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(List all UCNI guidance used)



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Pu Strategy Presentation will be given to the Joint LLNS/LANS Mission Committee

Meeting by (b) (6) on Monday, December 3, 2012 in

Livermore, CA

Plutonium Strategy: Executing an interim strategy while pursuing an enduring capability

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Los Alamos National Laboratory

December 2012

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The US strategy for plutonium must be reworked

- The US stockpile modernization strategy (3+2) relied on availability of new pits
 - The 2010 DoD/DOE MOU stated a production need for 50-80 new pits per year
- Deferral of the CMRR Nuclear Facility has impacted this LEP strategy
 - As a result, both nuclear Labs are pursuing pit reuse
- At NNSA's request, an interim plutonium capability strategy was developed that could support 20-30 new pits per year
 - A reprogramming request to begin execution is pending in Congress, and FY13 funding is limited to a portion of request for accelerated vault cleanout
 - Indications are that NNSA is pursuing funding over the FY14-18 FYNRP to implement
- Adequate and sustainable pit production capability and capacity, as well as broader plutonium capabilities are still required
 - Need capital acquisition of modern Pu facilities; process equipment in PF-4 for manufacturing; and human capital to execute plutonium missions to reach 30 pits per year or greater
 - While an enduring plutonium solution is pursued, the interim strategy must be executed to provide near-term capability using key resources at LANL and LLNL

The deferral of CMRR NF caused LANL to begin to re-evaluate options for an enduring plutonium capability

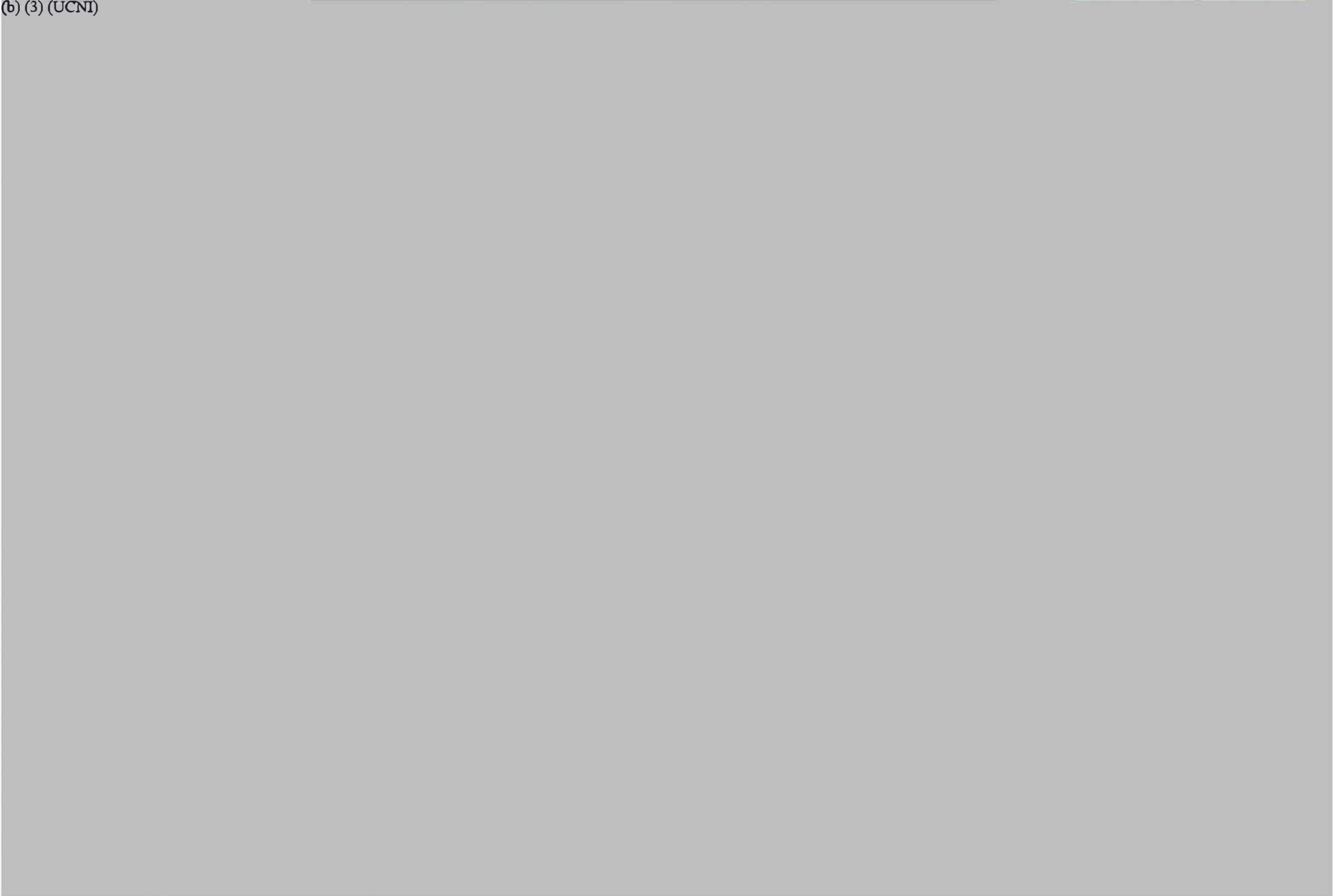
- Two parts of the plutonium capability require investment in the near-term:
 - Plutonium Manufacturing investments for equipment and later people to increase rate production capacity
 - The interim strategy:
 - Materials Characterization and Analytical Chemistry capability at LANL and LLNL
 - PF-4 Vault Cleanout – free up space by removing legacy material
- While a solution for plutonium analytical chemistry (AC) and material characterization (MC) resulting from CMRR NF deferral is being reevaluated – consideration of replacement or life extension of the current plutonium facility (PF-4) is now also important.
 - For example, installing needed AC/MC scope in PF-4 and moving higher “material at risk” plutonium operations into new, more robust underground modules

A modular approach may be a better way to acquire new plutonium facility space

- The United States has been largely unsuccessful since the 1980's in acquiring "big box" nuclear facilities in general and plutonium facilities in particular.
 - The challenges associated with these acquisitions are getting harder, not easier.
 - These challenges can be summarized as "it takes too long and therefore it costs too much"
- Because plutonium facilities are always "modular" by design, a modular solution may be the most practical
- We are exploring a strategy where we leverage the current TA-55-PF-4 facility network, and add small laboratory modules to the existing network, rather than attempt a big-box facility acquisition

The proposed strategy is simple: We change the process from acquiring all the modules we need for decades at one time (big-box) to acquiring the modules one at a time and connecting them to a network of existing facilities.

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The proposed Pu facility acquisition approach has a greater chance for success

Current Approach (What we have)	Proposed Approach (What we want)
“Big Box” facility concept: A single facility with internal rooms/modules connected by <i>internal</i> (hallways) transportation systems	Modular additions to the existing TA-55 network: Multiple independent modules connected by <i>external</i> transportation corridors and tunnel corridors
High facility scope/complexity and sized as a single project	Smaller facility scope and size, multiple projects form a system
High total project costs drives high cash flow	Able to lower total project costs per module and to consider a <i>constant</i> cash flow acquisition
Build new big-box facility every 30-40 years	Continuous construction on modules as needed to meet changing requirements
Every facility is unique	Standard nuclear modules with some repeatable details
20+ year cycles CD-0 to CD-4	(b) (5)

Attributes of the modular approach should increase the probability of Pu facility acquisition

- **Small:** Approximately 3,000 square feet of lab space, 30,000 gross square feet
- **Limited in Scope:** The modules draw on other services on the network like entry control, change rooms, storage & shipping to save space and money.

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- **Agile:** Can be added and/or re-configured quickly to meet changing program requirements.
- **Self Contained:** Required utilities are inherent to the module (depending upon safety theme). Some may draw utilities from the RLUOB as well.
- **Secure:** Underground preferred with appropriate systems for life safety.
- **Inter-Connected:** Two tunnel systems, one for personnel and equipment, one for material.

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We will evaluate what capability should move from PF-4 into new modules, based upon prioritized objectives

- Objective: Extend PF-4 useful lifetime by removing or reducing Material-at-Risk that results in lower accident consequence

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Objective: Be responsive to future program requirements:

- Additional pit manufacturing and or ARIES pit disposition capacity
- Storage vault module
- Dedicated pit reuse line
- Augment high material-at-risk analytical chemistry capacity
- Radiography or other capabilities

Program requirements change so frequently that the programmatic purpose of the module is best assigned as close to completion as possible

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A tunnel connecting PF-4 to RLUOB can be designed to accommodate a modular future and improve sample logistics

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- Consistent with the 60 Day Study planning, a tunnel is the safest and most secure way to connect PF-4 to the RLUOB
- The tunnel can have connection “nodes” to accommodate later project phases



A possible modular end state could provide adequate capability for the future

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- A possible end state adding 24,000 square feet of lab space across 8 modules
- Depending upon future requirements, additional entry control to the network may be required
- A 2nd shipping dock is nearly required already
- As higher MAR processes are transferred out of PF-4, space in PF-4 can accommodate other missions
- Additional space is available to the west



We must also modify our execution approach to nuclear construction projects in three major areas, or we could still fail

- NEPA process must be streamlined
 - NEPA process and decisions must occur before project design team is established
 - Government must be committed to NEPA decisions before expending large sums on projects
- Requirements development and conceptual design process must be improved
 - M&Os must use small programming teams to develop requirements and concepts
 - Requirements development must be done long before a project team is established
 - Requirements must be kept as simple as possible and changes must be absolutely necessary
 - Conceptual designs need to be just that, conceptual
 - Cost estimates must consider first-of-a-kind nature of nuclear projects
- The government must understand what cost ranges and uncertainties mean
 - Early cost estimates and ranges are almost always inaccurate.
 - It is more important to obtain facilities that can support missions at a practical cost than following a process that always results in increased costs.
 - The current deliberate decision and change control process adds to costs and schedule, oftentimes without commensurate benefit
- NNSA should also strongly consider pursuing DoD-like funding process for large construction and shipbuilding projects

Time is money

An enduring Pu Strategy that significantly extends the life of PF-4 and builds separate modules may provide the agility needed to support the stockpile

- Plutonium manufacturing investment and the interim Pu strategy must be pursued while the enduring strategy is developed and implemented
 - The \$120M reprogramming request at Congress to initiate the interim strategy is key
- The modular concept addresses most of the fundamental barriers to facility acquisition with a manageable scope and more importantly, schedule.
- Having an agile facility strategy in combination with near term plans to acquire new Plutonium space could potentially satisfy both customers and stakeholders

We need to further evaluate this concept to ensure that we don't uncover fatal flaws and to refine the approach. This capability is too important for the mission.

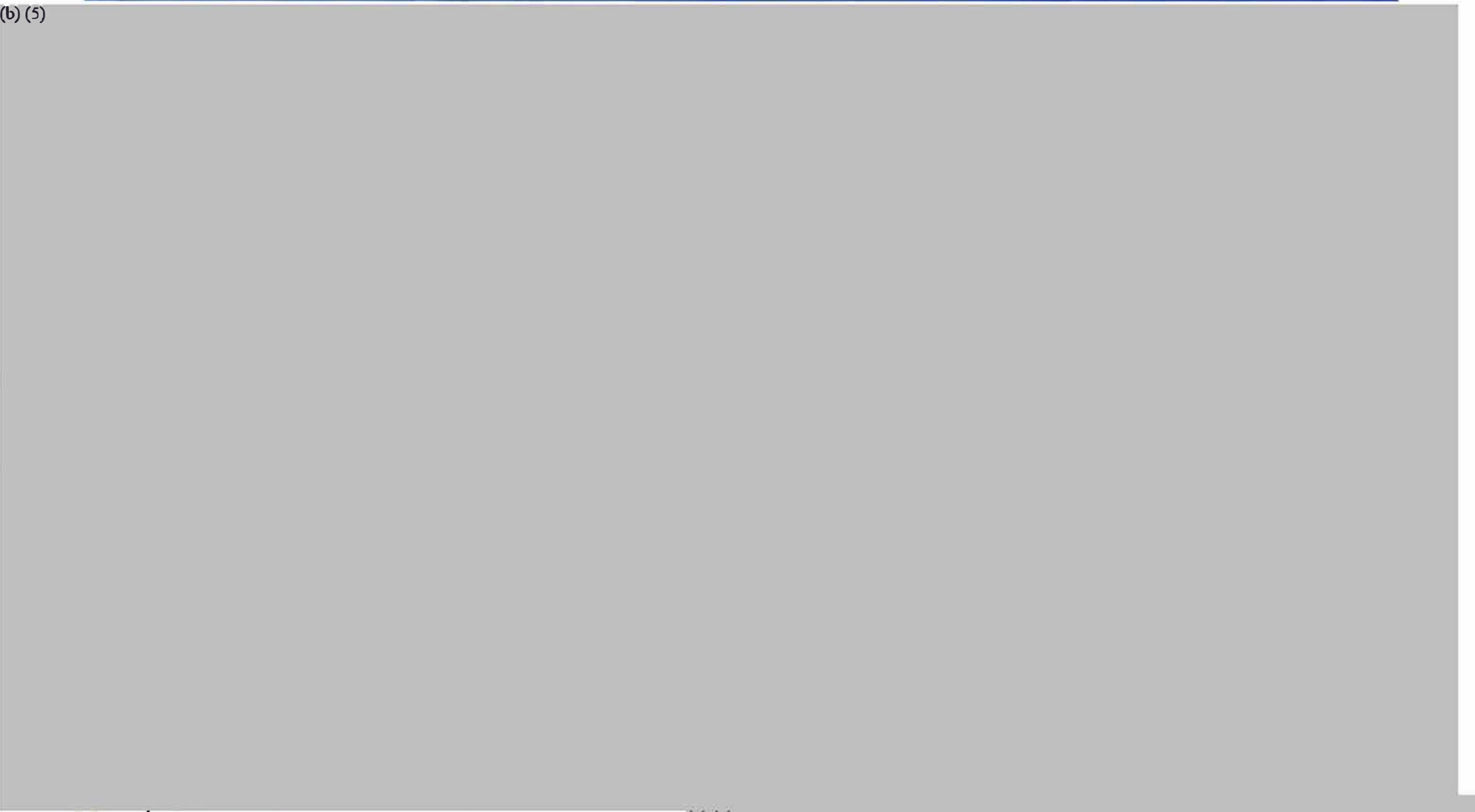
Backups

Key points

- Deferral of CMRR has shifted the national warhead Life Extension planning basis for Interoperable Warheads 1 & 2 (W78 and W88) from expectation of new pits to one of new pits plus reused pits
- Funding in FY13 does not achieve 30 PPY in people, machines, and facilities, but we are expecting to see funding in FY14-18 planning
- After announcement of the deferral of CMRR NF, LANL developed an “interim” strategy until we can fully develop an “enduring” strategy
 - This largely makes better/more use of existing facilities
- We are considering an alternate acquisition approach that merges PF-4 and CMR replacement using PF-4 and a modular configuration

Budget Required for Plutonium Manufacturing

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The interim Pu capability must be executed for the short-term, regardless of enduring path forward

- Interim capability plan is to maximize the use of the CMRR-RLUOB and space in the plutonium facility for analytical chemistry

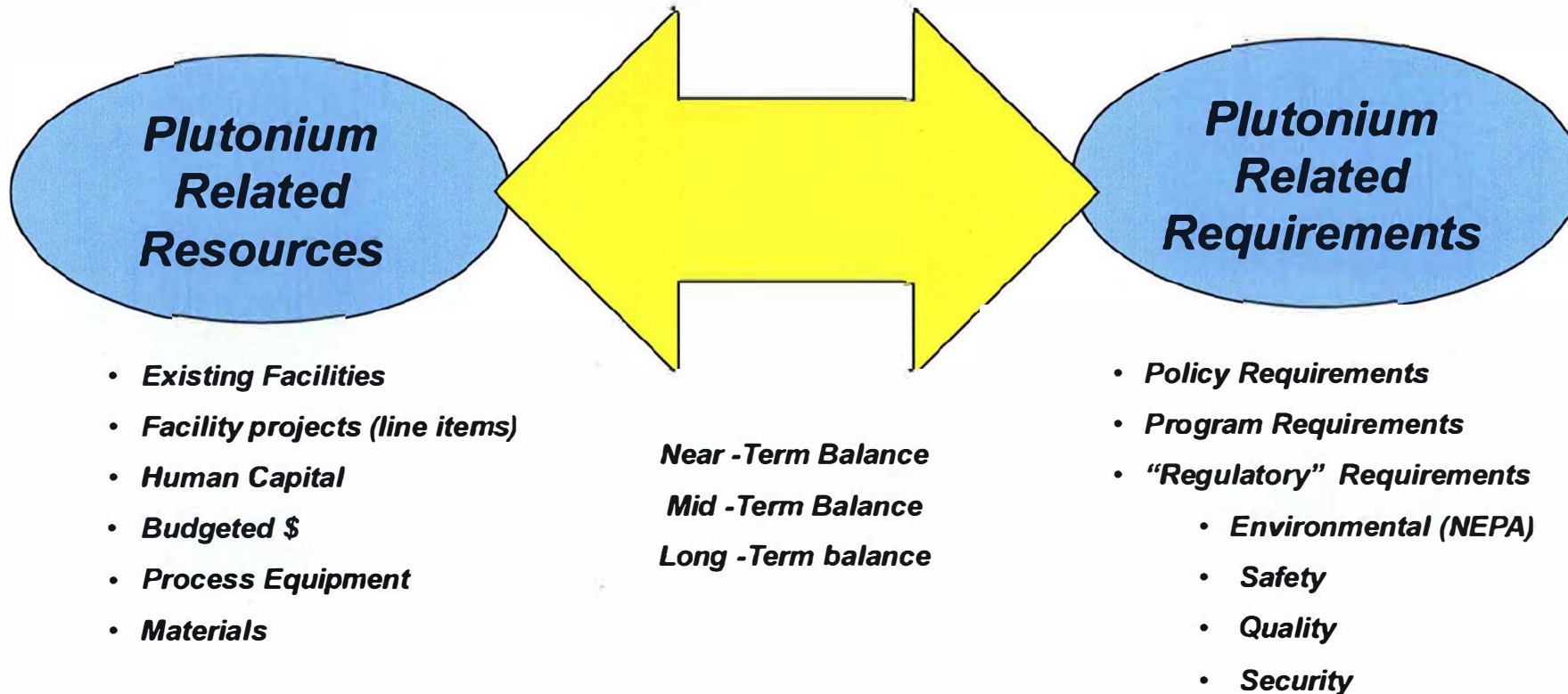
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- Material characterization will be performed in the LANL plutonium facility and at LLNL Superblock
- Recovering vault space in the plutonium facility and managing transuranic waste effectively will be important

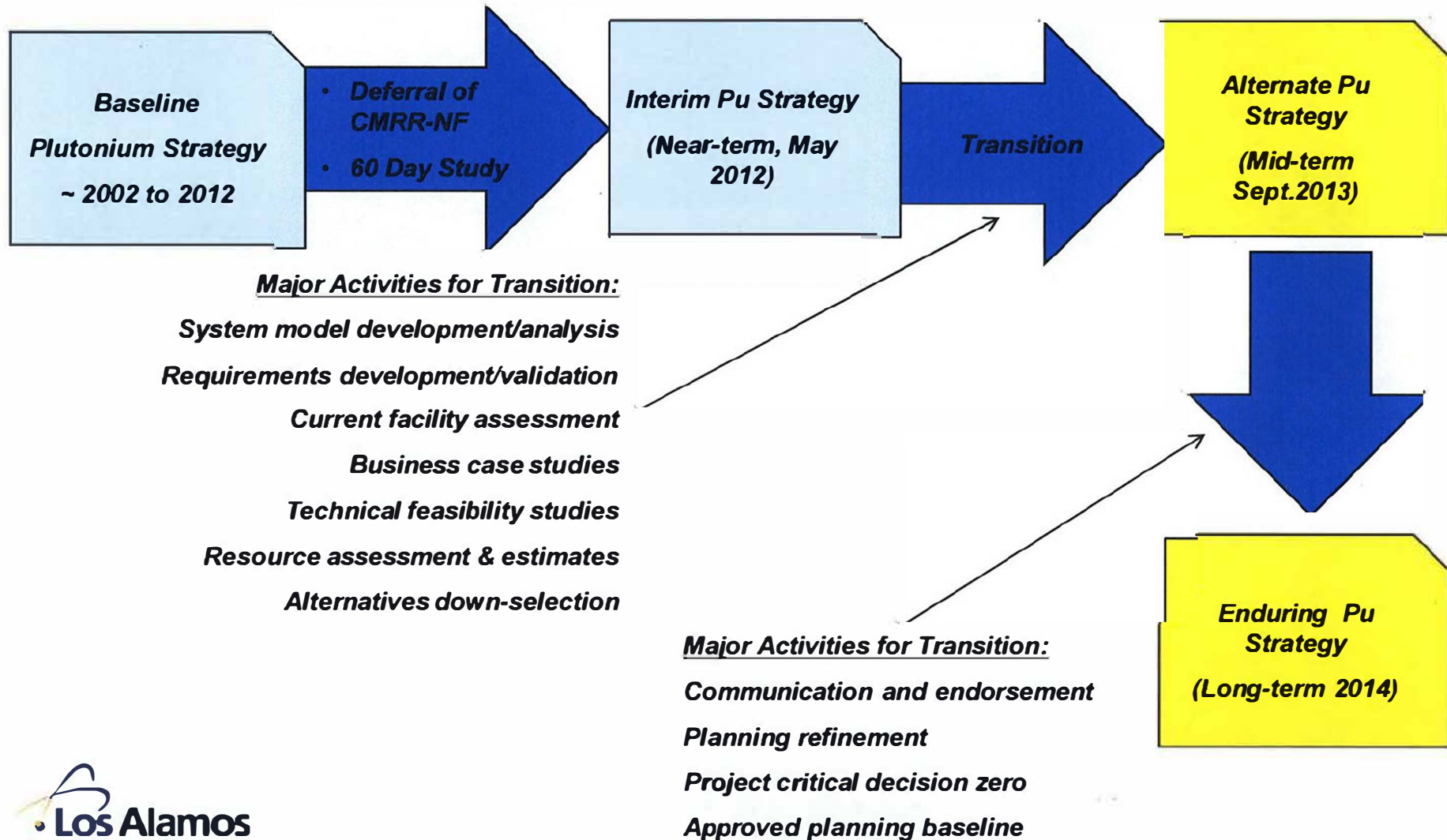
It will take significant effort to reach a 20-30 pit per year support capacity

A Pu strategy maintains balance between resources and requirements



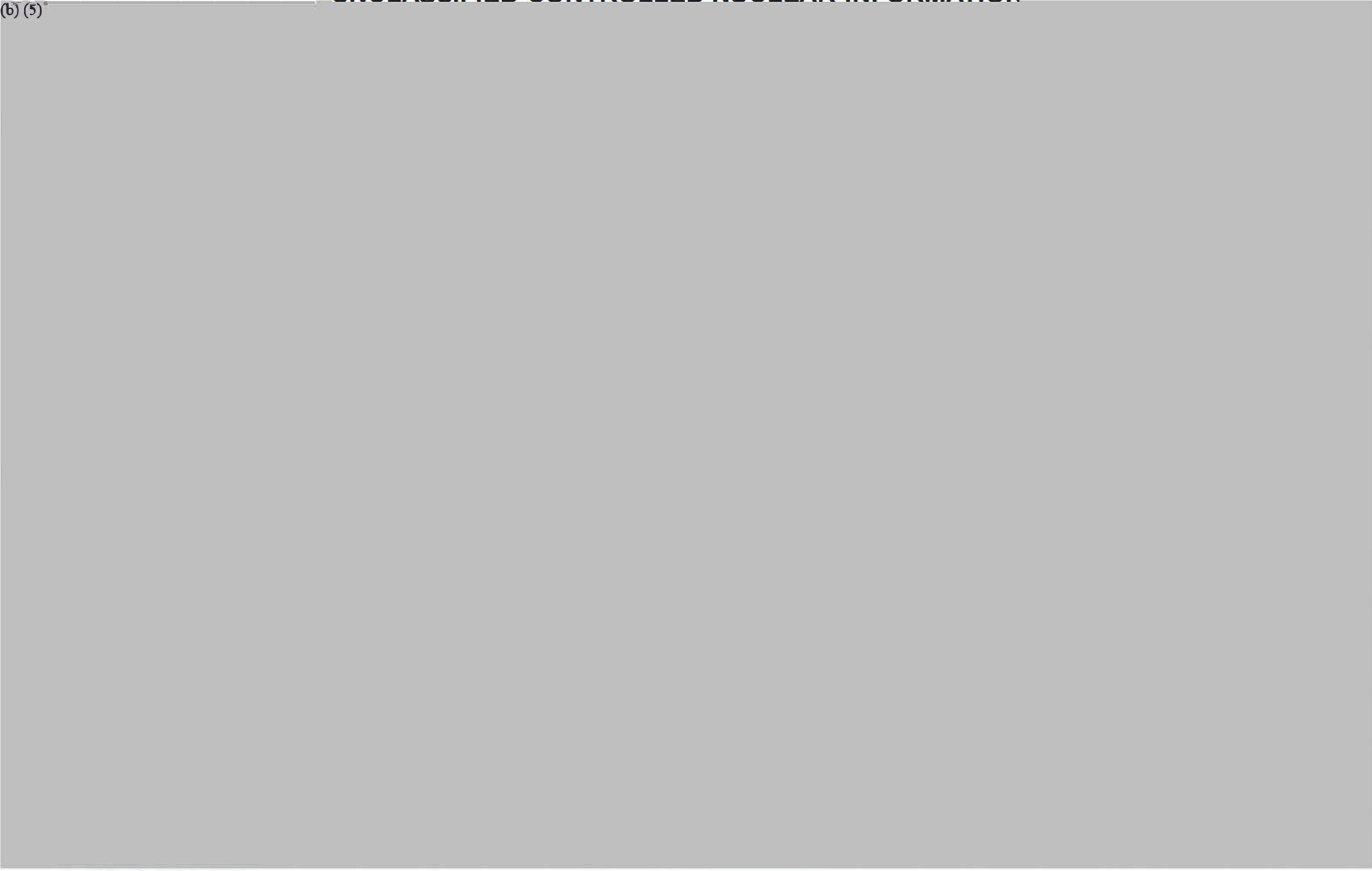
A plutonium strategy will be used to analyze gaps between resources & requirements, determine and plan the best approach to minimizing these gaps, and assigning the remainder as risk

The plutonium strategy for the stockpile has changed and will require detailed planning to reach an enduring strategy



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Presentation key points

- The Deferral of the CMRR Nuclear facility erased a decade of Integrated Nuclear Planning virtually overnight
- An “Interim” plutonium strategy was developed in 60 days leveraging existing facilities at LANL and elsewhere
 - Pit Mfg capacity planning to support future LEP’s shifted from 50-80 new pits/yr to ~ 30 pits/yr, a substantial reduction
 - This is an unacceptable boundary condition for LEP planning
- We need to develop an “Enduring” plutonium strategy that addresses the major gaps in the program
 - Capital acquisition of safe, secure Plutonium facilities
 - Process equipment needs in PF-4 for manufacturing
 - Human capital to execute plutonium missions

The cost and schedule to acquire new nuclear facilities has resulted in the consolidation of all major Cat I/2 nuclear scope into PF-4

Plutonium Strategy supports reentry system portion of the 3+2 stockpile strategy

Navy D5 Missile

Current Air Carried (+2) portion of the 3+2 stockpile strategy relies solely on reused pits

- W76-0 → LEP → W76-1 Mk4 (1)

Pits

- W88-0 → LEP → W88-1 Mk5/M21* (IHE) (2)

Interoperable between ICBM and SLBM

MMIII

- W78 → LEP → W78-1 Mk21*/Mk5 (IHE) (3)

Pits

- W87 (IHE)

* Also Discussion about Mk12a



Pit manufacturing not part of the 3+2

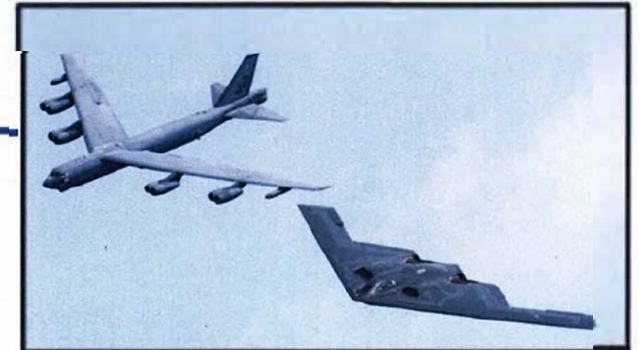
Bomb (already IHE)

- B61-3,4,10,7 → LEP to B61-12
 - B61-11 is maintained without LEP
 - B83 is maintained without LEP

Cruise Missile (already IHE)

- W80-0,1
 - W84 (3 warhead options)
- LEP into LRSO

Interoperable between Bomb and
Cruise missile - Desirable



(1)

(2)

Plutonium mission at LANL

- Plutonium – Understanding (science)
 - Nuclear weapons
 - Nuclear energy
 - Forensics
- Pits for the stockpile
- Power sources
- ARIES – Pit disposition
- Disposition of legacy Materials



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The CMRR Project Concept Comprised Two Buildings



CMRR RLUOB Facility is complete. Startup of Laboratories will be initially completed in FY13
CMRR-NF has been deferred at least 5 years



Current Plutonium Production Schedule for DoD (if funded)

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Significant investments in facility infrastructure, process equipment, skilled workforce, and manufacturing systems must occur early for these two production plans to be successful.

Accelerating the radiological laboratory utility office building material-at-risk limit will allow improved analytical chemistry capacity to be achieved

- Changing the material-at-risk levels from 6g weapons grade plutonium to 26g requires several key activities to be accomplished
 - Updating of the Documented Safety Analysis
 - Revision of facility procedures
 - Revision of the Radioactive Material Air Permit (NESHAPS)
 - Readiness assessment of facility processes

Current pace will not increase RLUOB capacity until 2016 at the earliest given expected budgets

The government has a poor track record in first of a kind construction projects, like large nuclear facilities

- Large nuclear design and construction projects take over 20-years to execute with many stops, starts and changes in direction
- National Environmental Policy Act (NEPA) activities associated with these large projects are often revisited and challenged, which adds to duration, cost and overall risk to acquire
- DOE Capital Acquisition process, though logical, adds time to execute projects, resulting in cost increases
- Congressional actions over > 4 administrations require affirmation, education and add to cost and schedule
- Requirement volatility over long acquisitions also lead to increases in time and cost
- Contractor's inadequate control of changes to design lead to cost increases or changes that result in unintended consequences

All of these time slips occur while a large EPC team is operating, causing large costs without commensurate benefit

Additional Analytical Chemistry Equipment that supports increased capability and capacity can be procured with reprogrammed funding

- Procurement would begin for the following Analytical Chemistry instruments and equipment
 - Inductively Coupled Plasma Atomic Emission Spectrometer (Trace Elements)
 - Inductively Coupled Plasma Mass Spectrometer (Trace Elements)
 - Separations equipment, such as column chromatography (Trace Elements)
 - Thermal Ionization Mass Spectrometer (Isotopics)
 - Gas Mass Spectrometer (Gas Analysis)
 - Alpha Spectrometers (Radiochemistry)
 - High Purity Germanium Detector Gamma Spectrometer (Radiochemistry)
 - Microwave digestion system and other sample dissolution equipment
 - Ion Chromatographs (halogen analysis)
 - Pyrohydrolysis sample preparation equipment (halogens)
 - Carbon, Nitrogen, and Hydrogen analyzers
 - Ultraviolet/Visible spectrometer

Some of these highly complex instruments require a long lead-time; not all will be procured with reprogrammed funding

Planning must begin for preparing the laboratories for installation and readiness activities

- Analytical chemistry in RLUOB and PF-4
 - Preparing laboratories for installation includes some enclosure procurement and installation, as well as finished utility connections
 - Procedures have to be written or modified as part of getting ready to operate
 - Documentation must be prepared to confirm readiness
 - Then readiness must be demonstrated via readiness assessments
- Material characterization in PF-4
 - Similar activities to Analytical Chemistry

Initiating engineering and design options for a robust material transfer capability is required for future operations

- Opportunity still exists to redirect a small portion of the CMRR-NF engineering team to evaluate and initiate a design for a material transfer tunnel
 - Careful examination of future use is required
 - If a tunnel concept is pursued, must not interfere with future building footprint in existing excavated area

413 Acquisition for Nuclear is Challenging

- Long Acquisition Time Periods ~ 20 years
 - 20 DOE PPBE budget cycles
 - 5 administrations, 10 congressional terms, 4 senate terms
 - Change in requirements cycle ~ annually, you are constantly chasing changes (Stockpile size, composition, Security requirements, Seismic requirements, etc)
 - Deferral seems the easiest course of action all too often....
- High Cash Flows
 - Peak cash flows in constrained budgets require a significant percentage of NSNA budget
 - Requires difficult and unacceptable trades between line items and other program work
 - There are so many regulators and stakeholders that holding to pre-CD-2 cost estimates has proven impossible
- We acquire these so infrequently, we never really get proficient.

There remain significant challenges to acquiring big box nuclear facilities, if anything, the acquisition process will more challenging over the next 2 decades absent structural change to the process

What ends the useful lifetime of a nuclear facility?

- When the cost to upgrade the facility to an acceptable level of regulatory compliance approaches the cost of a new facility or the facility is otherwise impossible to upgrade.....
- When the mission changes in a way that the facility is either not required or the work is less expensive at another facility.....
- All existing facilities suffer from regulatory “creep”. At some point, the regulatory envelope intersects with planned operations and alternative solutions will be considered

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Plutonium facilities are modular by design!

- You never want a single contamination incident to take out the whole facility. Build modules and network with Xport systems
- Typical module sizes run between 1,500 sq ft for PF-4 to perhaps 5,000-8,000 square feet in high capacity production facilities
- Technology improvements have generally made process equipment smaller and faster as well as enabling new processing methods
- For most things we might want to do in the future, a module of ~ 3,000 square feet is a good starting point

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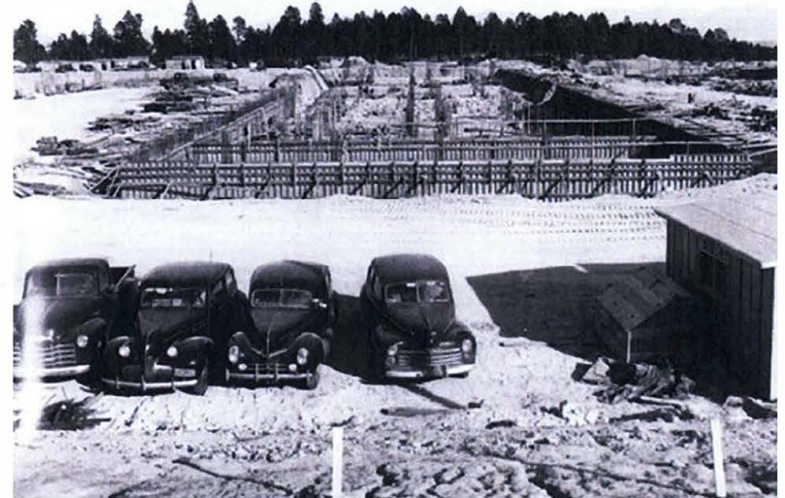
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Modules inside the facility form a network, if you already have a facility, you can add modules externally and network them.

Chemistry and Metallurgy Research (CMR) Facility operational for 60 years

- Provides critical scientific capabilities to support all plutonium operations and research
- Approximately 550,000 sq. ft.
- Wings 2, 3, 4, 5, and 7 for analytical chemistry and material characterization work. Wing 9 contains hot cells
- 1998 Los Alamos identified earthquake fault under CMR
- Studies of potential seismic upgrades to CMR concluded that the best solution was perform interim upgrades to CMR sufficient to last until completion of a replacement facility

CMR Construction site 1950



Current CMR Status

- Operations in CMR have been reduced over the last 10 years. Only Wings 5, 7, and 9 are operating
 - Most metallurgical (material characterization) operations in CMR have been curtailed
 - Analytical chemistry operations consolidated into Wings 5 and 7
 - Wing 9 hot cell work continues

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Phase 2: First Modular Addition to the Network

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– Provides the structure as a “repeatable detail” for future modules

- Expect to include all required utilities inside the module to be self-sufficient

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- Constructed above ground with option to bury when completed
- Internal configuration similar to PF-4 for program versatility



Summary Facility Strategy for Level 1 Pu Facilities*

<u>Facility</u>	<u>Sec Ct</u>	<u>Haz Cat</u>	<u>Near Term</u>	<u>Mid-Term</u>	<u>Long Term</u>
TA-55 PF-4	I	2	Operate and Upgrade	Operate and Upgrade	Operate
CMR	III	2	Operate	Terminate Program Operations	Decommission
CMRR-RLUOB	III	Rad	Take hot at 6 gm level	Promote to 26 gm level	Operate at 26 gm
TA-54 TRU	III	2	Operate	Replace	Operate replacement
RLWTF	III	2	Operate	Replace	Operate replacement
CMRR-NF	I	2	Examine Alternatives	Design	Construct

A modular approach cannot be successful without also solving three historical issues with NNSA construction

- NEPA process
 - DOE/NNSA NEPA process currently is so detailed that a preliminary facility design is required to answer all the questions and respond to all comments to satisfy the lawyers
 - Then, assumptions for these large projects are often revisited and challenged, which adds to duration, cost and overall risk to acquire
- Requirements development and conceptual design process
 - DOE Capital Acquisition process, though logical, adds time to execute projects, resulting in cost increases
- Change control
 - Contractor's inadequate control of changes to design lead to cost increases or changes that result in unintended consequences