifically, NR is responsible for U.S. Navy nuclear propulsion work, beginning with reactor plant technology development and design, continuing through reactor plant operation and maintenance, and ending with final disposition of naval spent nuclear fuel. The program ensures the safe and reliable operation of reactor plants in nuclear-powered submarines and aircraft carriers (constituting over 45 percent of the Navy's major combatants) and fulfills the Navy's requirements for new nuclear propulsion plants that meet current and future national defense requirements.

Naval Reactors' mission includes ensuring the safety of reactors and associated naval nuclear propulsion plants, and control of radiation and radioactivity associated with naval nuclear propulsion activities, including prescribing and enforcing standards and regulations for these areas, as they affect the environment and the safety and health of workers, operators, and the general public. Naval Reactors maintains oversight in areas such as security, nuclear safeguards and transportation, radiological controls, public information, procurement, logistics, and fiscal management.

As part of the National Nuclear Security Administration (NNSA), Naval Reactors is working to provide the U.S. Navy with nuclear propulsion plants that are capable of responding to the challenges of the 21st century security environment.

Highlights and Major Changes in the FY 2019 Budget Request

Naval Reactors' request of $1,788,618,000 in FY 2019 is for continued achievement of its core objective of ensuring the safe and reliable operation of the Nation's nuclear fleet.

Major Outyear Priorities and Assumptions

The outyear funding (FY 2020 through FY 2023) for Naval Reactors is $6,932,861,000. Outyear funding supports Naval Reactors' core mission of providing proper maintenance and safety oversight, and addressing emergent operational issues and technology obsolescence for 101 operating reactor plants. This includes 70 submarines, 11 aircraft carriers, and 4 research, development, and training platforms (including the land-based prototypes). Outyear funding also supports Naval Reactors' continued achievement of ongoing new plant design projects, as well as continued achievement of its legacy responsibilities, such as ensuring proper management of naval spent nuclear fuel, prudent recapitalization of aging facilities, and cleanup of environmental liabilities.

Department of Energy (DOE) Working Capital Fund (WCF) Support

The Naval Reactors appropriation projected contribution to the DOE WCF for FY 2019 is $3,930,000. This funding covers certain shared enterprise activities including managing enterprise-wide systems and data, telecommunications, and supporting the integrated acquisition environment.

Contractor Pensions

In FY 2019, for the Bettis and Knolls Laboratories, Naval Reactors' planned DOE-funded qualified contractor pension contribution is $39,500,000 and non-qualified contractor pension contribution is $1,124,796.

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[a] Funding does not reflect the transfer to the Office of Nuclear Energy for maintenance and operation of the Advanced Test Reactor.

Rickover Fellowship Program

Naval Reactors manages the fellowship to attract and develop technical leaders in the areas of reactor technology and design as it pertains to naval nuclear propulsion. NR anticipates spending $1,018,417 in FY 2019 to support this program.

Naval Reactors
Funding by Congressional Control

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
	(Dollars in Thousands)			
Naval Reactors				
Naval Reactors Operations and Infrastructure	449,682	446,628	525,764	+76,082
Naval Reactors Development	440,338	437,348	514,951	+74,613
S8G Prototype Refueling	124,000	123,158	250,000	+126,000
Columbia-Class Replacement Reactor Systems Development	213,700	212,249	138,000	-75,700
Program Direction	44,100	43,801	48,709	+4,609
Construction	148,300	147,292	311,194	+162,894
Subtotal, Naval Reactors[a]	**1,420,120**	**1,410,476**	**1,788,618**	**+368,498**
Rescission of Prior Year Balances	-328	-21	0	+328
Total, Naval Reactors	**1,419,792**	**1,410,455**	**1,788,618**	**+368,826**

Outyears for Naval Reactors Funding

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
	(Dollars in Thousands)			
Naval Reactors				
Naval Reactors Operations and Infrastructure	550,706	597,181	698,876	737,821
Naval Reactors Development	534,591	605,142	665,708	766,816
S8G Prototype Refueling	215,000	50,000	0	0
Columbia-Class Replacement Reactor Systems Development	75,500	64,700	55,000	53,900
Program Direction	50,500	51,700	52,800	53,900
Construction	364,600	315,100	238,720	134,600
Total, Naval Reactors	**1,790,897**	**1,683,823**	**1,711,104**	**1,747,037**

[a] Funding does not reflect the transfer to the Office of Nuclear Energy for maintenance and operation of the Advanced Test Reactor.

Naval Reactors Funding

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Naval Reactors				
Naval Reactors Operations and Infrastructure				
Research Reactor Facility Operations & Maintenance	149,390	148,375	107,531	-41,859
MARF Defueling and Layup	0	0	4,982	+4,982
Laboratory Facility Regulation, Compliance, & Protection	92,905	92,274	135,260	+42,355
Nuclear Spent Fuel Management	130,215	129,331	127,495	-2,720
Radiological/Environmental Remediation & Demolition	51,260	50,912	94,540	+43,280
Capital Equipment	2,600	2,582	2,000	-600
General Plant Projects	23,312	23,154	53,956	+30,644
Total, Naval Reactors Operations and Infrastructure	**449,682**	**446,628**	**525,764**	**+76,082**
Naval Reactors Development				
Ship Construction & Maintenance Support	39,361	39,094	40,337	+976
Nuclear Reactor Technology	128,822	127,947	166,367	+37,545
Reactor Systems & Component Technology	186,355	185,089	209,025	+22,670
Advanced Test Reactor Operations	75,100	74,590	83,722	+8,622
Capital Equipment	10,700	10,627	15,500	+4,800
Total, Naval Reactors Development	**440,338**	**437,348**	**514,951**	**+74,613**
S8G Prototype Refueling	123,820	122,368	250,000	+126,180
Capital Equipment (MIE)	180	790	0	-180
Total, S8G Protype Refueling	**124,000**	**123,158**	**250,000**	**+126,000**
Columbia-Class Reactor Systems Development	**213,700**	**212,249**	**138,000**	**-75,700**
Program Direction	**44,100**	**43,801**	**48,709**	**+4,609**
Construction	**148,300**	**147,292**	**311,194**	**+162,894**
Subtotal, Naval Reactors	**1,420,120**	**1,410,476**	**1,788,618**	**+368,498**
Rescission of Prior Year Balance	**-328**	**-21**	**0**	**+328**
Total, Naval Reactors	**1,419,792**	**1,410,455**	**1,788,618**	**+368,826**

Outyears for Naval Reactors

	(Dollars in Thousands)			
	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Naval Reactors				
Naval Reactors Operations and Infrastructure				
Research Reactor Facility Operations & Maintenance	125,210	124,554	128,668	120,640
MARF Defueling and Layup	6,975	14,998	55,993	86,054
Laboratory Facility Regulation, Compliance, & Protection	135,277	147,484	145,258	154,296
Nuclear Spent Fuel Management	139,356	148,261	172,438	188,833
Radiological/Environmental Remediation & Demolition	106,108	116,959	127,859	143,638
Capital Equipment	2,000	2,000	0	0
General Plant Projects	35,780	42,925	68,660	44,360
Total, Naval Reactors Operations and Infrastructure	**550,706**	**597,181**	**698,876**	**737,821**
Naval Reactors Development				
Ship Construction & Maintenance Support	46,437	53,513	55,140	61,024
Nuclear Reactor Technology	166,786	199,201	237,966	270,757
Reactor Systems & Component Technology	211,988	249,753	274,394	333,445
Advanced Test Reactor Operations	85,480	87,275	89,108	90,890
Capital Equipment	23,900	15,400	9,100	10,700
Total, Naval Reactors Development	**534,591**	**605,142**	**665,708**	**766,816**
S8G Prototype Refueling	**215,000**	**50,000**	**0**	**0**
Columbia-Class Reactor Systems Development	**75,500**	**64,700**	**55,000**	**53,900**
Program Direction	**50,500**	**51,700**	**52,800**	**53,900**
Construction	**364,600**	**315,100**	**238,720**	**134,600**
Total, Naval Reactors	**1,790,897**	**1,683,823**	**1,711,104**	**1,747,037**

Naval Reactors
Explanation of Major Changes
(Dollars in Thousands)

	FY 2019 Request vs FY 2017 Enacted
Naval Reactors	
Naval Reactors Operations and Infrastructure: This increase (+17%) supports general plant projects, regulatory and environmental compliance requirements, and increased decontamination and demolition efforts.	+76,082
Naval Reactors Development: This increase (+17%) supports unique technologies that are critical to delivering improvements in reactor performance and reliability and provide continuous support to U.S. Navy fleet operations.	+74,613
S8G Prototype Refueling: This increase (+102%) is consistent with the project's planned funding profile and supports refueling overhaul execution.	+126,000
***Columbia*-Class Reactor Systems Development:** This decrease (-35%) is consistent with the project's planned funding profile and supports FY 2019 procurement.	-75,700
Program Direction: This funding increase (+10%) includes general inflationary increases for personnel and pay related costs and travel requirements.	+4,609
Construction: This increase (110%) matches NR's program of record as detailed in the Ten-Year Facilities Plan and supports construction ramp-up for the Spent Fuel Handling Recapitalization Project.	+162,894
Total, Naval Reactors	**+368,498**

Naval Reactors
Naval Reactors Operations and Infrastructure

Description
The Naval Reactors Operations and Infrastructure resources ensure Naval Reactors maintains an integrated and effective enterprise across program sites located in Pennsylvania, New York, and Idaho, to provide safe and environmentally conscious operation of the nuclear fleet. The Naval Reactors Operations and Infrastructure program includes work efforts associated with the operation of two land-based nuclear prototypes at the Kesselring Site located in West Milton, NY; two dedicated, government-owned, contractor-operated laboratory facilities, Knolls and Bettis located in Schenectady, NY and West Mifflin, PA, respectively; and naval spent nuclear fuel handling facilities and operations at the Naval Reactors Facility at the Idaho National Laboratory in Idaho. These resources fund work that ensures unique Naval Reactors' infrastructure and advanced naval nuclear capabilities are maintained well into the future. These efforts include:

1. Operation and maintenance of the DOE land-based prototypes supporting technology development and nuclear operator training.

2. Planning and preparations to defuel the Modifications and Additions to Reactor Facilities (MARF) prototype and perform the necessary work to leave the plant in a benign condition for eventual disassembly.

3. Activities to ensure Naval Reactors program operations meet or exceed applicable federal, state, and local standards and requirements.

4. Disposition of naval spent nuclear fuel from the inactivation and refueling of ships.

5. Remediation, dismantlement, and disposal of inactive Naval Reactors program systems, facilities, and areas.

6. Design and procurement of capital equipment.

7. Design and construction of facilities and infrastructure to provide for capacity, security, safety, environmental, and obsolescence needs.

Research Reactor Facility Operations & Maintenance
The mission of this subprogram is to support the two land-based operating prototypes located at the Kesselring Site in New York through the following work efforts: (1) Test and examine reactor materials, components, systems, and new design applications under actual operating conditions. (2) Provide a ship-like operating platform to train nuclear operators. (3) Support improved design activities for the operating prototypes and perform systematic preventive maintenance, corrective maintenance, upgrades, and modifications on the prototypes and their support equipment. (4) Evaluate problems using engineering tests and other troubleshooting techniques. (5) Procure and maintain adequate spare parts, material, specialized tools and instrumentation for troubleshooting and prototype testing.

MARF Defueling and Layup
The mission of this subprogram is to support development of design documents, planning, and preparations necessary to defuel and layup the MARF prototype, in order to place the plant in a safe and benign condition, for eventual dismantlement and off-site disposal. This is accomplished through the following work efforts: (1) Advance planning including long lead material ordering and facilities preparations. (2) Work integration and scheduling. (3) Preparation and placement of contracts and management of subcontracted work. (4) Procurement of required services and shipment of required equipment and materials.

Laboratory Facility Regulation, Compliance & Protection
The mission of this subprogram is to ensure that Naval Reactors operations and design activities meet or exceed applicable federal, state, and local standards and requirements, such as Radiological Controls, Environmental, Safety and Health, Quality Assurance, and Nuclear Materials Management. This is accomplished by performing the following work efforts:

(1) Personnel training, instruction, supervision, independent oversight, and formal auditing. (2) Extensive personnel and environmental sampling and monitoring programs to ensure operations have no discernible impact on human health or the environment. (3) Prepare and issue numerous reports required by federal, state, and local regulations and requirements. (4) Review of new and existing nuclear plant design and the related procurement of nuclear fuel and new project equipment.

Nuclear Spent Fuel Management
The mission of this subprogram is to fulfill Naval Reactors' cradle-to-grave responsibility for aspects of naval nuclear propulsion by properly managing naval spent nuclear fuel (NSNF). Specifically, resources in this subprogram support the following work efforts: (1) safely receive, handle, prepare, package and temporarily store NSNF coming from the nuclear powered fleet, prototypes and the Advanced Test Reactor. This includes fuel handling operations at Department of Energy facilities; mechanically processing NSNF at the Naval Reactors Facility (NRF) in the State of Idaho; packaging the NSNF for dry storage in a geologic repository or interim storage facility, and disposing of the radiological waste by-products produced by these processes. (2) Support nuclear powered warship deployments by managing Naval Reactors NSNF shipping container capacity for aircraft carrier and submarine refueling overhauls and defueling inactivation operations. (3) Conduct destructive and non-destructive examinations of expended naval cores and irradiated test specimens from the Advanced Test Reactor located at the Idaho National Laboratory. (4) Manage the construction of projects that directly support improvements to the NSNF receiving, processing, packaging, and disposal efforts, reducing radiological risks at the NRF.

Radiological/Environmental Remediation & Demolition
The mission of this subprogram is to remediate, dismantle, and dispose of inactive Naval Reactors systems, facilities, and areas that once supported research and development, design, testing, training, and prototype operations. The current environment liability for Naval Reactors sites is estimated to total $7,810,000,000. Requirements are prioritized based on a criteria model that ensures currently available funding is provided to projects most critical to Naval Reactors with emphasis on balancing factors such as risk reduction and inactive facility lifecycle costs. Naval Reactors' radiological workforce is a highly trained group, capable of responding in the event of a radiological accident, as well as supporting routine radiological operations.

Capital Equipment
The mission of this subprogram is to provide the critical technical tools and equipment to ensure that Naval Reactors can achieve its mission. Capital equipment is defined as non-construction related equipment, computer systems, tooling, and furniture or fixtures having a useful life of two or more years and costing greater than $500,000. The tools and equipment are required to support the other work efforts within the sub-categories of Naval Reactors Operations and Infrastructure (e.g. operator training and facilities maintenance).

General Plant Projects
The mission of this subprogram is to execute minor new construction projects of a general nature, the Total Estimated Cost of which may not exceed the established minor construction threshold. General Plant Projects are necessary to adapt facilities to new or improved production techniques, to effect economies of operations, and to reduce or eliminate health, fire, and security vulnerabilities. These projects provide for design and construction, additions, and improvements to land, buildings, and utility systems, and they may include construction of small new buildings, additions to roads, and general area improvements. Funding is derived from established site construction plans and may be used for emergent and unforeseen infrastructure needs.

Naval Reactors
Naval Reactors Development

Description

The Naval Reactors Development resources fund work that ensures the current and future fleet is the most advanced, well-maintained, and capable nuclear fleet in the world. This funding supports unique technologies used only in naval reactors that are crucial to delivering superior navy fleet operations. These efforts include:

1. Supporting the fleet and ensuring safe reactor operations by engineering solutions to emergent reactor issues, supporting equipment replacement and maintenance, and tracking reactor performance over time.

2. Developing and enhancing the fundamental methods, modeling, and materials used in reactor cores and plants, which lowers operating costs and improves performance.

3. Designing and maintaining the major reactor plant components and plant systems required for naval nuclear propulsion.

4. Operation of the Advanced Test Reactor (performed by DOE Office of Nuclear Energy) and performance of irradiation testing for ongoing evaluation of new material applications and core designs.

5. Design and procurement of capital equipment.

Ship Construction & Maintenance Support

The mission of this subcategory is to support both the operation and new construction of the nuclear powered fleet. Operating reactors require continuous mechanical, thermal, hydraulic, materials, and chemistry analyses to fully evaluate the impact of existing design features, core materials, and system modifications on reactor performance and to ensure safe operation throughout the life of the core. Maintenance of the reactor plants involves designing equipment and systems to handle new fuel, highly radioactive spent fuel, and components safely.

Nuclear Reactor Technology

The mission of this subcategory is to develop and apply core material systems that will improve nuclear safety, stealth capability, tactical ability, and reactor plant performance; to support the qualification of the manufacture of those systems at the core vendor; and to deploy these systems in Prototype reactors. The materials testing covered under Nuclear Reactor Technology forms the bedrock of naval nuclear propulsion, providing Naval Reactors with the research and development capacity to fully understand and respond to issues in the operating fleet at the elemental level and enabling Naval Reactors to remain at the forefront of nuclear reactor operations. This subcategory supports the Rickover Fellowship program as well as fuel and poison development efforts, including the examination of expended fuel modules and irradiated core components at the ECF located at the Naval Reactors Facility, which is part of the Idaho National Laboratory (INL).

Reactor Systems & Component Technology

The mission of this subcategory is to provide Naval Reactors with the technology for major reactor plant components (e.g., steam generators) as well as plant systems (e.g., instrumentation and control). This subcategory provides the support and expertise necessary to ensure the satisfactory operation of steam generators in the naval nuclear fleet and prototypes and for design and implementation of the *Virginia*-Class and *Ford*-Class steam generators as well as the heat exchanger applications for the *Columbia*-Class. The major objective of instrumentation and control component and system development is to deliver the next generation of instrumentation, control, and electrical equipment for naval nuclear applications.

Advanced Test Reactor Operations

The mission of this subprogram is to test and qualify reactor materials and fuels to be incorporated into nuclear fleet applications. Funding in this subprogram provides for operation, engineering, maintenance and other support activities associated with the Advanced Test Reactor (ATR) at the Idaho National Laboratory (INL). While ATR is a facility owned by the Office of Nuclear Energy and operated by their contractor, Naval Reactors funds a portion of the cost of base operations, as well as Naval Reactors-specific testing.

Capital Equipment

The mission of this subprogram is to provide the critical technical tools and equipment to ensure that Naval Reactors can achieve its mission. Capital equipment is defined as non-construction related equipment, computer systems, tooling, and furniture or fixtures having a useful life of two or more years and costing greater than $500,000. The tools and equipment are required to support other work efforts within the subcategories of Naval Reactors Development (e.g., designing and testing of reactor plant systems, and development of new technologies).

Naval Reactors
S8G Prototype Refueling

Description
The land-based prototype located at the Kesselring Site in West Milton, New York serves as a critical operating reactor to demonstrate technology advancements for fleet application. The land-based prototype requires a refueling overhaul, beginning in FY 2018. Originally built as a prototype for the *Ohio*-Class submarine propulsion plant, this testing platform has been integral to the development of technologies used for the *Virginia*-Class and *Seawolf*-Class, which have resulted in improved performance and reliability while reducing lifecycle costs. Continued operation of this land-based prototype and development of advanced core technology will enable extended core lifetimes, more efficient use of nuclear fuel, greater compactness, and cross-platform adaptability. By constructing the replacement Technology Demonstration Core (TDC) for the prototype with technologies planned for the *Columbia*-Class, technical, cost, and schedule risks to the ship construction program will be mitigated. The manufacturing development, technology demonstration, and new core technologies development began in FY 2010.

Overhaul of reactor and steam plant systems will be performed in conjunction with the land-based prototype refueling overhaul. System overhaul includes the required preventative and corrective maintenance to support subsequent plant operations. In addition, establishing critical site infrastructure to support the Land-based Prototype Refueling Overhaul is required to enable safe and efficient execution of the overhaul.

The land-based prototype reactor plant provides a cost-effective test and evaluation platform, for new technologies, materials, and components before they are introduced to the fleet, and a vital training platform for reactor plant operators. To preserve this critical research and development asset for the long-term and to achieve a life-of-ship core for the *Columbia*-Class, the refueling overhaul execution effort must begin in FY 2019 in order to complete in FY 2021 to support operator training and proof-of-concept for the *Columbia*-Class core. Funding has been identified in the amount of $250,000,000 in FY 2019.

Naval Reactors
***Columbia*-Class Reactor Systems Development**

Description
Ohio-Class ballistic missile submarines (SSBNs) have been the backbone of the Nation's sea-based strategic deterrent since the early-1980s. Recapitalization of this strategic asset is required as *Ohio*-Class retires. With the *Columbia*-Class, the Navy plans to maintain our sea-based strategic deterrent force with a class of 12 ships, two fewer than today's *Ohio*-Class due in part to a life-of-ship-core. This new life-of-ship core will eliminate the need for mid-life reactor refuelings (mid-life refueling overhauls are an over three year evolution during which the ship is unavailable for service). By increasing the operational availability of the class, development of a new reactor plant for the *Columbia*-Class will permit 12 SSBNs to do the work of 14 *Ohio*-Class submarines– an estimated operational and sustainment savings of over $40 billion over the life of the class.

Research, development, and design for the *Columbia*-Class SSBN began in FY 2010. The new design will leverage *Virginia*-Class technology, as well as manufacturing development and demonstration efforts being performed as part of the Land-based Prototype Refueling Overhaul program. NR must design a new reactor plant to meet the Navy's required capabilities, maximize operational availability, and reduce acquisition and lifecycle costs. The DOE reactor plant design and development work for the *Columbia*-Class will continue in FY 2019 and beyond to mature the design for initial fabrication and procurement of long-lead nuclear components.

Work to support the *Columbia*-Class SSBN is tightly synchronized with Navy-funded propulsion plant work. The DOE-funded design work includes reactor plant component design and development, core design analysis and manufacturing development, reactor plant instrumentation and control design and development, reactor plant configuration, reactor systems development and integration, and reactor performance, analysis, and validation. The FY 2019 design, development, and testing work is essential to progress propulsion component design in support of this year's long lead component contract placement and to continue work in support of testing and safety analysis. Funding has been identified in the amount of $138,000,000 for this effort in FY 2019.

Naval Reactors
Performance Measures

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023
S1B Reactor Plant Design – Cumulative percentage of work complete on the *Columbia*-Class submarine reactor plant design.							
Target	55% complete	65% complete	74% complete	80% complete	83% complete	86% complete	90% complete
Result	**Exceeded** - 57.8						
Endpoint Target	By the end of FY 2027, complete 100% of the *Columbia*-Class submarine reactor plant design (formerly known as the *Ohio*-Class Replacement).						

Naval Reactors
Program Direction

Description

Due to the essential nature of nuclear reactor work, Naval Reactors provides centrally controlled, technical management of program operations. Federal employees directly oversee and set policies and procedures for developing new reactor plants, operating existing reactor plants, facilities supporting these plants, contractors, and the Bettis and Knolls Atomic Power Laboratories. In addition, these employees interface with other DOE offices and local, state, and Federal regulatory agencies.

Naval Reactors' Federal employees are typically recruited from a community of highly trained military engineers who have completed a rigorous five-year on-the-job training program unique to Naval Reactors. This training program has groomed engineers with skill sets far beyond that of nuclear engineers found in the commercial and Federal sectors.

Travel funds are used to perform oversight activities of facilities located worldwide that require comprehensive audits and in-person visits to ensure compliance and safety. Additionally, Naval Reactors Representative positions at the field sites (to include locations in the United Kingdom, Japan, Hawaii, and the continental United States) rotate periodically due to retirements, attrition, and succession planning.

Other Related Expenses includes the maintenance of Naval Reactors' IT hardware, engineering software, working capital funding, and related licenses supporting mission-essential technical work. Additionally, these funds will support planned upgrades and maintenance of video teleconferencing equipment, security investigations of Federal personnel, and training requirements.

Highlights and Major Changes in the FY 2019 Budget Request

The Naval Reactors Program Direction budget reflects general inflationary increase for personnel and pay related costs. Despite recent and planned retirements that have resulted in a loss of NRs engineering experience, in FY 2019 NR will continue to reshape the workforce to manage knowledge transfer to ensure the accomplishment of the NR mission.

FY 2020-FY 2023 Key Milestones

NR plans to continue developing its highly technical workforce to ensure the NR mission is preserved well into the future.

Program Direction

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Naval Reactors				
Headquarters				
Salaries and Benefits	22,300	22,300	23,500	+1,200
Travel	200	185	1,000	+800
Other Related Expenses	2,000	1,849	3,200	+1,200
Total, Headquarters	**24,500**	**24,334**	**27,700**	**+3,200**
Naval Reactors Laboratory Field Office				
Salaries and Benefits	17,600	17,600	18,200	+600
Travel	800	744	937	+137
Other Related Expenses	1,200	1,123	1,872	+672
Total, Naval Reactors Laboratory Field Office	**19,600**	**19,467**	**21,009**	**+1,409**
Total Program Direction				
Salaries and Benefits	39,900	39,900	41,700	+1,800
Travel	1,000	929	1,937	+937
Other Related Expenses	3,200	2,972	5,072	+1,872
Total, Program Direction	**44,100**	**43,801**	**48,709**	**+4,609**
Federal FTEs	**246**	**246**	**246**	**0**

Funding

Outyears Program Direction for Naval Reactors
Funding

	(Dollars in Thousands)			
	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Naval Reactors				
Headquarters				
Salaries and Benefits	24,000	24,500	25,000	25,500
Travel	1,200	1,200	1,300	1,300
Other Related Expenses	3,600	3,700	3,800	3,800
Total, Headquarters	**28,800**	**29,400**	**30,100**	**30,600**
Naval Reactors Laboratory Field Office				
Salaries and Benefits	18,600	19,000	19,400	19,800
Travel	1,000	1,100	1,100	1,200
Other Related Expenses	2,100	2,200	2,200	2,300
Total, Naval Reactors Laboratory Field Office	**21,700**	**22,300**	**22,700**	**23,300**
Total Program Direction				
Salaries and Benefits	42,600	43,500	44,400	45,300
Travel	2,200	2,300	2,400	2,500
Other Related Expenses	5,700	5,900	6,000	6,100
Total, Program Direction	**50,500**	**51,700**	**52,800**	**53,900**
Federal FTEs	**246**	**246**	**246**	**246**

Program Direction
Other Related Expenses

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Other Related Expenses				
Transportation	400	360	800	+400
Communications, Utilities and Miscellaneous Charges	200	190	430	+230
Other Services from Federal Sources	450	402	682	+232
Advisory and Assistance Services	150	140	180	+30
Operation and Maintenance of Facilities	200	180	270	+70
Operations and Maintenance of Equipment	330	290	670	+340
Supplies and Materials	220	200	300	+80
Equipment	450	410	870	+420
Working Capital Fund	800	800	870	+70
Total, Other Related Expenses	**3,200**	**2,972**	**5,072**	**+1,872**

Outyears Other Related Expenses for Naval Reactors

(Dollars in Thousands)

	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Other Related Expenses				
Transportation	860	870	890	900
Communications, Utilities and Miscellaneous Charges	470	480	480	490
Other Services from Federal Sources	780	820	830	840
Advisory and Assistance Services	200	210	210	220
Operation and Maintenance of Facilities	290	300	300	310
Operations and Maintenance of Equipment	700	720	740	750
Supplies and Materials	330	360	370	380
Equipment	1,170	1,230	1,260	1,280
Working Capital Fund	900	910	920	930
Total, Other Related Expenses	**5,700**	**5,900**	**6,000**	**6,100**

Program Direction

Activities and Explanation of Changes

FY 2017 Enacted	FY 2019 Request	Explanation of Changes FY 2019 Request vs FY 2017 Enacted
Salaries and Benefits $39,900,000	**Salaries and Benefits $41,700,000**	**Salaries and Benefits +$1,800,000**
• Federal salaries and benefits for employees that directly oversee and set policies and procedures for developing new reactor plants, operating existing reactor plants, facilities supporting these plants, contractors, and the Bettis and Knolls Atomic Power Laboratories.	• Federal salaries and benefits for employees that directly oversee and set policies and procedures for developing new reactor plants, operating existing reactor plants, facilities supporting these plants, contractors, and the Bettis and Knolls Atomic Power Laboratories.	• Reflects a general inflationary increase for personnel and pay related costs as well as anticipated costs of benefits.
Travel $1,000,000	**Travel $1,937,000**	**Travel +$937,000**
• Perform oversight activities of facilities located worldwide that require comprehensive audits and in-person visits to ensure compliance and safety. • Rotation of Naval Reactors Representatives at the field sites (U.K., Japan, Hawaii, and the continental United States) due to retirement, attrition, and succession planning.	• Perform oversight activities of facilities located worldwide that require comprehensive audits and in-person visits to ensure compliance and safety. • Rotation of Naval Reactors Representatives at the field sites (U.K., Japan, Hawaii, and the continental United States) due to retirement, attrition, and succession planning.	• Reflects expected travel requirement to execute oversight activities.
Other Related Expenses $3,200,000	**Other Related Expenses $5,072,000**	**Other Related Expenses +$1,872,000**
• Maintenance of Naval Reactors' IT hardware, engineering software, and related licenses supporting mission essential technical work. • Support planned upgrades and maintenance of video teleconferencing equipment, security investigation of Federal personnel, and training requirements.	• Maintenance of Naval Reactors' IT hardware, engineering software, and related licenses supporting mission essential technical work. • Support planned upgrades and maintenance of video teleconferencing equipment, security investigation of federal personnel, and training requirements.	• Reflects a general inflationary increase to support IT and maintenance operations.

Naval Reactors
Capital Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2018 Request	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Capital Operating Expenses Summary (including Major Items of Equipment (MIE))						
Capital Equipment >$500K (including MIE)	N/A	N/A	13,480	13,999	17,500	+4,020
Plant Projects (GPP and IGPP)	N/A	N/A	23,312	23,154	53,956	+30,644
Total, Capital Operating Expenses	**N/A**	**N/A**	**36,792**	**37,153**	**71,456**	**+34,664**
Capital Equipment > $500K (including MIE)						
Total Non-MIE Capital Equipment (>$500K)	N/A	N/A	7,800	7,709	12,000	+4,200
High Performance Computer (FY 2017 Buy)	5,500	0	5,500	0	0	-5,500
High Performance Computer (FY 2018 Buy)	5,500	0	0	5,500	0	0
High Performance Computer (FY 2019 Buy)	5,500	0	0	0	5,500	+5,500
Land-Based Prototype Instrumentation and Control	17,900	14,100	180	790	0	-180
Total, Capital Equipment (including MIE)	**N/A**	**N/A**	**13,480**	**13,999**	**17,500**	**+4,020**
Plant Projects (GPP and IGPP)						
Total Plant Projects (GPP/IGPP) (Total Estimated Cost (TEC) <$5M)	N/A	N/A	17,312	22,354	43,856	+26,544
NRF Vehicle Barrier System	6,000	0	6,000	0	0	-6,000
NRF Security Upgrades	8,000	0	0	300	7,700	+7,700
KS Service Water and Sanitary Sewer Upgrade	5,255	0	0	0	450	+450
KS S8G Weather Resistant Enclosure	7,700	0	0	500	750	+750
NRF Northeast Boundary Area	9,200	0	0	0	700	+700
BL AMTL Upgrade EMTF Infrastructure	7,900	0	0	0	500	+500
Total, Plant Projects (GPP/IGPP)	**N/A**	**N/A**	**23,312**	**23,154**	**53,956**	**+30,644**
Total, Capital Summary	**N/A**	**N/A**	**36,792**	**37,153**	**71,456**	**+34,664**

Outyears for Naval Reactors

	(Dollars in Thousands)			
	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Capital Operating Expenses Summary (including Major Items of Equipment (MIE))				
Capital Equipment >$500K (including MIE)	25,900	17,400	9,100	10,700
Plant Projects (GPP and IGPP)	35,780	42,925	68,660	44,360
Total, Capital Operating Expenses	**61,680**	**60,325**	**77,760**	**55,060**
Capital Equipment > $500K (including MIE)				
Total Non-MIE Capital Equipment (>$500K)	15,400	11,900	3,600	5,200
High Performance Computer (FY 2020 Buy)	5,500	0	0	0
High Performance Computer (FY 2021 Buy)	0	5,500	0	0
High Performance Computer (FY 2022 Buy)	0	0	5,500	0
High Performance Computer (FY 2023 Buy)	0	0	0	5,500
RML High Radiation Scanning Electron Microscope Replacement	5,000	0	0	0
Total, Capital Equipment (including MIE)	**25,900**	**17,400**	**9,100**	**10,700**

Outyears for Naval Reactors

	(Dollars in Thousands)			
	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request
Plant Projects (GPP and IGPP)				
Total Plant Projects (GPP/IGPP) (Total Estimated Cost (TEC) <$5M)	12,555	6,609	22,190	11,460
BL BRES / Fitness Center Complex	7,710	0	0	0
BL Training Facility	0	0	6,200	0
BL AMTL Upgrade EMTF Infrastructure	3,080	0	560	3,760
NRF Office Building #3	0	0	8,700	0
NRF Northeast Boundary Area	0	8,500	0	0
NRF HVAC Control Update	0	0	5,300	0
NRF Rad Filtered Vent Upgrade	0	0	7,200	0
NRF HVAC Upgrade	0	0	0	6,700
NRF Steam Heat and Control Upgrade	0	0	0	7,700
NRF Site Access Entry Point	0	0	0	400
KL Crafts Facility	0	7,050	0	0
KL Legacy Eliminating Office Bldg	0	9,000	0	0
KL NDT Renovation	0	0	595	5,750
KL A1 Upgrades	0	0	900	8,100
KL RT Fluid Mechanics Lab Upgrade & Relocation	0	0	0	490
KS Service Water and Sanitary Sewer Upgrade	4,805	0	0	0
KS S8G Weather Resistant Enclosure	6,450	0	0	0
KS Building 83 Upgrade	525	5,270	0	0
KS Natural Gas Infrastructure	655	6,496	0	0
KS Fire System Upgrade	0	0	8,060	0
KS Fire House Replacement	0	0	8,955	0
Total, Plant Projects (GPP/IGPP)	**35,780**	**42,925**	**68,660**	**44,360**
Total, Capital Summary	**61,680**	**60,325**	**77,760**	**55,060**

Naval Reactors
Construction Projects Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2018 Request	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted	FY 2019 vs FY 2018
10-D-903, KS Security Upgrades								
Total Estimated Cost (TEC)	22,891	9,991	12,900	0	12,812	0	-12,900	0
Other Project Cost (OPC)	2,189	800	361	350	350	678	317	+328
TPC, 10-D-903, KS Security Upgrades	**25,080**	**10,791**	**13,261**	**350**	**13,162**	**678**	**-12,583**	**+328**
14-D-901, Spent Fuel Handling Recapitalization Project								
Total Estimated Cost (TEC)	1,472,400	145,500	96,900	113,000	96,321	284,100	187,200	+171,100
Other Project Cost (OPC)	174,100	132,800	3,100	3,000	3,000	2,900	-200	-100
TPC, 14-D-901, Spent Fuel Handling Recapitalization Project[a]	**1,646,500**	**278,300**	**100,000**	**116,000**	**99,321**	**287,000**	**187,000**	**+171,000**
15-D-902, KS Engineroom Team Trainer Facility								
Total Estimated Cost (TEC)	36,400	3,100	33,300	0	33,074	0	-33,300	0
Other Project Cost (OPC)	2,220	1,920	300	0	0	0	-300	0
TPC, 15-D-902, KS Engineroom Team Trainer Facility	**38,620**	**5,020**	**33,600**	**0**	**33,074**	**0**	**-33,600**	**0**
15-D-903, KL Fire System Upgrade								
Total Estimated Cost (TEC)	16,200	1,200	0	15,000	0	0	0	-15,000
Other Project Cost (OPC)	1,295	600	0	695	695	0	0	-695
TPC, 15-D-903, KL Fire System Upgrade	**17,495**	**1,800**	**0**	**15,695**	**695**	**0**	**0**	**-15,695**
15-D-904, NRF Overpack Storage Expansion 3								
Total Estimated Cost (TEC)	15,700	1,300	700	13,700	695	0	-700	-13,700
Other Project Cost (OPC)	400	250	0	0	0	150	150	+150
TPC, 15-D-904, NRF Overpack Storage Expansion 3	**16,100**	**1,550**	**700**	**13,700**	**695**	**150**	**-550**	**-13,550**

[a] The Consolidated and Further Continuing Appropriation Act, 2015 provides funding for Other Project Costs (OPC) within project funds beginning in FY 2015. All prior year funding was OPC.

Naval Reactors
Construction Projects Summary

(Dollars in Thousands)

	Total	Prior Years	FY 2017 Enacted	FY 2018 Request	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted	FY 2019 vs FY 2018
17-D-911, BL Fire System Upgrade								
Total Estimated Cost (TEC)	14,600	0	1,400	0	1,390	13,200	11,800	+13,200
Other Project Cost (OPC)	1,900	950	250	400	400	0	-250	-400
TPC, 17-D-911, BL Fire System Upgrade	**16,500**	**950**	**1,650**	**400**	**1,790**	**13,200**	**11,550**	**+12,800**
19-D-930, KS Overhead Piping								
Total Estimated Cost (TEC)	31,894	0	0	0	-	10,994	10,994	+10,994
Other Project Cost (OPC)	420	0	0	0	-	210	210	+210
TPC, 19-D-930, KS Overhead Piping	**32,314**	**0**	**0**	**0**	**-**	**11,204**	**11,204**	**+11,204**
Total All Construction Projects								
Total Estimated Cost (TEC)	1,610,085	161,091	145,200	141,700	144,292	308,294	163,094	+166,594
Other Project Cost (OPC)	182,524	137,320	4,011	4,445	4,445	3,938	-73	-507
TPC, All Construction Projects	**1,792,609**	**298,411**	**149,211**	**146,145**	**148,737**	**312,232**	**163,021**	**+166,087**

Outyears to Completion for Naval Reactors

	(Dollars in Thousands)				
	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request	Outyears to Completion
14-D-901, Spent Fuel Handling Recapitalization Project					
Total Estimated Cost (TEC)	315,300	234,700	186,700	43,300	52,900
Other Project Cost (OPC)	3,700	4,300	6,300	4,400	13,600
TPC, 14-D-901, Spent Fuel Handling Recapitalization Project	**319,000**	**239,000**	**193,000**	**47,700**	**66,500**
17-D-911, BL Fire System Upgrade					
Total Estimated Cost (TEC)	0	0	0	0	0
Other Project Cost (OPC)	0	300	0	0	0
TPC, 17-D-911, BL Fire System Upgrade	**0**	**300**	**0**	**0**	**0**
19-D-930, KS Overhead Piping					
Total Estimated Cost (TEC)	20,900	0	0	0	0
Other Project Cost (OPC)	0	210	0	0	0
TPC, 19-D-930, KS Overhead Piping	**20,900**	**210**	**0**	**0**	**0**
20-D-XXX, NRF Boiler House					
Total Estimated Cost (TEC)	1,000	1,000	0	15,400	0
Other Project Cost (OPC)	0	0	0	0	800
TPC, 20-D-XXX, NRF Boiler House	**1,000**	**1,000**	**0**	**15,400**	**800**
20-D-XXX, KL Fuel Development Laboratory					
Total Estimated Cost (TEC)	23,700	0	0	0	0
Other Project Cost (OPC)	1,244	148	0	0	0
TPC, 20-D-XXX, KL Fuel Development Laboratory	**24,944**	**148**	**0**	**0**	**0**
21-D-XXX, NRF Medical Science Complex					
Total Estimated Cost (TEC)	0	30,800	0	0	0
Other Project Cost (OPC)	120	0	240	600	0
TPC, 21-D-XXX, NRF Medical Science Complex	**120**	**30,800**	**240**	**600**	**0**

Outyears to Completion for Naval Reactors

	(Dollars in Thousands)				
	FY 2020 Request	FY 2021 Request	FY 2022 Request	FY 2023 Request	Outyears to Completion
21-D-XXX, BL Component Test Complex					
Total Estimated Cost (TEC)	0	44,300	0	0	0
Other Project Cost (OPC)	1,100	50	0	6,500	1,750
TPC, 21-D-XXX, BL Component Test Complex	**1,100**	**44,350**	**0**	**6,500**	**1,750**
22-D-XXX, KL Chemistry and Radiological Health Building					
Total Estimated Cost (TEC)	0	0	41,620	0	0
Other Project Cost (OPC)	124	5	100	107	1,320
TPC, 22-D-XXX, KL Chemistry and Radiological Health Building	**124**	**5**	**41,720**	**107**	**1,320**
22-D-XXX, KL Security Upgrades					
Total Estimated Cost (TEC)	0	0	2,100	0	24,530
Other Project Cost (OPC)	312	1,201	0	0	136
TPC, 22-D-XXX, KL Security Upgrades	**312**	**1,201**	**2,100**	**0**	**24,666**
22-D-XXX, NRF Production Maintenance Complex					
Total Estimated Cost (TEC)	0	0	2,000	1,500	38,500
Other Project Cost (OPC)	1,078	1,154	16	80	1,999
TPC, 22-D-XXX, NRF Production Maintenance Complex	**1,078**	**1,154**	**2,016**	**1,580**	**40,499**
23-D-XXX, Naval Examination Acquisition Project[a]					
Total Estimated Cost (TEC)	0	0	0	70,000	TBD
Other Project Cost (OPC)	7,700	15,300	26,500	25,300	TBD
TPC, 23-D-XXX, Naval Examination Acquisition Project	**7,700**	**15,300**	**26,500**	**95,300**	**TBD**
Total All Construction Projects					
Total Estimated Cost (TEC)	360,900	310,800	232,420	130,200	115,930
Other Project Cost (OPC)	15,378	22,668	33,156	36,987	19,605
TPC, All Construction Projects	**376,278**	**333,468**	**265,576**	**167,187**	**135,535**

[a] Critical Decision – 0, *Mission Need Statement*, is planned for the 2nd quarter FY 2018; therefore, the OPC profile is notional and no TPC has been established.

Research and Development

The Office of Management and Budget (OMB) Circular No. A-11, "Preparation, Submission, and Execution of the Budget," dated July 2013, requires the reporting of research and development (R&D) data. Consistent with this requirement, R&D activities funded by NNSA are displayed below.

(Dollars in Thousands)

	FY 2017 Enacted	FY 2018 Annualized CR	FY 2019 Request	FY 2019 Request vs FY 2017 Enacted
Research and Development (R&D)				
Basic	0	0	0	0
Applied	0	0	0	0
Development	1,235,028	1,231,530	1,405,968	+170,940
Subtotal, R&D	**1,235,028**	**1,231,530**	**1,405,968**	**+170,940**
Equipment	13,480	13,499	17,500	+4,020
Construction	171,612	165,447	365,150	+193,538
Total, R&D [a]	**1,420,120**	**1,410,476**	**1,788,618**	**+368,498**

[a] Funding does not reflect the transfer to the Office of Nuclear Energy for maintenance and operation of the Advanced Test Reactor.

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14-D-901, Spent Fuel Handling Recapitalization Project
Naval Reactors Facility, Idaho
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary

The FY 2019 Request for 14-D-901, Spent Fuel Handling Recapitalization is $287,000K. Critical Decision (CD)-1, Alternative Selection and Cost Range, was approved on March 19, 2015 with a total project cost (TPC) of $1,646,500K (then-year) with a CD-4 of 3Q FY 2025.

Significant Changes

This Construction Project Data Sheet (CPDS) is an update of the FY 2018 CPDS and does not include a new start for the budget year.

Per the Consolidated and Further Continuing Appropriations Act, 2015, the Spent Fuel Handling Recapitalization Project Major Construction Project funding includes both Total Estimated Cost and Other Project Cost.

The Spent Fuel Handling Recapitalization Project is implementing a phased approach to design the facility as first incorporated in the FY 2017 CPDS. This CPDS transfers the costs associated with the phased design in FY 2019 and FY 2020 from the construction category to the design category to better characterize the design costs. The TPC remains unchanged as the Project continues to progress.

A Federal Project Director has been assigned to this project and has approved this CPDS.

Consistent with the National Environmental Policy Act Record of Decision, published on December 5, 2016, the Spent Fuel Handling Recapitalization Project will design and construct a new facility, the Naval Spent Fuel Handling Facility, with a footprint of approximately 213,000 square feet for handling naval spent nuclear fuel, including the capability to receive, unload, prepare, and package naval spent nuclear fuel. The Project is currently in the final design phase, which includes finalization of safety assessments, design drawings and specifications, and project management processes to support permanent construction activities in FY 2019. The Project began final design work in 1Q FY 2018.

Spent fuel handling operations in the existing Expended Core Facility will overlap with operations in the new Naval Spent Fuel Handling Facility for a period of 5 to 12 years and examination operations in the existing Expended Core Facility will continue for the foreseeable future; therefore, the costs associated with D&D of the Expended Core Facility are not included in the range of costs cited for the Spent Fuel Handling Recapitalization Project.

Critical Milestone History[a]

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete[b]	CD-4
FY 2014	03/29/2008		1Q FY 2014	3Q FY 2015	4Q FY 2016	4Q FY 2016	N/A	4Q FY 2022
FY 2015	03/29/2008		1Q FY 2014	3Q FY 2015	4Q FY 2016	4Q FY 2016	N/A	4Q FY 2022
FY 2015 Rev[c]	03/29/2008		1Q FY 2015	3Q FY 2017	4Q FY 2018	1Q FY 2018	N/A	4Q FY 2024
FY 2016[d]	03/29/2008		2Q FY 2015	1Q FY 2018	4Q FY 2019	4Q FY 2018	N/A	3Q FY 2025
FY 2017	03/29/2008	03/19/2015	03/19/2015	1Q FY 2018	3Q FY 2020[e]	4Q FY 2018	N/A	3Q FY 2025
FY 2018	03/29/2008	03/19/2015	03/19/2015	4Q FY 2018[f]	3Q FY 2020	4Q FY 2018	N/A	3Q FY 2025
FY 2019	03/19/2008	03/19/2015	03/19/2015	4Q FY 2018	3Q FY 2020	4Q FY 2018	N/A	3Q FY 2025

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternate Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the Project design will be/was complete(d)
CD-3 – Approve Start of Construction
D&D Complete – Completion of D&D work (see Section 9)
CD-4 – Approve Start of Operations or Project Closeout

Fiscal Quarter or Date

Fiscal Year	CD-3A	CD-3B	CD-4A
FY 2017	2Q FY 2017	1Q FY2018	3Q FY 2024
FY 2018	12/7/2016	4Q FY 2017	3Q FY 2024
FY 2019	12/7/2016	6/14/2017	3Q FY 2024

CD-3A – Start of Long Lead Material Procurement
CD-3B – Start of Early Site Preparation
CD-4A – Start of M-290 Shipping Container Unloading Operations

[a] Schedules are only estimates and consistent with the high end of the schedule ranges.
[b] D&D is not within the scope of this project.
[c] The FY 2015 Revision incorporated the expected impacts of the Consolidated Appropriations Act, 2014 funding reductions.
[d] The FY 2016 CPDS incorporated the impacts from the FY 2015 delayed appropriation.
[e] The FY 2017 CPDS incorporated a phased design.
[f] The FY 2018 CPDS revised the CD-2 milestone date to be consistent with DOE Order 413.3, which requires 90% of the design to be complete before establishing the Performance Baseline.

Project Cost History[a]

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2014	369,400	917,100	1,286,500	165,000	N/A	165,000	1,451,500
FY 2015	369,400	917,100	1,286,500	165,000	N/A	165,000	1,451,500
FY 2015 Rev[b]	263,000	1,144,900	1,407,000	178,200	N/A	178,200	1,586,100
FY 2016[c]	268,800	1,182,100	1,450,900	195,600	N/A	195,600	1,646,500
FY 2017[d]	239,800	1,232,600	1,472,400	174,100	N/A	174,100	1,646,500
FY 2018	239,800	1,232,600	1,472,400	174,100	N/A	174,100	1,646,500
FY 2019[e]	306,982	1,165,418	1,472,400	174,100	N/A	174,100	1,646,500

No construction, excluding approved long lead procurement and early site preparation, will be performed until the project performance baseline has been validated and CD-2/3 has been approved.

[a] Figures are only estimates and consistent with the high end of the cost ranges.
[b] The FY 2015 Revision incorporated the expected impacts of the Consolidated Appropriations Act, 2014 funding reductions.
[c] The FY 2016 CPDS incorporated the impacts from the FY 2015 delayed appropriation.
[d] Divisions between cost categories were updated based on progression of the Project designs and CD-1 completion.
[e] Divisions between cost categories were updated to account for the phased design.

2. Project Scope and Justification

Scope

The Spent Fuel Handling Recapitalization Project will design and construct a new facility, the Naval Spent Fuel Handling Facility, to incorporate the capabilities for naval spent nuclear fuel handling that currently exist in the Expended Core Facility and its support facilities. Additionally, a major portion of this new facility is required to support additional capability, which does not exist in the Expended Core Facility, to handle full-length aircraft carrier naval spent nuclear fuel received in M-290 shipping containers. The Naval Spent Fuel Handling Facility footprint will be approximately 213,000 square feet. Of this, approximately 121,000 square feet is required for spent fuel shipping container and dry storage operations, which includes approximately 17,000 square feet for water pool spent fuel preparation and in-process storage. The remainder of the facility, approximately 92,000 square feet, is required for waste management, facility systems operations, staging, warehousing, and administrative office space. Additionally, the facility will include two major process lines, over 20 operating stations, over 40 facility systems, and approximately 30 major equipment systems. The Spent Fuel Handling Recapitalization Project is in the final design phase; therefore, the facility design is subject to change until designs are complete.

The following represents the general scope of the Spent Fuel Handling Recapitalization Project:

- Design and construct a facility and facility systems for naval spent nuclear fuel handling, including the capability to receive, unload, prepare, and package naval spent nuclear fuel.
- Design and construct infrastructure needed to support naval spent nuclear fuel handling operations.
- Design and procure equipment to make the facility ready for use to receive, unload, prepare, and package naval spent nuclear fuel.
- Provide the additional capability to unload M-290 spent fuel shipping containers in addition to the capability to unload M-140 shipping containers, which is currently provided by the Expended Core Facility.
- Prepare testing, operating, and preventive maintenance procedures and drawings, as needed, for the naval spent nuclear fuel handling process systems, equipment, facilities, and facility systems.
- Develop training programs and conduct personnel training, where appropriate.
- Develop project management procedures and manage Project activities.
- Provide support services needed for the Project.
- Manage sub-contracts supporting the design and construction.
- Prepare an Environmental Impact Statement in accordance with National Environmental Policy Act.

Justification

The mission of Naval Reactors is to provide the nation with militarily effective nuclear propulsion plants and to ensure their safe, reliable, long-lived, and affordable operation. Naval Reactors maintains total responsibility for all aspects of the U.S. Navy's nuclear propulsion systems, including research, design, construction, testing, operation, maintenance, and disposal. At the end of reactor service life, Naval Reactors transports naval spent nuclear fuel from its origin (e.g., naval spent nuclear fuel from servicing shipyards and naval training platforms) to the Naval Reactors Facility at the Idaho National Laboratory.

The Expended Core Facility, located at the Naval Reactors Facility in Idaho, is the only facility with the capabilities to receive naval spent nuclear fuel shipping containers and process naval spent nuclear fuel. Although the existing Expended Core Facility continues to be maintained and operated in a safe and environmentally responsible manner, the infrastructure is over 60 years old, does not meet current standards (i.e., requirements that were not applicable at the time of construction) and requires recapitalization. The Expended Core Facility is also incapable of receiving full-length aircraft carrier naval spent nuclear fuel, which is required to support aircraft carrier refuelings. The magnitude of required sustainment efforts and incremental infrastructure upgrades within the Expended Core Facility pose substantial risk to the continued preparation of naval spent nuclear fuel for long term storage. Specifically, sustainment efforts could require delays to naval spent nuclear fuel shipping container unloading operations, which would interrupt refueling and defueling schedules for nuclear-powered vessels and would adversely affect the operational availability of the nuclear fleet. If this interruption were to extend over long periods of time, the ability to sustain fleet operations would be impacted, resulting ultimately in a significant decrement to the Navy's responsiveness and agility to fulfill military missions worldwide.

The existing Expended Core Facility at the Naval Reactors Facility in Idaho is a single facility that is approximately 197,000 square feet. However, other facilities at the Naval Reactors Facility support operations within the Expended Core Facility and include additional areas for administrative support and warehouse storage. The Expended Core Facility has two major capabilities: (1) to receive, unload, prepare, and package naval spent nuclear fuel and, (2) to conduct naval spent nuclear fuel examinations.

Actions necessary to continue Naval Reactors' ability to support naval spent nuclear fuel handling were the subject of an Environmental Impact Statement. The Final Environmental Impact Statement for recapitalization of the infrastructure supporting naval spent nuclear fuel was published on September 30, 2016 and included an assessment of the environmental impacts associated with handling of naval spent nuclear fuel for the following alternatives:

(1) No Action Alternative – Maintain the naval spent nuclear fuel handling capabilities of the existing Expended Core Facility by continuing to use the existing infrastructure while performing corrective maintenance and repairs.
(2) Overhaul Alternative – Recapitalize the naval spent nuclear fuel handling capabilities of the Expended Core Facility by overhauling the existing facility with major refurbishment projects for the infrastructure and water pools.
(3) New Facility Alternative, including the Spent Fuel Handling Recapitalization Project – Recapitalize the naval spent nuclear fuel handling capabilities of the Expended Core Facility by constructing and operating a new facility at one of two potential locations at Naval Reactors Facility in Idaho.

The National Environmental Policy Act Record of Decision, which identified the New Facility Alternative as the preferred method to recapitalize the naval spent nuclear fuel handling capabilities of the Expended Core Facility, was published on December 5, 2016.

The Spent Fuel Handling Recapitalization Project has an equivalency to the project management requirements in DOE Order 413.3, Program and Project Management for the Acquisition of Capital Assets. The Project is being conducted in accordance with the Naval Reactors Implementation Bulletin for DOE O 413.3, and appropriate project management requirements have been met.

Prior to CD-2/3 approval, an independent cost estimate will be performed by the Department of Defense Office of Cost Assessment and Program Evaluation or another capable independent organization external to DOE.

Key Performance Parameters (KPPs)
The Threshold KPPs represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion. The Objective KPPs will be finalized with CD-2 approval.

Performance Measure	Threshold	Objective
N/A	N/A	N/A

3. Project Cost and Schedule

Financial Schedule[a]

(Dollars in Thousands)

	Budget Authority Appropriations[b]	Obligations[c]	Costs[d]
Total Estimated Cost (TEC)			
Design			
FY 2015	N/A	N/A	19,542
FY 2016	N/A	N/A	56,846
FY 2017	N/A	N/A	79,572
FY 2018	N/A	N/A	83,840
FY 2019[e]	N/A	N/A	40,192
FY 2020[p]	N/A	N/A	26,990
Total Design	N/A	N/A	306,982
Construction			
FY 2017[f]	N/A	N/A	4,624
FY 2018[q]	N/A	N/A	51,648
FY 2019	N/A	N/A	264,250
FY 2020	N/A	N/A	243,927
FY 2021	N/A	N/A	266,046
FY 2022	N/A	N/A	220,023
FY 2023	N/A	N/A	58,467
FY 2024	N/A	N/A	31,483
FY 2025	N/A	N/A	24,950
Total Construction	N/A	N/A	1,165,418
Total Estimated Costs (TEC)			
FY 2015	N/A	N/A	19,542
FY 2016	N/A	N/A	56,846
FY 2017	N/A	N/A	84,196
FY 2018	N/A	N/A	135,488
FY 2019	N/A	N/A	304,442
FY 2020	N/A	N/A	270,917
FY 2021	N/A	N/A	266,046
FY 2022	N/A	N/A	220,023
FY 2023	N/A	N/A	58,467
FY 2024	N/A	N/A	31,483
FY 2025	N/A	N/A	24,950

[a] Figures are only estimates and consistent with the high end of the cost ranges. Estimates updated within Total Project Cost based on progression of Project plans.
[b] Due to the Consolidated and Further Continuing Appropriations Act, 2015, the TEC and OPC appropriations for FY 2015 and beyond are combined into the TPC appropriations.
[c] Due to the Consolidated and Further Continuing Appropriations Act, 2015, the TEC and OPC obligations for FY 2015 and beyond are combined into the TPC obligations.
[d] FY 2017-2026 costs are updated to reflect the current spending plan.
[e] Costs associated with the phased design have been included in the TEC-Design costs.
[f] Includes long lead material and site preparation.

	Budget Authority Appropriations[b]	Obligations[c]	Costs[d]
Total TEC	N/A	N/A	1,472,400
Other Project Costs (OPC)			
FY 2010[a]	6,600	6,600	6,372
FY 2011[r]	36,100	36,100	31,168
FY 2012[r]	25,200	25,200	29,420
FY 2013[r]	29,000	29,000	27,172
FY 2014[r]	25,400	25,400	28,017
FY 2015	N/A	N/A	8,514
FY 2016	N/A	N/A	1,567
FY 2017	N/A	N/A	3,134
FY 2018	N/A	N/A	2,334
FY 2019	N/A	N/A	1,541
FY 2020	N/A	N/A	2,510
FY 2021	N/A	N/A	3,191
FY 2022	N/A	N/A	8,285
FY 2023	N/A	N/A	6,132
FY 2024	N/A	N/A	6,019
FY 2025	N/A	N/A	4,562
FY 2026	N/A	N/A	4,162
Total OPC	N/A	N/A	174,100
Total Project Costs (TPC)			
FY 2010	6,600	6,600	6,372
FY 2011	36,100	36,100	31,168
FY 2012	25,200	25,200	29,420
FY 2013	29,000	29,000	27,172
FY 2014	25,400	25,400	28,017
FY 2015	70,000	70,000	28,056
FY 2016	86,000	86,000	58,413
FY 2017	100,000	100,000	87,330
FY 2018	116,000	116,000	137,822
FY 2019	287,000	287,000	305,983
FY 2020	319,000	319,000	273,427
FY 2021	239,000	239,000	269,237
FY 2022	193,000	193,000	228,308
FY 2023	47,700	47,700	64,599
FY 2024	32,900	32,900	37,502
FY 2025	29,800	29,800	29,512
FY 2026	3,800	3,800	4,162
Grand Total	**1,646,500**	**1,646,500**	**1,646,500**

[a] FY 2010-2014 OPC was updated to reflect actual costs rather than costs authorized by the Project.
[b] Due to the Consolidated and Further Continuing Appropriations Act, 2015, the TEC and OPC appropriations for FY 2015 and beyond are combined into the TPC appropriations.
[c] Due to the Consolidated and Further Continuing Appropriations Act, 2015, the TEC and OPC obligations for FY 2015 and beyond are combined into the TPC obligations.
[d] FY 2017-2026 costs are updated to reflect the current spending plan.

Details of Project Cost Estimate[a]

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate[b]	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	291,705	225,793	N/A
Contingency	15,277	14,007	N/A
Total, Design[c]	306,982	239,800	N/A
Construction			
Long Lead Material and Site Preparation	57,143	57,143	N/A
Spent Fuel Handling Equipment	248,577	295,029	N/A
Facility Construction	700,108	723,340	N/A
Contingency	159,590	157,088	N/A
Total, Construction[u]	1,165,418	1,232,600	N/A
Total Estimated Cost	1,472,400	1,472,400	N/A
Contingency, TEC	174,867	171,095	N/A
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Planning	42,697	42,697	N/A
Conceptual Design	88,453	88,453	N/A
Start-up	15,153	15,006	N/A
Other (e.g., EIS, Project Reviews)	4,913	7,240	N/A
Contingency	22,884	20,704	N/A
Total, OPC	174,100	174,100	N/A
Contingency, OPC	22,884	20,704	N/A
Total Project Cost	1,646,500	1,646,500	N/A
Total Contingency (TEC+OPC)	197,751	191,799	N/A

[a] Figures are only estimates and consistent with the high end of the cost ranges.
[b] Previous Total Estimate is from the FY 2018 CPDS.
[c] Divisions between cost categories were updated to account for the phased design.

Schedule of Appropriations Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	Outyears	Total
FY 2014	TEC	677,600	226,700	134,900	132,300	64,300	50,700	0	0	1,286,500
	OPC	128,900	3,300	5,100	7,700	10,700	9,300	0	0	165,000
	TPC	806,500	230,000	140,000	140,000	75,000	60,000	0	0	1,451,500
FY 2015	TEC	677,600	226,700	134,900	132,300	64,300	50,700	0	0	1,286,500
	OPC	128,900	3,300	5,100	7,700	10,700	9,300	0	0	165,000
	TPC	806,500	230,000	140,000	140,000	75,000	60,000	0	0	1,451,500
FY 2015 Rev	TEC	263,000	268,100	293,500	265,600	197,900	66,900	33,200	19,700	1,407,900
	OPC	131,600	3,300	4,500	4,500	6,500	6,700	7,900	13,200	178,200
	TPC	394,600	271,400	298,000	270,100	204,400	73,600	41,100	32,900	1,586,100
FY 2016	TEC	235,900	98,600	283,300	313,700	234,300	186,100	54,800	44,200	1,450,900
	OPC	141,600	3,400	3,700	5,300	4,700	6,900	7,200	22,800	195,600
	TPC	377,500	102,000	287,000	319,000	239,000	193,000	62,000	67,000	1,646,500
FY 2017	TEC	242,400	99,000	284,100	315,300	234,700	186,700	57,300	52,900	1,472,400
	OPC	135,900	3,000	2,900	3,700	4,300	6,300	4,400	13,600	174,100
	TPC[a]	378,300	102,000	287,000	319,000	239,000	193,000	61,700	66,500	1,646,500
FY 2018	TEC	242,400	113,000	284,100	315,300	234,700	186,700	43,300	52,900	1,472,400
	OPC	135,900	3,000	2,900	3,700	4,300	6,300	4,400	13,600	174,100
	TPC[v]	378,300	116,000	287,000	319,000	239,000	193,000	47,700	66,500	1,646,500
FY 2019[v]	TEC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	OPC	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	TPC	378,300	116,000	287,000	319,000	239,000	193,000	47,700	66,500	1,646,500

4. Related Operations and Maintenance Funding Requirements

Start of Operation of Beneficial Occupancy	4Q FY 2024
Expected Useful Life	40 years
Expected Future Start of D&D	4Q FY 2064

Related Funding Requirements
(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	166.4	166.4	6,655.7	6,655.7

[a] Per the Consolidated and Further Continuing Appropriations Act, 2015, the Spent Fuel Handling Recapitalization Project Major Construction Project funding includes both Total Estimated Cost and Other Project Cost. For clarity, the FY 2019 CPDS was updated to reflect appropriations only at the Total Project Cost level.

5. D&D Information

The new area being constructed in this project is replacing existing facilities; however, the costs of D&D of the facilities that are being replaced are not included in the costs of this construction project.

	Square Feet
New area being constructed by this Project at the Naval Reactors Facility	213,000[a]
Area of D&D in this Project at the Naval Reactors Facility	0
Area at the Naval Reactors Facility to be transferred, sold, and/or D&D outside the project including area previously "banked"	0
Area of D&D in this Project at other sites	0
Area at other sites to be transferred, sold, and/or D&D outside the Project including area previously "banked"	0
Total area eliminated	0

Spent fuel handling operations in the existing Expended Core Facility will overlap with operations in the Spent Fuel Handling Recapitalization Project facility for a period of 5 to 12 years and examination operations in the existing Expended Core Facility will continue for the foreseeable future; therefore, no D&D is planned at this time. Separate National Environmental Policy Act action will be taken to address these future actions, if necessary.

6. Acquisition Approach

The integrated Management & Operating (M&O) prime partners will plan and execute the Spent Fuel Handling Recapitalization Project in accordance with requirements. Naval spent nuclear fuel handling equipment will be procured through the procurement M&O partners. An Engineering, Procurement, and Construction Management (EPCM) firm was selected as the subcontracting strategy for design and construction management of the facility and facility systems. The EPCM contract is cost plus fixed fee. Long-lead materials will be purchased and site preparation work will be performed ahead of CD-2/3.

[a] The facility area has decreased from the conceptual design and is subject to change based on final design.

17-D-911, BL Fire System Upgrade
Bettis Atomic Power Laboratory, West Mifflin, PA
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary

The FY 2019 Request for the BL Fire System Upgrade is $13,200K. The total project cost (TPC) is $16,500K, approved at Critical Decision (CD) CD-1 on April 27, 2016 with a CD-4 of 4Q FY 2021.

Significant Changes

This Construction Project Data Sheet (CPDS) is an update of the FY 2017 CPDS and does not include a new start for the budget year.

A Federal Project Director has been assigned to this project and has approved this CPDS. This project upgrades the Bettis Laboratory fire protection system to achieve compliance with National Fire Protection Association code requirements. FY 2019 funds requested for this project will be used for construction efforts.

Critical Milestone History[a]

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2017	2/14/2014	1Q FY 2016	3Q FY 2016	2Q FY 2018	2Q FY 2019	3Q FY 2019	N/A	4Q FY 2021
FY 2019[b]	2/14/2014	12/2/2015	4/27/2016	3Q FY 2018	3Q FY 2019	4Q FY 2019	N/A	4Q FY 2021

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed
CD-1 – Approve Alternate Selection and Cost Range
CD-2 – Approve Project Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete/d
CD-3 – Approve Start of Construction
D&D Complete –Completion of D&D work
CD-4 – Approve Start of Operations or Project Closeout

Project Cost History[c]

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, D&D	OPC, Total	TPC
FY 2017	1,400	13,200	14,600	1,500	N/A	1,500	16,100
FY 2019[d]	1,400	13,200	14,600	1,900	N/A	1,900	16,500

[a] Schedules are only estimates and consistent with the high end of the schedule ranges.
[b] Dates adjusted to align with contracted design completion dates.
[c] Figures are only estimates and consistent with the high end of the cost ranges.
[d] Costs updated to reflect revised Characterization estimate approved at CD-1.

2. Project Scope and Justification

Scope

This project will replace existing Emergency Alert System (EAS) components, interconnecting cabling, and control components to improve system capabilities, improve maintainability, and bring the Bettis Laboratory fire protection system into compliance with National Fire Protection Association (NFPA) code requirements. Planned upgrades include: reduced time delay between alarm actuation and sounding the audible alarm; use of strobe lights for providing visual notification of an alarm; improved location of speakers; and expanded capability to add alarm codes and announcements.

Justification

The primary performance gap in the EAS relates to time delays in processing alarm signals. The time delay experienced between actuation of an alarm signal and the sounding of site-wide audible alarms, currently as much as 90 seconds, exceeds the required maximum delay of 10 seconds required in NFPA 72 (2010).

Current code requires both audible and visual notification of an alarm in the affected area to ensure notification despite hearing impairment. Emergency evacuation announcements are currently made using a code system, which requires occupants to refer to posted signs or carried cards to determine the nature and location of the emergency for which a code is being given. The current EAS does not provide the capability to separate individual building notifications from site-wide notifications, due to single-channel connections. Having the ability to separate individual building notifications from site-wide notifications would permit alarms to remain active in the affected building while site-wide notifications can be silenced and re-engaged as necessary.

The project has an equivalency to the project management requirements in DOE O 413.3, Program and Project Management for the Acquisition of Capital Assets. The project is being conducted in accordance with the NR Implementation Bulletin for DOE O 413.3, and appropriate project management requirements have been met.

Key Performance Parameters (KPPs)

The Threshold KPPs represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion. The Objective KPPs will be finalized with CD-2 approval.

Performance Measure	Threshold	Objective
N/A	N/A	N/A

3. Project Cost and Schedule

Financial Schedule

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design			
FY 2017	1,400	1,400	219
FY 2018	0	0	700
FY 2019	0	0	481
Total Design	1,400	1,400	1,400
Construction			
FY 2019	13,200	13,200	0
FY 2020	0	0	5,400
FY 2021	0	0	7,800
Total Construction	13,200	13,200	13,200
Total Estimated Costs (TEC)			
FY 2017	1,400	1,400	219
FY 2018	0	0	700
FY 2019	13,200	13,200	481[a]
FY 2020	0	0	5,400
FY 2021	0	0	7,800
Total TEC	14,600	14,600	14,600
Other Project Costs (OPC)			
FY 2015	700	700	700
FY 2016	250	250	250
FY 2017	250	250	250
FY 2018	400	400	400
FY 2019	0	0	0
FY 2020	0	0	0
FY 2021	300	300	300
Total OPC	1,900	1,900	1,900
Total Project Costs (TPC)			
FY 2015	700	700	700
FY 2016	250	250	250
FY 2017	1,650	1,650	469
FY 2018	400	400	1,100
FY 2019	13,200	13,200	481
FY 2020	0	0	5,400
FY 2021	300	300	8,100
Grand Total	16,500	16,500	16,500

[a] Costing profile change due to shift of CD-3 to 4Q FY 2019.

Details of Project Cost Estimate

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design			
Design	1,400	1,400	N/A
Contingency	0	0	N/A
Total, Design	1,400	1,400	N/A
Construction			
Construction	10,400	10,400	N/A
Contingency	2,800	2,800	N/A
Total, Construction	13,200	13,200	N/A
Total Estimated Cost	14,600	14,600	N/A
Contingency, TEC	2,800	2,800	N/A
Other Project Cost (OPC)			
OPC except D&D			
Conceptual Planning	200	200	N/A
Conceptual Design	600	600	N/A
Startup	300	300	N/A
Characterization	800	400	N/A
Contingency			
Total, OPC	1,900	1,500	N/A
Contingency, OPC	0	0	N/A
Total Project Cost	16,500	16,100	N/A
Total Contingency (TEC+OPC)	2,800	2,800	N/A

Schedule of Appropriation Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	Total
FY 2017	TEC	1,400	0	13,200	0	0	0	0	14,600
	OPC	1,200	0	0	0	300	0	0	1,500
	TPC	2,600	0	13,200	0	300	0	0	16,100
FY 2019	TEC	1,400	0	13,200	0	0	0	0	14,600
	OPC	1,200	400	0	0	300	0	0	1,900
	TPC	2,600	400	13,200	0	300	0	0	16,500

4. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2020
Expected Useful Life	25 years
Expected Future Start of D&D of this capital asset	4Q FY 2045

Related Funding Requirements
(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	N/A	0.1234	N/A	4.499

5. D&D Information

There is no new area being constructed in this construction project.

6. Acquisition Approach

The procurement strategy being evaluated for this project is Design-Bid-Build due to the uncertainty caused by the large number of interfaces with legacy systems and facilities. The construction contract will be placed using a fixed price contract.

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19-D-930, KS Overhead Piping
Kesselring Site, West Milton, NY
Project is for Construction Only

1. Summary, Significant Changes, and Schedule and Cost History

Summary
The FY 2019 Request for the KS Overhead Piping is $10,994K. The total project cost (TPC) is $32,314K, approved at Critical Decision (CD) CD-1 on June 5, 2017 with a CD-4 of 1Q FY 2023.

Significant Changes
This Construction Project Data Sheet (CPDS) is new and will include a new start for the budget year.

A Federal Project Manager has been assigned to this project and has approved this CPDS. This project provides critical utilities for the east and west sides of the Kesselring Site. In FY 2019, funds requested for this project will be used for East Side piping construction efforts.

Critical Milestone History[a]

Overall KS Overhead Piping (19-D-930)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2019	3/9/2016	11/30/2016	6/5/2017	2Q FY 2019	1Q FY 2020	2Q FY 2020	1Q FY 2022	1Q FY 2023

Overhead Piping East Side (19-D-930-01)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2019	3/9/2016	11/30/2016	6/5/2017	1Q FY 2019	4Q FY 2018	1Q FY 2019	1Q FY 2020	1Q FY 2022

Overhead Piping West Side (19-D-930-02)

Fiscal Quarter or Date

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2019	3/9/2016	11/30/2016	6/5/2017	2Q FY 2019	1Q FY 2020	2Q FY 2020	1Q FY 2022	1Q FY 2023

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range
Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)
CD-1 – Approve Alternative Selection and Cost Range
CD-2 – Approve Performance Baseline
Final Design Complete – Estimated/Actual date the project design will be/was complete/d
CD-3 – Approve Start of Construction
D&D Complete –Completion of D&D work
CD-4 – Approve Start of Operations or Project Closeout

[a] Schedules are only estimates and consistent with the high end of the schedule ranges.

Project Cost History[a]

Overall KS Overhead Piping (19-D-930) (Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC Except D&D	OPC, D&D	OPC, Total	TPC
FY 2019	N/A	31,894	31,894	0	420	420	32,314

Overhead Piping East Side (19-D-930-01)

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC Except D&D	OPC, D&D	OPC, Total	TPC
FY 2019	N/A	10,994	10,994	0	210	210	11,204

Overhead Piping West Side (19-D-930-02)

(Dollars in Thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC Except D&D	OPC, D&D	OPC, Total	TPC
FY 2019	N/A	20,900	20,900	0	210	210	21,110

2. Project Scope and Justification

Scope

This project will construct a replacement overhead piping utility distribution system for the Kesselring Site in West Mifflin, New York. The distribution systems will include as a minimum: steam, condensate, compressed air, and demineralized water. The new distribution will provide for the future needs and development for the Kesselring site as well as address all potential life cycle cost and maintenance savings for the ensuing 40 years beyond installation.

The overhead piping systems are made up of east and west loops, which can be independently isolated from each other. This project includes two subprojects, one for each loop. Completion of one subproject is not dependent upon completion of the other subproject. D&D efforts supporting construction will be completed using operating funds.

Justification

The majority of the piping systems and support structures on the Kesselring Site are over 50 years old and are subject to frequent leaks and emergent maintenance that affects the reliable delivery of mission critical system services. In specific sections, a conditional assessment has validated the overhead piping systems have degraded and have reached or exceeded their useful life. In some areas the piping distribution systems have inadequate capacity to support current and future site needs. In addition to recapitalizing infrastructure and accommodating capacity issues, the distribution system must be reconfigured for ease of maintenance without interruption of system services.

The project has an equivalency to the project management requirements in DOE O 413.3, Program and Project Management for the Acquisition of Capital Assets. The project is being conducted in accordance with the NR Implementation Bulletin for DOE O 413.3, and all appropriate project management requirements have been met.

Key Performance Parameters (KPPs)

The Threshold KPPs represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion. The Objective KPPs will be finalized with CD-2 approval.

Performance Measure	Threshold	Objective
N/A	N/A	N/A

[a] Figures are only estimates and consistent with the high end of the cost ranges.

3. Project Cost and Schedule

Financial Schedule

Overhead Piping East Side (19-D-930-01)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Construction			
FY 2019	N/A	N/A	1,007
FY 2020	N/A	N/A	4,508
FY 2021	N/A	N/A	4,500
FY 2022	N/A	N/A	979
Total Estimated Costs (TEC)			
FY 2019	10,994	10,994	1,007
FY 2020	0	0	4,508
FY 2021	0	0	4,500
FY 2022	0	0	979
Total TEC	**10,994**	**10,994**	**10,994**
Other Project Costs (OPC)			
FY 2019	210	210	210
Total, OPC	210	210	210
Total Project Costs (TPC)			
FY 2019	11,204	11,204	1,217
FY 2020	0	0	4,508
FY 2021	0	0	4,500
FY 2022	0	0	979
Grand Total	**11,204**	**11,204**	**11,204**

Overhead Piping West Side (19-D-930-02)

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Construction			
FY 2020	N/A	N/A	1,000
FY 2021	N/A	N/A	4,409
FY 2022	N/A	N/A	6,712
FY 2023	N/A	N/A	8,779
Total Estimated Costs (TEC)	N/A	N/A	20,900
FY 2020	20,900	20,900	1,000
FY 2021	0	0	4,409
FY 2022	0	0	6,712
FY 2023	0	0	8,779
Total TEC	20,900	20,900	20,900
Other Project Costs (OPC)			
FY 2021	210	210	210
Total OPC	210	210	210
Total Project Costs (TPC)			
FY 2020	20,900	20,900	1,000
FY 2021	210	210	4,619
FY 2022	0	0	6,712
FY 2023	0	0	8,779
Grand Total	21,110	21,110	21,110

Overall Project

(Dollars in Thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Construction			
FY 2019	N/A	N/A	1,007
FY 2020	N/A	N/A	5,508
FY 2021	N/A	N/A	8,909
FY 2022	N/A	N/A	7,691
FY 2023	N/A	N/A	8,779
Total Estimated Costs (TEC)			
FY 2019	10,994	10,994	1,007
FY 2020	20,900	20,900	5,508
FY 2021	0	0	8,909
FY 2022	0	0	7,691
FY 2023	0	0	8,779
Total, TEC	31,894	31,894	31,894
Other Project Cost (OPC)			
FY 2019	210	210	210
FY 2020	0	0	0
FY 2021	210	210	210
Total OPC	420	420	420
Total Project Costs (TPC)			
FY 2019	11,204	11,204	1,217
FY 2020	20,900	20,900	5,508
FY 2021	210	210	9,119
FY 2022	0	0	7,691
FY 2023	0	0	8,779
Grand Total	32,314	32,314	32,314

Details of Project Cost Estimate

Overhead Piping East Side (19-D-930-01)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Construction			
Construction	7,302	N/A	N/A
Contingency	3,692	N/A	N/A
Total, Construction	10,994	N/A	N/A
Other TEC			
Contingency	N/A	N/A	N/A
Total, Other TEC	N/A	N/A	N/A
Total Estimated Cost	10,994	N/A	N/A
Contingency, TEC	3,692	N/A	N/A
Other Project Cost (OPC)			
OPC except D&D			
Contingency	0	N/A	N/A
D&D	210	N/A	N/A
Total, OPC	210	N/A	N/A
Contingency, OPC	0	N/A	N/A
Total Project Cost	11,204	N/A	N/A
Total, Contingency (TEC+OPC)	3,692	N/A	N/A

Overhead Piping West Side (19-D-930-02)

(Budget Authority in Thousands of Dollars)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Construction			
Construction	15,594	N/A	N/A
Contingency	5,306	N/A	N/A
Total, Construction	20,900	N/A	N/A
Other TEC			
Contingency	N/A	N/A	N/A
Total, Other TEC	N/A	N/A	N/A
Total Estimated Cost	20,900	N/A	N/A
Contingency, TEC	5,306	N/A	N/A
Other Project Cost (OPC)			
OPC Except D&D			
Contingency	0	N/A	N/A
D&D	210	N/A	N/A
Total, OPC	210	N/A	N/A
Contingency, OPC	0	N/A	N/A
Total Project Cost	21,110	N/A	N/A
Total Contingency (TEC+OPC)	5,306	N/A	N/A

Overall Project

(Budget Authority in Thousands of Dollars)			
	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Construction			
Construction	22,896	N/A	N/A
Contingency	8,998	N/A	N/A
Total, Construction	31,894	N/A	N/A
Other TEC			
Contingency	N/A	N/A	N/A
Total, Other TEC			
Total Estimated Cost	31,894	N/A	N/A
Contingency, TEC	8,998	N/A	N/A
Other Project Cost (OPC)			
OPC Except D&D			
Contingency	0	N/A	N/A
D&D	420	N/A	N/A
Total, OPC	420	N/A	N/A
Contingency, OPC	0	N/A	N/A
Total Project Cost	32,314	N/A	N/A
Total, Contingency (TEC+OPC)	8,998	N/A	N/A

Schedule of Appropriation Requests

(Dollars in Thousands)

Request Year	Type	Prior Years	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2023	Outyears	Total
FY 2019	TEC	0	0	10,994	20,900	0	0	0	0	31,894
	OPC	0	0	210	0	210	0	0	0	420
	TPC	0	0	11,204	20,900	210	0	0	0	32,314

4. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	1Q FY 2023
Expected Useful Life	40 years
Expected Future Start of D&D of this capital asset	1Q FY 2063

Related Funding Requirements
(Budget Authority in Millions of Dollars)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations and Maintenance	N/A	0.0353N/A	N/A	0.724

5. D&D Information

There is no new area being constructed in this construction project.

6. Acquisition Approach

The procurement strategy being evaluated for this project is Design-Bid-Build due to the uncertainty caused by the large number of interfaces with legacy systems and facilities. Construction is planned to be a fixed price contract.

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General Provisions—Department of Energy
(including transfer of funds)

Sec. 301. (a) No appropriation, funds, or authority made available by this title for the Department of Energy shall be used to initiate or resume any program, project, or activity or to prepare or initiate Requests For Proposals or similar arrangements (including Requests for Quotations, Requests for Information, and Funding Opportunity Announcements) for a program, project, or activity if the program, project, or activity has not been funded by Congress.

(b) (1) Unless the Secretary of Energy notifies the Committees on Appropriations of both Houses of Congress at least 3 full business days in advance, none of the funds made available in this title may be used to—

(A) make a grant allocation or discretionary grant award totaling $1,000,000 or more;

(B) make a discretionary contract award or Other Transaction Agreement totaling $1,000,000 or more, including a contract covered by the Federal Acquisition Regulation;

(C) issue a letter of intent to make an allocation, award, or Agreement in excess

(D) of the limits in subparagraph (A) or (B); or announce publicly the intention to make an allocation, award, or Agreement in excess of the limits in subparagraph (A) or (B).

(2) The Secretary of Energy shall submit to the Committees on Appropriations of both Houses of Congress within 15 days of the conclusion of each quarter a report detailing each grant allocation or discretionary grant award totaling less than $1,000,000 provided during the previous quarter.

(3) The notification required by paragraph (1) and the report required by paragraph (2) shall include the recipient of the award, the amount of the award, the fiscal year for which the funds for the award were appropriated, the account and program, project, or activity from which the funds are being drawn, the title of the award, and a brief description of the activity for which the award is made.

(c) The Department of Energy may not, with respect to any program, project, or activity that uses budget authority made available in this title under the heading "Department of Energy—Energy Programs", enter into a multiyear contract, award a multiyear grant, or enter into a multiyear cooperative agreement unless—

(1) the contract, grant, or cooperative agreement is funded for the full period of performance as anticipated at the time of award; or

(2) the contract, grant, or cooperative agreement includes a clause conditioning the Federal Government's obligation on the availability of future year budget authority and the Secretary notifies the Committees on Appropriations of both Houses of Congress at least 3 days in advance.

(d) Except as provided in subsections (e), (f), and (g), the amounts made available by this title shall be expended as authorized by law for the programs, projects, and activities specified in the "Final Bill" column in the "Department of Energy" table included under the heading "Title III—Department of Energy" in the explanatory statement accompanying this Act.

(e) The amounts made available by this title may be reprogrammed for any program, project, or activity, and the Department shall notify the Committees on Appropriations of both Houses of Congress at least 30 days prior to the use of any proposed reprogramming that would cause any program, project, or activity funding level to increase or decrease by more than $5,000,000 or 10 percent, whichever is less, during the time period covered by this Act.

(f) None of the funds provided in this title shall be available for obligation or expenditure through a reprogramming of funds that—

(1) creates, initiates, or eliminates a program, project, or activity;

(2) increases funds or personnel for any program, project, or activity for which funds are denied or restricted by this Act; or

(3) reduces funds that are directed to be used for a specific program, project, or activity by this Act.

(g) (1) The Secretary of Energy may waive any requirement or restriction in this section that applies to the use of funds made available for the Department of Energy if compliance with such requirement or restriction would pose a substantial risk to human health, the environment, welfare, or national security.

(2) The Secretary of Energy shall notify the Committees on Appropriations of both Houses of Congress of any waiver under paragraph (1) as soon as practicable, but not later than 3 days after the date of the activity to which a requirement or restriction would otherwise have applied. Such notice shall include an explanation of the substantial risk under paragraph (1) that permitted such waiver.

SEC. 302. The unexpended balances of prior appropriations provided for activities in this Act may be available to the same appropriation accounts for such activities established pursuant to this title. Available balances may be merged with funds in the applicable established accounts and thereafter may be accounted for as one fund for the same time period as originally enacted.

SEC. 303. Funds appropriated by this or any other Act, or made available by the transfer of funds in this Act, for intelligence activities are deemed to be specifically authorized by the Congress for purposes of section 504 of the National Security Act of 1947 (50 U.S.C. 3094) during fiscal year 2019 until the enactment of the Intelligence Authorization Act for fiscal year 2019.

SEC. 304. None of the funds made available in this title shall be used for the construction of facilities classified as high-hazard nuclear facilities under 10 CFR Part 830 unless independent oversight is conducted by the Office of Enterprise Assessments to ensure the project is in compliance with nuclear safety requirements.

SEC. 305. None of the funds made available in this title may be used to approve critical decision–2 or critical decision–3 under Department of Energy Order 413.3B, or any successive departmental guidance, for construction projects where the total project cost exceeds $100,000,000, until a separate independent cost estimate has been developed for the project for that critical decision.

SEC. 306. Notwithstanding section 301(c) of this Act, none of the funds made available under the heading "Department of Energy—Energy Programs—Science" in this or any subsequent Energy and Water Development and Related Agencies appropriations Act for any fiscal year may be used for a multiyear contract, grant, cooperative agreement, or Other Transaction Agreement of $1,000,000 or less unless the contract, grant, cooperative agreement, or Other Transaction Agreement is funded for the full period of performance as anticipated at the time of award.

SEC. 307. (a) NEW REGIONAL RESERVES.—The Secretary of Energy may not establish any new regional petroleum product reserve unless funding for the proposed regional petroleum product reserve is explicitly requested in advance in an annual budget submission and approved by the Congress in an appropriations Act.
(b) The budget request or notification shall include—
(1) the justification for the new reserve;
(2) a cost estimate for the establishment, operation, and maintenance of the reserve, including funding sources;
(3) a detailed plan for operation of the reserve, including the conditions upon which the products may be released;
(4) the location of the reserve; and
(5) the estimate of the total inventory of the reserve.

SEC. 308. Treatment of Lobbying and Political Activity Costs as Allowable Costs under Department of Energy Contracts.
(a) Allowable Costs.—
(1) Section 4801(b) of the Atomic Energy Defense Act (50 U.S.C. 2781(b)) is amended—
(A) by striking "(1)" and all that follows through "the Secretary" and inserting The Secretary"; and
(B) by striking paragraph (2).
(2) Section 305 of the Energy and Water Development Appropriation Act, 1988, as contained in section 101(d) of Public Law 100–202 (101 Stat. 1329–125), is repealed.
(b) Regulations Revised.—The Secretary of Energy shall revise existing regulations consistent with the repeal of 50 U.S.C. 2781(b)(2) and section 305 of Public Law 100–202 and shall issue regulations to implement 50 U.S.C. 2781(b), as amended by subsection (a), no later than 150 days after the date of the enactment of this Act. Such regulations shall be consistent with the Federal Acquisition Regulation 48 C.F.R. 31.205–22.

SEC. 309. Not to exceed 5 percent of any appropriation made available for Department of Energy activities funded in this Act may be transferred between such appropriations, but no such appropriation, except as otherwise provided, shall be increased or decreased by more than 5 percent by any such transfers, and notification of any such transfers shall be submitted promptly to the Committees on Appropriations of the House of Representatives and the Senate.

SEC. 310. Notwithstanding section 161 of the Energy Policy and Conservation Act (42 U.S.C. 6241), the Secretary of Energy shall draw down and sell one million barrels of refined petroleum product from the Strategic Petroleum Reserve during fiscal year 2019. Proceeds from sales under this section shall be deposited into the general fund of the Treasury during fiscal year 2019.

SEC. 311. The Secretary of Energy may draw down and sell up to 1 million barrels of crude oil from the Strategic Petroleum Reserves during fiscal year 2019. The proceeds of such sale shall be deposited into the SPR Petroleum Account and shall remain available until expended.

TITLE V—GENERAL PROVISIONS

SEC. 501. None of the funds appropriated by this Act may be used in any way, directly or indirectly, to influence congressional action on any legislation or appropriation matters pending before Congress, other than to communicate to Members of Congress as described in 18 U.S.C. 1913.

SEC. 502. None of the funds made available by this Act may be used in contravention of Executive Order No. 12898 of February 11, 1994 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations).