Thinking Inside the Boxes:
Can Existing Buildings Meet DoD's Pit Needs?

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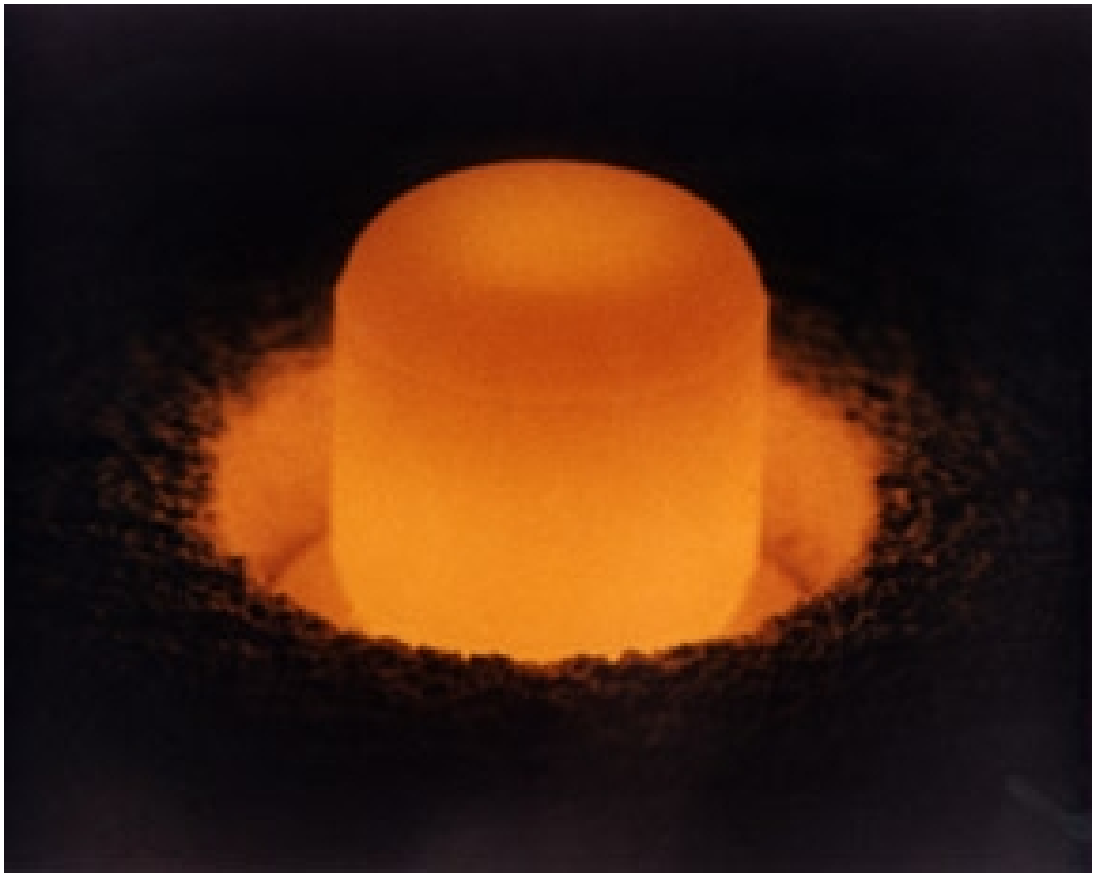
Key Terms

- Material At Risk (MAR)
- Hazard Category
- Radiological Facility
- Security Category
- Analytical Chemistry (AC)
- Plutonium-238 (Pu-238)

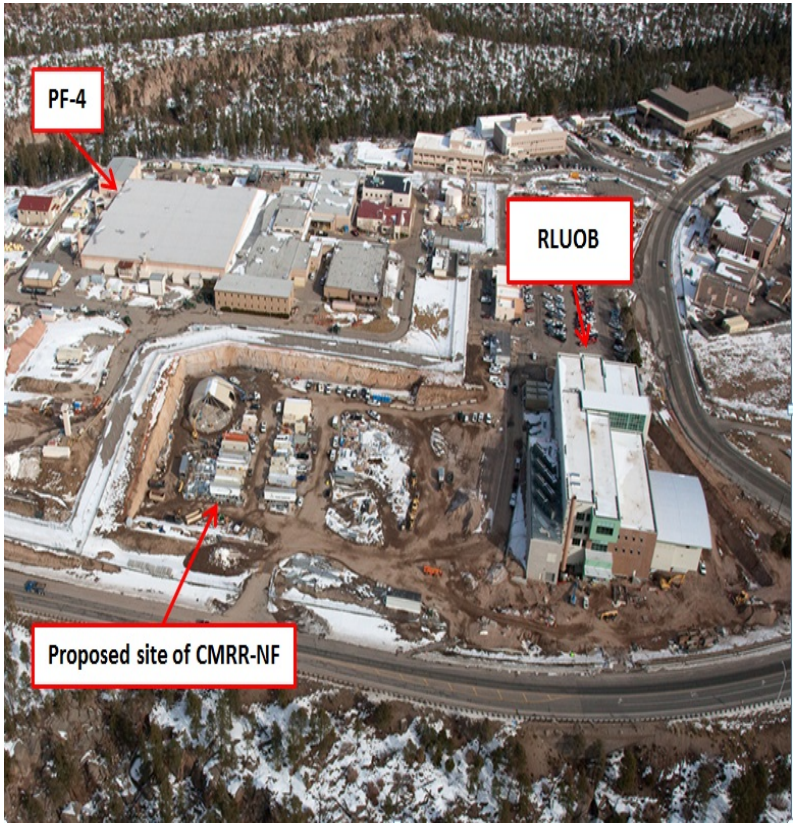
Plutonium-238



Source: Department of Energy

PF-4 and CMR

At Los Alamos National Laboratory



Chemistry and Metallurgy Research facility

Source: Los Alamos National Laboratory

A Framework for Analyzing Options

	Hazard Category (HC)	
Security Category (SC)	**High (HC-2)**	**Low (HC-3)**
High (SC-I/II)	**Task:** Pit destruction (ARIES) and casting **Buildings:** PF-4 or module (new)	**null set** (no Pu tasks require this combination of attributes)
Low (SC-III/IV)	**Task:** Pu-238 work **Buildings:** HB Line, H Canyon, PTPF (new) at SRS; Building CPP-1634 (expanded) at INL; module at LANL (new)	**Task:** AC **Buildings:** RLUOB with 1 kg WGPu; Building 332 at LLNL;* F/H Laboratory or Building 773-A at SRS

Source: CRS

*Building 332 is SC-III/HC-2. It is included in this box because the AC tasks discussed here are only HC-3.

Task: Pit Casting (and Destruction)

	Hazard Category (HC)	
Security Category (SC)	**High (HC-2)**	
High (SC-I/II)	**Task:** Pit destruction (ARIES) and casting **Buildings:** PF-4 or module (new)	

Source: CRS

Task: Plutonium-238 Work

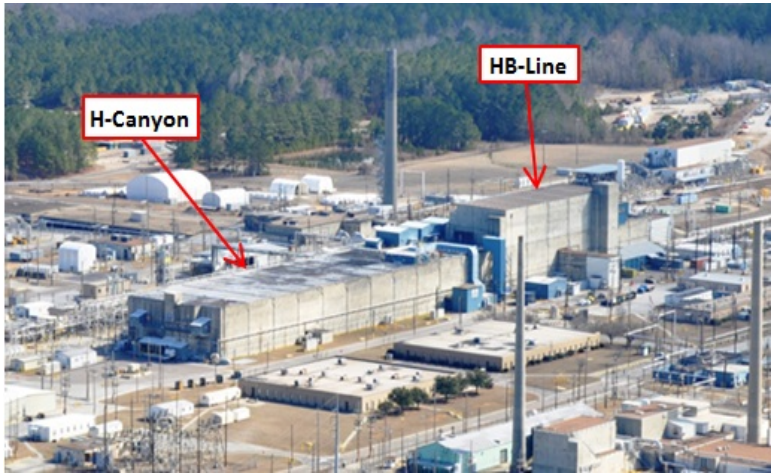
	Hazard Category (HC)	
Security Category (SC)	**High (HC-2)**	
Low (SC-III/IV)	**Task:** Pu-238 work **Buildings:** HB Line, H Canyon, PTPF (new) at SRS; Building CPP-1634 (expanded) at INL; module at LANL (new)	

Source: CRS

Pu-238 Work Outside PF-4

Building CPP-1634
Source: Idaho National Laboratory

H-Canyon and HB-Line
Source: Savannah River Site



Task: Analytical Chemistry

	Hazard Category (HC)	
Security Category (SC)		**Low (HC-3)**
Low (SC-III/IV)		**Task:** Analytical Chemistry **Buildings:** RLUOB with 1 kg WGPu; Building 332 at Livermore;* F/H Laboratory or Building 773-A at Savannah River Site

Source: CRS

*Building 332 is SC-III/HC-2. It is included in this box because the AC tasks discussed here are only HC-3.

Building 332 and F/H Laboratory

Building 332
Source: Lawrence Livermore National Laboratory

F/H Laboratory
Source: Savannah River Site

Radiological Laboratory-Utility-Office Building (RLUOB) at Los Alamos

Source: Los Alamos National Laboratory

Volume of 26g Weapons-Grade Pu

Not nearly enough to do AC for 80 ppy

Source: CRS

RLUOB Ventilation

Source: Los Alamos National Laboratory

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Title:	Preliminary Outline of Potential Tasks Required for RLUOB to Exceed Hazard Category-3 Nuclear Facility Threshold Quantity
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Intended for:	Preliminary Planning and Discussions with NNSA and other Customers
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Form 836 (7/06)

Preliminary Outline of Potential Tasks Required for RLUOB to Exceed Hazard Category-3 Nuclear Facility Threshold Quantity

I. Purpose

This document is to provide a high level outline of the activities required to upgrade Radiological Laboratory Utility/Office Building (RLUOB) to a hazard category-3 (HC-3) nuclear facility (>38.6 grams up to 2,600 grams of ^{239}Pu equivalent).

II. Scope

The outline of tasks listed below is drawn from Codes of Federal Regulations (CFR), Department of Energy (DOE) Orders (DOE O), Standards (DOE STD) and Guides (DOE G), and Los Alamos National Laboratory (LANL) internal procedures. It is aligned to functional organizations to facilitate review by line organizations and eventual scheduling.

III. Potential Tasks

Hazards Analysis

- Define source term in sufficient detail to support the hazards analysis.
- Perform hazard categorization per DOE-STD-1027, *Hazard Categorization and Accident Analysis*, and LANL safety basis procedure (SBP) 114-2, *Hazard Evaluation and Accident Analysis*.
  - Perform initial hazards screening
  - Develop hazards analysis to finalize the hazard categorization.

External Stakeholders

- National Nuclear Security Administration (NNSA) and Department of Defense (DoD)– program customers
- NNSA/Los Alamos Field Office (LAFO)
- NNSA/Chief of Defense Nuclear Safety (CDNS)
- Defense Nuclear Facilities Safety Board (DNFSB)
- Interested Parties (public)

National Environment Policy Act (NEPA)

- Develop an environmental assessment per 40CFR1508.9, *Environmental assessment*.
- Develop an environmental impact statement if required by 40CFR1501.4 (*Whether to prepare an environmental impact statement*) in accordance with 40CFR1502 (*Environmental Impact Statement*) and DOE O 450 (*Environmental Protection Program*) and O 451.1B (*National Environmental Policy Act Compliance Program*)
- Review and update the Air Emission and Rad-NESHAP [1]Permit

Safety Analysis

- Develop safety design strategy per SBP 114-1, *Safety Basis Development for Projects*
- Develop conceptual safety design report per SBP 114-1
- Develop preliminary safety design report per SBP 114-1

[1] EPA National Emission Standards for Hazardous Air Pollutants for Radionuclides (Rad-NESHAP)

- Develop documented safety analysis (DSA) and technical safety requirements (TSR)[2] per DOE- STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis* and per SBP 114-1

  Note: These documents are not different documents, but evolutionary stages in the documentation of the safety basis.

Engineering

- Develop system adequacy analysis per Engineering Administrative Procedure (AP)-341-515
- Develop safety design report per DOE-STD-1189, *Integration of Safety into the Design Process*.
- Develop preliminary safety design report per DOE STD 1189.
- Identify vital safety systems per AP-341-101
- Determine critical characteristics for design of safety related items per AP-341-607
- Perform commercial grade dedication per AP-341-703
- Develop functions and requirements documents per AP-341-601
- Develop requirements and criteria document per AP-341-602
- Identify and procure critical spare parts per AP-341-521
- Develop instrument set point calculations per AP-341-613
- Develop software change packages per AP-341-507
- Develop management level determinations per AP-341-502
- Update master equipment list per AP-341-404
- Maintain technical baseline per AP-341-616
- Develop system procurement specifications per AP-341-609 and 610 as required
- Develop design and analysis for seismic upgrades as required. RLUOB safety Structure, System and Components (SSCs) are not currently required to be operational following a seismic event per LAFO direction.
- Develop design and analysis for fire protection upgrades as required
- Develop design, analysis and procurement documentation for building out new laboratory modules (i.e. gloveboxes and hoods) as required
- Review and approve detailed system and equipment design
- Develop test procedures to re-commission existing systems and commission new systems Per Engineering Standard Manual (ESM) chapter 15
- Implement International Building Code (IBC) per ESM chapter 16 for required modifications
- Update pressure safety certifications per ESM chapter17 for new or upgraded systems
- Identify new component labels and tags
- Update record drawings/develop as-built drawings

Fire Protection

- Identify major fire scenarios and special fire considerations for input to likely SSC designation

[2] TSR is the ~~minimum set of requirements to~~ keep nuclear facility in safe operations based on each nuclear facility's documented safety analysis.

- Develop updated Fire Hazards Analysis per DOE G 151.1-1 *Emergency Management Guide*, DOE O 420.1, *Facility Safety*, DOE O 440.1, *Worker Safety and Health Program for DOE*, DOE G 420.1-3, *Implementation Guide for DOE Fire Protection and Emergency Services Programs for Use with DOE O 420.1B, Facility Safety*, and 10CFR851, *Worker Safety and Health Program*.
- Update fire barrier design and fire areas if needed
- Determine required fire protection system modifications such as a diesel driven fire pump and fire water storage tank.
- Perform Fire Marshall reviews and inspections

Criticality Safety

- Determine criticality potential and develop input to hazard categorization per DOE O 420.1B, DOE STD-3007, *DOE Standard Guidelines for Preparing Criticality Safety Evaluations at Department of Energy Nonreactor Nuclear Facilities*, and DOE G 421.1-1, *Criticality Safety Good Practices Program Guide for DOE Nonreactor Nuclear Facilities*.
- Develop criticality control philosophy and criticality guidance for design
- Develop updated criticality design requirements during preliminary design
- Update criticality limits and controls during detailed design
- Incorporate criticality controls into TSRs and operating procedures.
- Develop critical safety evaluation document and safety limits for operations

Radiation Protection

- Develop As Low As Reasonably Achievable (ALARA) strategy per 10CFR835, *Occupational Radiation Protection* and DOE G 441.1-1B, *Radiation Protection Program Guide*
- Perform preliminary shielding analysis considering material location and quantity
- Develop ALARA considerations in design
- Identity contamination control upgrades and zoning
- Develop final shielding analysis
- Develop final ALARA review
- Develop final monitoring plan and procure required monitoring equipment

Quality Assurance (QA)

- Update QA Plan per 10CFR830, *Nuclear Safety Management*, DOE O 414.1C, *Quality Assurance*, and NQA-1, *Nuclear Quality Assurance*.
- Implement added QA requirements
- Perform QA assessments and audits

Security

- Determine and convert uncleared lab area to a secured area is necessary
- Develop draft safeguards requirements identification per DOE O 470.3 *Graded Security Protection Policy* and O 470.4, *Safeguards and Security Program*
- Develop final material control and accountability (MC&A) plan

Training

- Perform job task analyses and establish training implementation matrix for RLUOB as a nuclear facility per DOE O 426.2, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*
- Implement appropriate Conduct of Training
- Establish Operator's qualification requirements for HC-3 Nuclear Facility in RLUOB
- Qualify personnel for the qualified nuclear facility positions such as Nuclear Facility Manager, Nuclear Facility Operator, Cognizant System Engineer, etc.
- Certify fissile material handlers and glovebox workers

Operations

- Revise operations protocol process to support construction
- Implement appropriate Conduct of Operations
- Update operations procedures as required

Maintenance

- Upgrade preventive and predictive maintenance instructions as required
- Upgrade maintenance program for full compliance to DOE O 433.1B, *Nuclear Maintenance Management Programs (NMMPs) Guide* for nuclear facilities
- Install new component labels and tags

Environmental

- Update Permits & Requirements Identification (PRID) for RLUOB facility operations, analytical chemistry operations and supporting functions

Emergency Preparedness

- Develop emergency preparedness hazard survey and screen per 29CFR1910.119, *Occupational Safety and Health Standards*, 40CFR68, Chemical Accident Prevention Provisions, and DOE O 151.1C, *Comprehensive Emergency Management*
- Update to the emergency plan and training

Radiological and Hazardous Waste Management

- Update primary waste streams and waste profiles
- Update chemical management plan
- Design and install additional waste management capabilities in RLUOB
- Update waste procedures and waste profiles

Industrial Hygiene and Safety

- Update RLUOB chemical management plan
- Update other industrial hygiene and safety requirements

Construction Planning

- Develop construction safety plans
- Develop construction cost and schedule
- Develop construction quality assurance plan
- Develop construction procurement plan
- Develop construction document control plan
- Develop construction inspection and testing plan
- Develop equipment and materials storage and staging areas
- Perform construction to outfit lab and upgrade facility systems if needed

Commissioning

- Develop commissioning plan
- Execute test and balance
- Execute commissioning
- Construction turnover to operations

Operational Readiness Review (ORR)

- Personnel training, equipment and operational dry runs
- Preparation and conduct Management Self-Assessment
- Preparation and conduct Contractor Readiness Review
- Preparation and conduct DOE Operational Readiness Review (per DOE O 425.1D, *Verification of Readiness to Start up or Restart Nuclear Facilities*)

Materials and Supplies

- Stock laboratories with necessary materials and supplies

Personnel Relocation

- Relocate critical staff into RLUOB as required

External Reviews

- DOE, DNFSB, Project Reviews

Next Steps

1. Safety Basis scoping study for RLUOB to exceed HC-3 nuclear facility threshold quantity
2. Review and comment of required tasks by functional organizations.
3. Facility scoping review
4. System adequacy assessment
5. Parse activities into project management phases
6. Create logic network and milestones
7. Develop schedule and cost estimate

Dose from a Pu Spill and Fire in RLUOB

Type and Quantity (g) Pu		Dose (rem) to:	
Pu-239E	WGPu*	MOI**	CW**
38.6	26	0.01	0.27
750	505	0.25	5.20
1,500	**1,010**	**0.49**	**10.41**
2,610	1,760	0.86	18.11
Dept. of Energy guideline*		**5-25**	**100**

Source: Calculations by Los Alamos National Laboratory

* Weapons-grade plutonium (WGPu) is more radioactive than Pu-239; 1 g WGPu is as radioactive as 1.48 g Pu-239.

** MOI: maximally exposed offsite individual (at site boundary). CW: collocated worker, 100 meters from building that has released plutonium. Dose standards are from U.S. Department of Energy, DOE Standard: Integration of Safety into the Design Process, DOE-STD-1189-2008, March 2008, pp. A-5, A-6.