LA-UR-12-00634
Approved for public release; distribution is unlimited.

Final Report, Data Call to Support the Surplus Plutonium Disposition Supplemental Environmental Impact Statement

Steven R. Booth
Drew E. Kornreich
John Isaacson
Steven D. McKee
Jennie A. Richardson

February 2012

Illustration:

Front Cover – Aerial view of TA-55 and the Plutonium Facility at Los Alamos National Laboratory.

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by the Los Alamos National Security, LLC for the National Nuclear Security Administration of the U.S. Department of Energy under contract DE-AC52-06NA25396. By acceptance of this article, the publisher recognizes that the U.S. Government retains a nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

TABLE OF CONTENTS

I. INTRODUCTION.....5

II. PRODUCTION SCENARIO AND EQUIPMENT LIST.....5

III. CONSTRUCTION AND MODIFICATION AT PF-4.....6
- A. Description of Modifications to PF-4.....6
- B. Construction Time Horizon.....7
- C. Air Pollution Equipment Required for Construction.....7
- D. Impacts to Construction Workers.....7
- E. Other Construction Impacts.....9

IV. PIT DISASSEMBLY AND CONVERSION OPERATIONS AT PF-4.....13
- A. General Plutonium Operations at PF-4.....13
- B. Plutonium Metal and Oxide Production Schedule.....21
- C. Emissions of PDC Equipment.....21
- D. PDC Staffing and Radiological Exposure.....24
- E. Utilities Usage during Operations.....26
- F. Waste Generation and Transportation.....27
- G. Other Resources.....28
- H. Safety Basis Accidents.....29
- I. Transportation of Material.....35

LIST OF FIGURES

1. Equipment requirements as a function of plutonium throughput 6
2. Possible layout of construction subcontractor trailer and parking area.....13

LIST OF TABLES

1. Time Horizon for PF-4 Construction Projects 8
2. Construction Workers Over Time 8
3. Total Construction Waste for PF-4 10
4. Actual Air Emissions from PF-4, Calendar Year 2010.....12
5. Air Pollutant Emitting Equipment.....22
6. Annual Air Pollutant Limits 24
7. Staff Resources (FTEs).....25
8. Total Operational Waste and Shipment Parameters for
No Action Alternative.....27
9. Total Operational Waste and Shipment Parameters for Action Alternative 28
10. Safety Basis Accident Impact Parameters 30
11. Material at Risk and Safety Basis Accident Factors 33

I. INTRODUCTION

Based on conclusions of a recent pit disassembly and conversion (PDC) alternatives study[1], the plutonium facility at Los Alamos (TA-55-4, "PF-4") may be a viable location for converting pits into a feed material for making mixed oxide fuel rods at SRS. The alternatives study was separate from the on-going effort to develop a Supplemental Environmental Impact Statement (SEIS) for Surplus Plutonium Disposition. NNSA has decided to include the Los Alamos option in the NEPA analysis. An NNSA memorandum "Data Call to Support the Surplus Plutonium Disposition Supplemental Environmental Impact Statement" received on October 26, 2011 directed Los Alamos to gather data in support of this effort.

This report provides data for incorporation into the SEIS being written by SAIC, Inc. under contract to NNSA. To create the bounding conditions for the NEPA estimates, a production level of 2.5 metric tons (MT) per year of either plutonium oxide or metal is used for the Action Alternative. Impact estimates for both material types are made, and whichever is determined to be bounding will be included in the SEIS. The No Action case is the existing ARIES program to produce 2.0 MT of oxide total.

Responding to the data call requires several areas of expertise. Los Alamos subject matter experts and process modeling analysts estimate equipments lists, facility modifications, waste quantities, labor needs and radiological doses. Los Alamos NEPA experts assist SAIC in compiling existing data from the LANL SWEIS and CMRR EIS for public and other impacts. The structure of this report follows directly from the original data call, with specific data call elements denoted in red text.

II. PRODUCTION SCENARIO AND EQUIPMENT LIST

In the Alternatives Study, Los Alamos participates in Alternatives 3 (2 MT/y—metal and oxide), 5 (1.3 MT/y—oxide), 7 (1.5 MT/y—metal), and 7A (1.9 MT/y—metal). The SEIS data call considers a larger production than any of these options: 2.5 MT/y of metal or oxide. To calculate the NEPA impacts based on this production rate, the hypothetical scenario is to install a full (2.5 MT/y) metal production equipment line and the same for oxide. So PF-4 would be equipped with capability to handle full production of either metal or oxide. This bounds the NEPA construction impacts because both equipment lines would be included. To calculate operational impacts, whichever line gives the largest impacts will be used. This production scenario was accepted by NNSA.[2]

The equipment that must be installed inside PF-4 to accomplish the production scenario is described here. The planned facility modifications are derived largely based on a deterministic model of the ARIES operation built in Microsoft Excel™. The primary result of the modeling is a list of equipment requirements as a function of the final throughput in kg-Pu/y. The equipment requirements for the 2.5 MT/y throughput capacity are provided in Figure 1. The requirements assume single-shift, 40 hours/wk operations, and include a suite of facility downtimes. The maximum level of metal or oxide (2.5 MT Pu/y) throughput is shown in the figure as a solid

[1] MPR Associates, Inc., "Pit Disassembly and Conversion Project – Evaluation of Alternatives," MPR-351 DRAFT, October 2011.
[2] Sachiko McAlhany (NNSA), personal communication, October 27, 2011.

horizontal line. Each new piece of equipment added in any column has a different color. The number of copies of equipment for any given throughput level can be determined by counting colors.

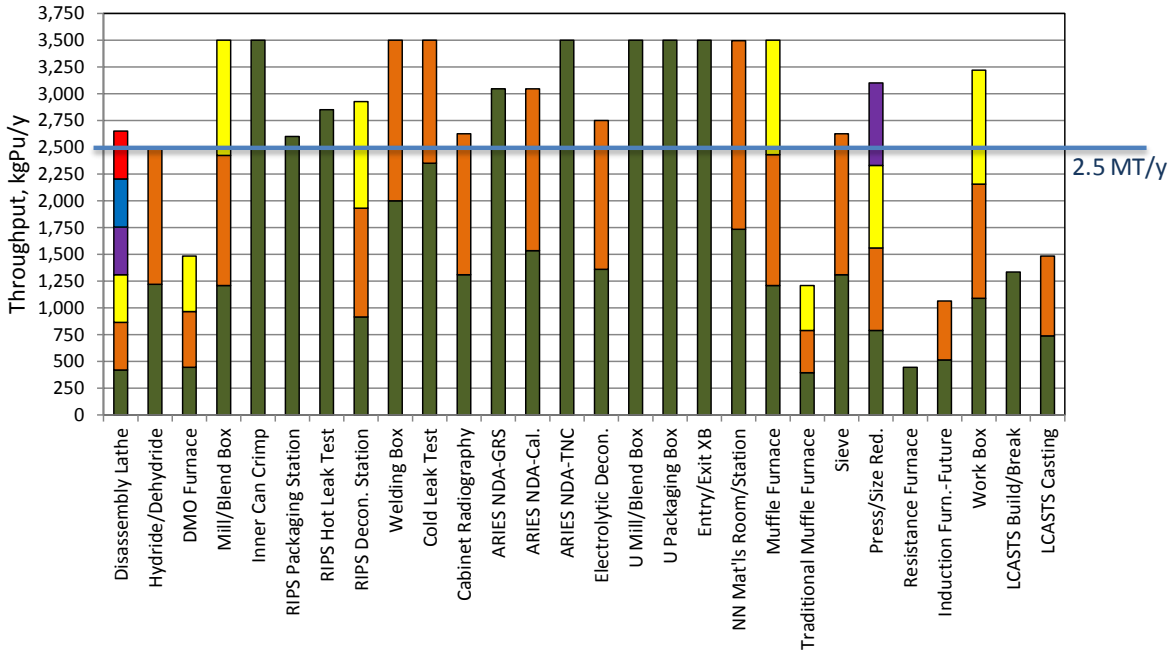


Figure 1: Equipment requirements as a function of plutonium throughput. Each piece of equipment added in any column is denoted with a different color.

The modeling included analysis of various options for metal production on the right side of Figure 1. The various metal-conversion alternatives are additive in that they independently can support the throughput shown.

> Metal production can utilize three alternative technologies – resistance furnaces, gravity induction furnaces, and the modern foundry. Installation of the modern foundry will take several years. … The operations that apply to metal production, disassembly, packaging, and NDA have relatively high capacity per instrument with the exception of disassembly. Six disassembly stations are needed to meet the maximum capacity, as shown by the far-left bar.[3]

III. CONSTRUCTION AND MODIFICATION AT PF-4

A. Description of Modifications to PF-4

Based on the equipment list and installation plan defined above, modifications to PF-4 will occur. This includes modifications and reconfigurations of rooms, vaults, and gloveboxes where identified PDC equipment and operations for the Action Alternative will be placed.

[3] Kniss, et al., LA-CP-11-1243, p. 43.

No Action Alternative.

The existing ARIES program under the No Action Alternative has upgrades currently planned:

- Modifications of pit disassembly lathe, already operating in PF-4, that will be used by LANL's existing ARIES program,
- Installation of hydride/dehydride equipment,
- Acquisition and installation of second Pu direct metal oxidation (DMO) furnace,
- Installation of second mill/blend machine,
- Installation of four new safes in the basement, and
- Installation of new part storage boxes in two gloveboxes.

These modifications will not require any new construction project workers to implement, and will have no construction environmental impacts or waste. Consequently, in the data call response that follows, the focus is on the Action Alternative exclusively.

Action Alternative.

To achieve the Action production rate of 2.5 MT/y of metal or oxide, twenty gloveboxes must be decontaminated and decommissioned, eighteen gloveboxes modified, and eighteen new gloveboxes installed.

B. Construction Time Horizon

- *Estimated length of construction period in months.*
- *Estimated month and year that construction could start.*

If this is the selected alternative, construction work could start within six months after project approval is received, and would last approximately 96 months. The schedule used here arbitrarily assumes the project begins in FY2013. Large construction activities are the installation of the Modern Foundry and replacement of the Special Recovery Line (SRL).

C. Air Pollution Equipment Required for Construction

Describe air pollutant emitting equipment that may be required for modification, and frequency and duration of use.

Construction materials and new operational equipment will be delivered by trucks that will have nominal air emissions. Once inside PF-4 and within the HEPA-protected environment, electric-powered tools and forklifts will be used, and no criteria air pollutant emissions will occur.

D. Impacts to Construction Workers

Number of construction workers needed to support the effort (average annual and peak annual number of FTEs).

The construction will be done by a combination of resident TA-55 technicians, outside project subcontract workers (e.g., project managers and crafts), and technical experts for equipment installation. Some of the outside workers will need escorting, and, depending on sensitivities, additional security guards may be required. The count of workers is calculated by project, and ignores current PF-4 workers that would provide ancillary support to the project such as radiological control technicians (RCTs). That is, only workers who are assigned directly to the project are counted.

Table 1 shows the distribution of projects over time. Table 2 shows the number of construction workers over the eight-year time horizon (FY2013 to FY2020). Overall, the average FTEs would be about 40, with a peak of about 46 in 2015. (There will be about 60 project workers (full- and part-time), which is equivalent to about 40 FTEs.)

TABLE 1
Time Horizon for PF-4 Construction Projects

	Number of PF-4 Construction Projects Underway, by Fiscal Year (FY)								
Type of Project {1}	**FY2013**	**FY2014**	**FY2015**	**FY2016**	**FY2017**	**FY2018**	**FY2019**	**FY2020**	**Total**
D&D Gloveboxes	5	6	9						20
Modify Gloveboxes		4	4	3	2		5		18
Install New Gloveboxes		1	3	4	5	2	2	1	18
Install Cold Equipment						2	2		4
Total	5	11	16	7	7	4	9	1	**60**

{1} Construction projects are spread over two or more years. Noted fiscal year is the center of the project schedule. Pencil tank removal is included as part of glovebox D&D.

TABLE 2
Construction Workers Over Time

	Construction FTEs, by Fiscal Year (FY) {2}								
Type of Project {1}	**FY2013**	**FY2014**	**FY2015**	**FY2016**	**FY2017**	**FY2018**	**FY2019**	**FY2020**	**Total**
D&D Gloveboxes	3	4	6						13
Modify Gloveboxes		2	2	2	1		3		10
Install New Gloveboxes		1	3	4	5	2	2	1	18
Install Cold Equipment						0.5	0.5		1
Subcontract Resources	35	35	35	35	35	35	35	35	35
Total	38	42	46	41	41	37	40	36	**77**

{1} Construction projects are spread over two or more years. Noted fiscal year is the center of the project schedule. Pencil tank removal is included as part of glovebox D&D.
{2} Assumes 1,720 hours per FTE year.

Estimated number of radiological workers and annual dose to those workers (peak individual [rem] and total [person-rem]).

The exposure depends on the equipment installation list and the clean-out schedule shown in Table 1 above. The number of workers exposed to background radiation in PF-4 during construction is estimated from the crews required during the peak construction year: FY2015. Of the sixteen projects underway that year, nine are D&D efforts which have 16 workers and last about two months each. Packing eighteen months of effort into twelve calendar months means two crews will be working at the same time during part of this year, a total of 32 workers. Four glovebox modifications add fourteen workers, and three glovebox installs add fourteen more. Therefore, the total number of workers exposed will be about 60.[4] The peak individual dose to these workers will be maintained at <2 rem per year per administrative mandate.

[4] Note that this refers to "workers" rather than "FTEs."

Total background dose at PF-4 is 0.22 mrem/h (0.17 mrem/h neutron plus 0.05 mrem/h photon).[5] Natural dose is 0.025 mrem/h. So total person rem is 72,906 hours hours (for all PF-4 construction projects shown in Table 1) times 0.25 mrem/h equals 18,226 mrem, or 18 person rem associated with the Action Alternative construction projects.

E. Other Construction Impacts

Estimate of utility use required to support modifications at PF-4: electricity (peak and annual in megawatts/megawatt-hours; water (in gallons); fuel (in gallons).

Construction for the Action Alternative is expected to be a very small portion of general PF-4 activities. Only electricity is metered at PF-4. Power hand tools and electric forklifts and lab cranes will be used. The additional electricity use during the peak of construction will be less than one percent of the annual average PF-4 total. TA-55 electricity use in FY2011 is 1,200 megawatt-hours per month, with an average peak demand of 2.0 megawatts. For the year, electricity use is about 1,200 x 12 = 14,400 megawatt hours. PF-4 alone has consumption of about 8,300 megawatt hours in FY2011.

Fuel use for construction inside PF-4 will be less than 100 gallons per year on average during the eight-year construction horizon. Installing the contractor trailer will require up to 2,700 gallons of diesel for site preparation (grading, compaction, and utility trenching) and asphalting the parking area, as needed.

Sanitary water needs for each worker will be about 25 gallons per day.[6] Assuming 1,730 hours per year and eight hour days, this is about 5,500 gallons annual per FTE (25 x 217). The upper bound of construction worker annual needs is 60 x 5,500, 330,000 gallons. As a comparison, the total water usage for LANL in FY2011 is 426 million gallons.[7] Sanitary water use by construction workers will be a total of 2.6 million gallons over the eight year construction period. Contractor trailer installation will require an additional 10,000 gallons for compaction and dust control. Water use for construction purposes inside of PF-4 will be less than 100 gallons per year.

Estimated amount of waste that could be generated by construction effort (in cubic meters for solid waste and liters for liquid waste): LLW, MLLW, TRU, Haz/Chem, and non-haz.

Transportation parameters for generated waste (per type of waste) including: containers (e.g., drums, boxes, none); transport vehicles and packaging (e.g., TRUPACT-II or TRUPACT-III for TRU waste, heavy combination trucks for LLW, MLLW, and hazardous waste, rolloffs for non-hazardous waste, etc.); waste destinations (e.g., NNSS or Area G for LLW, etc.); external radiation levels of packages or shipments of radioactive wastes (TI [or millirem/hour at 1 meter]); bounding radionuclide-specific concentrations (as packaged) for radioactive wastes (curies per unit volume).

The most important factor for waste estimating is the amount and type of D&D that will occur, which is in turn dependant on re-purposing existing areas. For the Action alternative, twenty

[5] Drew Kornreich, from LA-CP-97-167 that describes background dose from PF-4 vault.
[6] Mell Smithour, ES-Utilities and Infrastructure, personal communication, December 15, 2011.
[7] Monica Witt, UI-DO, personal communication, December 15, 2011.

existing boxes will be decommissioned. Installing new boxes or modifying old ones does not create significant waste, and is ignored here. The calculation of construction waste has two parts: 1) waste associated with removing gloveboxes, and 2) waste from D&D of all other equipment and utilities in a laboratory room.

All LLW is assumed to be packaged into ST-90 (90 cubic feet) containers with maximum payload of 10,000 pounds. At LANL, almost never is the container weight-limited. A packaging efficiency of 80 percent is assumed by volume to determine the number of ST-90s needed. The destination is the Nevada National Security Site (NNSS), shipped via flat-bed trucks.

All MLLW, except for lead-lined gloveboxes, is packaged in 55-gallon drums. Drum weight capacity is 900 pounds and is almost never the limiting constraint. Assuming a campaign-method to the D&D of gloveboxes and rooms, a separate drum for MLLW will be needed for each, e.g., one for electrical, one for piping, one for mechanical. Given this assumption, Table 3 includes three drums of MLLW even though the volume could be fit into one. The destination is a commercial permitted Treatment, Storage, Disposal (TSD) site at a location yet to be determined, shipped via box truck. LANL typically ships MLLW to facilities in Washington, Tennessee, Utah, Florida, Texas, and Nevada.

All TRU waste is assumed to be packaged into standard waste boxes (SWBs), with an allowable volume of 40 cubic feet with maximum payload of 4,000 pounds. A packaging efficiency of 80 percent is assumed, and the destination is the Waste Isolation Pilot Plant (WIPP), via TRUPACT II and WIPP trucks.

TABLE 3
Action Alternative: Total Construction Waste for PF-4

Waste Type	Total Waste (ft3)	Total Waste (m3)	Container Type	Container Capacity (ft3)	Concentration per Container {4}	Number of Containers {1}	External Radiation (mrem/hr	Transport Vehicle & Packaging	Waste Destination {2}
LLW	1,320	37	ST-90	90	< 100 nanocuries/g	18	Limit: 200; actual <0.4 {3}	Flat bed Truck	NNSS
MLLW (D&D)	6	0.2	55 gal drum	7.4	< 100 nanocuries/g	3	Limit: 200 {3}	Box Truck	Commercial TSD, various locations
MLLW (GBs)	1,980	56	Custom, Type-A	1 glovebox	< 100 nanocuries/g	20	Limit: 200 {3}	Flat bed Truck	NNSS
TRU	660	19	SWB	40	< 325 g of Pe	21	Limit: 200 {3}	TRUPACT II	WIPP
Haz/Chem	-	-							Commercial TSD, various locations
Non Haz	-	-							
Liquid	-	-							TA-50, RLWTF

{1} Assume 80 percent packaging efficiency. Each glovebox custom-packed individually. Three drums MLLW assumed because of campaign-mode for electrical, mechanical, and piping work during room D&D.
{2} Definitions: Nevada National Security Site (NNSS); Treatment, Storage Disposal site (TSD); Waste Isolation Pilot Plant (WIPP); Radioactive Liquid Waste Treatment Facility (RLWTF).
{3} The regulatory limit is 200 mr/hr at any point on the external surface of the package, per Code of Federal Regulations Title 49, Part 173.441, "Radiation level limitations and exclusive use provisions." Actual value is very low, e.g., about 0.4 mr/hr for LLW.
{4} LLW: alpha-emitting transuranic elements or actinides with half-lives of greater than 20 years and a combined activity of less than 100 nanocuries per gram of waste. TRU: package limit is 325 grams of Pu239 equivalent nuclear material per solid waste box (SWB).

All gloveboxes will be shipped in specially procured Type A shipping containers fabricated to dimensions specific to each glovebox, so size is not an issue. The containers are shipped to NNSS via flat-bed trucks.

Transport vehicle capacities are as follows. WIPP trucks can haul three TRUPACT IIs per load. All LLW and MLLW destined for NNSA will be via flatbed truck with perhaps five of the custom glovebox containers per load. The commercial TSD facility will use a box truck operated by an off-site contractor that can handle the whole LANL volume in one load.[8]

Recognizing that construction or modification would occur within an existing building, provide estimates of any significant (e.g., >10%) increases in radioactive or non-radioactive emissions, noise, or liquid effluents.

HEPA filters in PF-4 will handle any air emissions associated with construction activities, with no additional radioactive or non-radioactive pollutants released. Liquid effluents to be produced by construction inside of PF-4 will be less than ten gallons and will be handled by the Radioactive Liquid Waste Treatment Facility at TA-50. All air emissions and liquid effluents are expected to be substantially less than ten percent of current emissions. Noise emissions will not emanate beyond PF-4.

During installation of a double-wide contractor trailer, earth-moving equipment is assumed for clearing and site preparation of two acres for a pad and parking lot. A grader, bulldozer, water truck, and compactor will be needed for site preparation. A back-hoe will be used for utility trenching. This will create typical transportation air pollution such as carbon monoxide, particulates from diesel exhaust, and ozone. About two months will be needed to get the site fully prepared, including the parking lot. The installation of the trailer will require about one month.[9] Given the typical amount of construction and heavy truck activity in the Pajarito Corridor, this additional air pollution will be insignificant.

In the 2008 SWEIS (Appendix C-21, Table C-14), Pu emissions are 0.0000195 curies from PF-4. Uranium emissions are not listed for PF-4, but as a site, LANL estimates a release of 0.15 curies per year (2008 SWEIS, p. 5-60). The limit for the whole LANL site for each hazardous air pollutant (HAP) is eight tons per year, with 24 tons per year for all HAPs combined. PF-4 is an insignificant contributor to this total. Actual stack releases for PF-4 are reported annually. For example, the most recent data for calendar year 2010 are shown in Table 4.

Construction Required Outside of PF-4

A project of this size will require a double-wide construction trailer to support up to 60 contract employees. This would provide room for daily project meetings, offices, lunches, and other general project needs. Parking would be required for up to 60 employees if each drives a private vehicle.[10] Total disturbed area will be less than two acres, to include the trailer, parking lot, and lay-down area. Figure 2 shows a potential layout.

[8] Ibid., p. 4
[9] Scott Marriott, MNGRFCT-ES, personal communication, January 6, 2012.
[10] Wayne Smyth, personal communication, November 29, 2011.

Ground disturbance associated with installing this temporary trailer will require the use of LANL's formal Permit Requirements Identification (PRID) process to make sure all permits are in place and no cultural or natural resources are impacted. Depending on the project, the process may include subject matter experts in site planning, archeology, geology, water resources, and ecology. Detailed resource maps are used with GPS site overlays to evaluate the impact of site alternatives. The optimal site is chosen using decision analysis to weigh multiple evaluation criteria such as cultural impacts, geology, ground and surface water, threatened and endangered species, project needs, and cost.

The PRID formal siting process has a goal to create the least land disturbance possible. In this case, priority will be given to previous trailer locations, where a pad already exists along with adequate parking and utility hook-ups. This minimizes environmental impact and lowers cost.

TA-55 is an industrial area where construction projects (including CMRR) are on-going. Because of this, available land may be difficult to find in the immediate vicinity of PF-4. Consequently, another site within the Pajarito Corridor is assumed that requires grading and compaction. This area is very well characterized for cultural and hazardous sites, and the two-acre site will be located to avoid any sensitive resources.

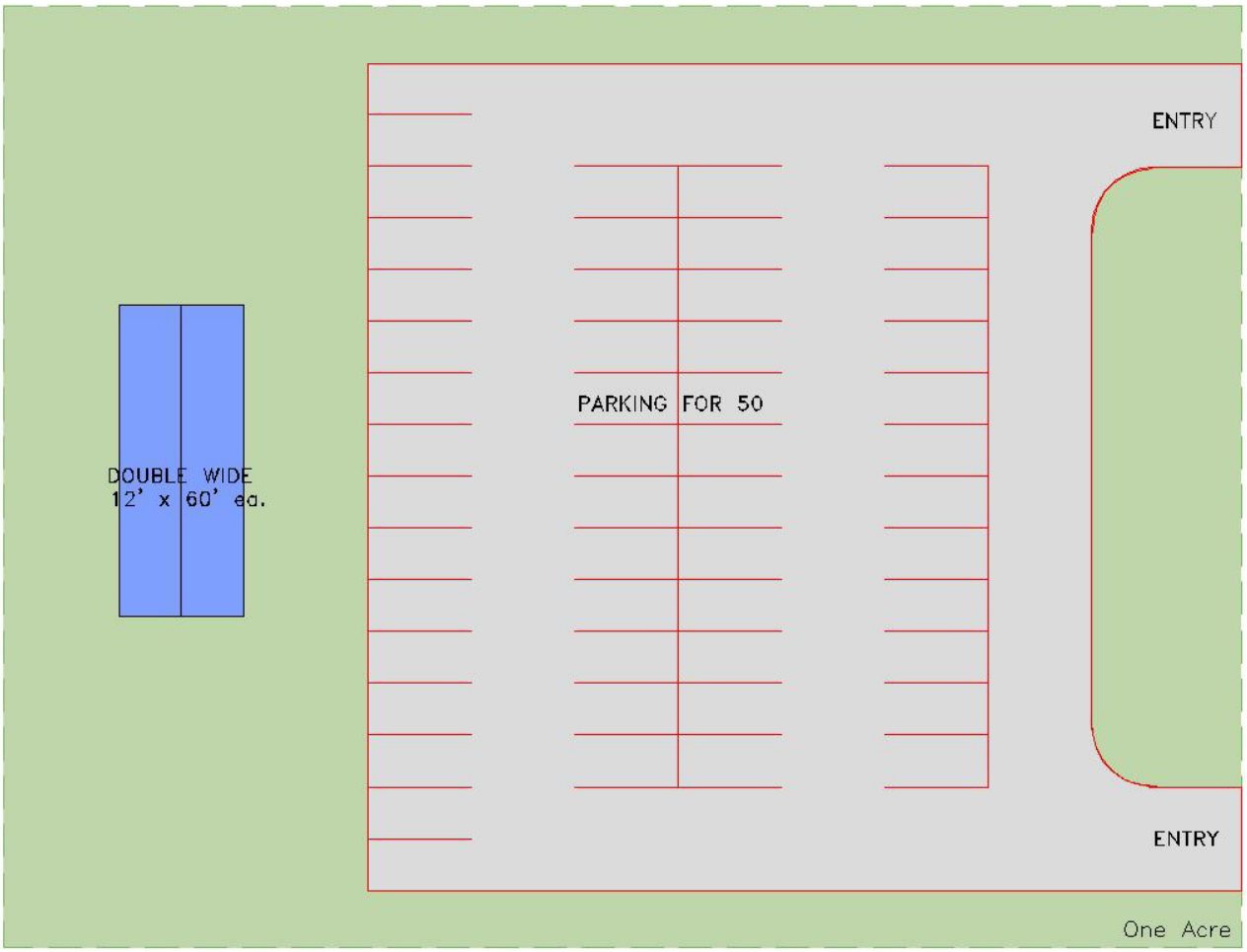
TABLE 4
Actual Air Emissions from PF-4, Calendar Year 2010

Emission (Ci)	Stack ES-15 {1}	Stack ES-16 {2}	Total
Am-241	5.42E-10	1.51E-09	2.05E-09
Pu-238	7.11E-10		7.11E-10
Pu-239	8.00E-10	3.37E-10	1.14E-09
U-234	1.29E-08		1.29E-08
U-238	8.73E-09	1.55E-08	2.42E-08
Pa-234m (p)	8.73E-09	1.55E-08	2.42E-08
Th-228	8.31E-09	1.16E-08	1.99E-08
Th-230		2.68E-09	2.68E-09
Th-234 (p)	8.73E-09	1.55E-08	2.42E-08
H-3 (Gas)		9.94E+00	9.94E+00
H-3 (HTO)		6.22E+00	6.22E+00
Sr-90		1.34E-09	1.34E-09
Y-90 (p)		1.34E-09	1.34E-09

{1} ES-15 (north stack) handles the 100 and 200 areas of PF-4.

{2} ES-16 (south stack) handles the 300 and 400 areas of PF-4.

Source: Fuehne, David P., "2010 LANL Radionuclide Air Emissions Report," LA-14441, June 2011, p. 28.



Source: Lisa Jo Dunham, SPPI, January 9, 2012.

Figure 2: Possible layout of construction subcontractor trailer and parking area.

IV. PIT DISASSEMBLY AND CONVERSION OPERATIONS AT PF-4

The PDC program will create possible environmental impacts that must be accounted for in the SEIS. These factors are described in this section.

A. General Plutonium Operations at PF-4

General facility capabilities related to plutonium preparation and handling are described here. The current ARIES program (No Action Alternative) uses about 4,500 square feet. The Action alternative adds another 3,000 s.f., for an approximate total of 7,500 s.f.

Floor plan with equipment arrangement
This information is contained in another LANL document, LA-CP-12-00002.[11]

Fire protection systems
The fire suppression system (FSS) safety function is to minimize the size, duration, and spread of fires.[12] The FSS operates in the first floor laboratories, the vault, and all areas of the basement (including the PF-4 tunnel) during a fire.

The Fire Suppression System is classified as a Safety Class (SC) Safety Structure, System or Component (SSC) for operational fires and as Management Level (ML) 1 as prescribed in Conduct of Engineering AP-341-502, Management Level Determination. The FSS limits the size, temperature, and duration of fires. Once the sprinklers are actuated, they provide a cooling effect to the hot layer, thus reducing the driving force for transport of radioactive aerosol from the fire room and also reducing the temperature of the combustion gases that may be drawn into the ventilation exhaust systems. The FSS is not credited for a floor-wide PC-3 (evaluation-basis earthquake) seismic induced fire, but will provide its safety function during lesser seismic events.

The FSS was included as part of the original TA-55 Plutonium Processing Facility built in 1975. The FSS is formed from two main subsystems, the Fire Suppression Water Supply System (FSWSS) and the Fire Suppression Sprinkler System (FSSS). The FSS supplies pressurized water from the TA-55 fire water supply tanks through the FSWSS firewater loop around TA-55 to the PF-4 individual sprinkler outlets. The PF-4 FSSS consists of four wet-pipe sprinkler systems in which pressurized water is always available at the sprinklers under normal conditions. The TA-55 PF-4 FSSS was designed to comply with the applicable requirements of NFPA 13, Standard for the Installation of Sprinkler Systems for Ordinary Hazard Group Two (OH-II). This provides 0.20 gpm/ft^2 over the most hydraulically remote 1,500 square foot location, with an added 250 gpm hose stream that is available inside or outside the facility. An exception is made for the PF-4 OH-I Vault, where 0.15 gpm is provided over the design area.

The FSWSS supplies fire water to the FSSS, TA-55 hydrants, PF-4 and PF-5 Standpipe systems, the PF-4 HEPA filter plenum cool down spray systems, and TA-55 fire main and laterals through redundant sets of pump houses and water storage tanks. Each pump house contains an electric and diesel fire pump, and a smaller jockey pump, which maintains system line pressure during non-emergency operations. The jockey and fire pumps in the two pump houses have an individual controller which monitors the respective pump for failures/faults or pump operation, and notifies operations personnel through alarms both locally inside the pump house at the controller and in the TA-55 Operations Center. Diesel fuel for the diesel fire pumps is stored in a day tank with make-up fuel located in a larger underground storage tank outside, next to the respective pump house. The individual pump houses provide protection and environmental

[11] Booth, Steven R., et al., "Preliminary Response to Data Call to Support the Surplus Plutonium Disposition Supplemental Environmental Impact Statement, Part 2—Operations Data," Unclassified Controlled Nuclear Information and Official Use Only, January 3, 2012.
[12] Information is adapted from "Fire Suppression System—System Design Description," TA55-SDD-FSS-3310,R1, Unclassified Controlled Nuclear Information and Official Use Only, September 16, 2010.

temperature control for the jockey and fire pumps through a hanging heater unit. An ancillary function of the pump houses includes providing protection and environmental temperature control for the water storage tanks' water heating systems.

The fire water storage tanks are gravity supplied from two LANL water distribution tanks that are located about one mile west of TA-55 on both the north and south side of Pajarito Road. An automatic and manual fill valve control water flow into the PF-11 pump house storage tank. A manual fill valve controls water flow into the PF-10 pump house water storage tank. Water for LANL's distribution system is supplied by Los Alamos County. The fire water storage tanks are painted on the interior to protect each tank from excessive corrosion. They have an abandoned Impressed Current Cathodic Protection System ICCPS that has not been properly maintained.

The FSSS encompasses the sprinklers for each building. The FSSS, standpipe and filter plenum spray systems are monitored by the Fire Alarm System (FAS) for detection of water flow through the applicable system riser. The FAS is considered a separate system from the FSS and has its own system design document (SDD). The FSSS is designed with test and drain valve outlets for system inspection and routine maintenance. The test valve outlets branch off the main riser and penetrate through each building base to the outside.

The FSS must remain operational both during and after a PC-2 seismic event; therefore, the FSS is designed in accordance with the requirements of NFPA, UBC, ANSI, and ASME codes. The FSS has redundant subsystems and components to ensure operational availability of the system for fire protection.

Features that control releases of airborne contaminants

The PF-4 ventilation system is credited with a Safety Significant (SS) function, and enables workers to operate safely with processes containing hazardous and radioactive materials.[13] The ventilation system confines radioactive material and other hazardous materials, and also dilutes and removes hazardous gases originating from laboratories and gloveboxes.

During normal and off-normal conditions, the PF-4 ventilation system is credited to maintain a negative pressure gradient between the basement, corridor, laboratory, and gloveboxes. In addition, it routes airflow from process areas to High Efficiency Particulate Air (HEPA) filters before either recirculation to the laboratories, or exhaust from the building through the Safety Class confinement system HEPA filters. The Isotope Fuels Impact Test (IFIT) Facility ventilation system must maintain a negative pressure relative to the environment and route exhaust from the building through the confinement system HEPA filters. During fires and other off-normal conditions in which the PF-4 ventilation ductwork survives, the basement, corridor, laboratory, and glovebox exhaust systems, as well as the independent IFIT Facility ventilation, must direct airflow to the SC exhaust HEPA filters.

The PF-4 Ventilation System and Ductwork mitigate an accident by providing contamination control (i.e. reducing the spread of contamination throughout the facility and outside of PF-4) in conjunction with the confinement system. It provides physical confinement barriers for

[13] Information for this section comes from "PF-4 Ventilation and Ductwork System Design Description," Unclassified Controlled Nuclear Information, March 12, 2011.

contaminated air and cascading differential pressure zones where higher negative pressure help control and confine greater levels of contaminants. These cascade pressures help ensure safe zones and maintain air flow directions into areas of greater risk. These pressure zones and interior partitions help control contamination migration and help ensure safe haven zones remain protected.

The ventilation system itself provides no credited Safety Class (SC) functions. However, the interfacing ventilation portion of the confinement system (HVACCF) does provide a SC function. It is part of the overall confinement system which is credited with mitigation of the release of radioactive materials to the public and environment during normal operations and design basis accidents. Most, but not all, of the supply and exhaust plenums, and the ductwork from these plenums to the building penetrations, perform the SC functions of the confinement system. These components comprise HVACCF. The PF-4 supply and exhaust HEPA filters and plenums with direct paths to atmosphere, the ductwork between the PF-4 structural shell and the plenums and HEPAs (HVACCF), the PF-4 structure and shell, and the confinement doors used for personnel entry or exit have a *passive* safety-class function credited to the confinement system in the DSA. The confinement system provides the final physical barrier to offsite radiological releases, and ensures that radioactive materials used in process operations remain within the building during both normal operations and accident conditions.

Off-normal conditions, such as total loss of power or instrument air supply, illustrate the value of the passive safety class function. The Facility Control System (FCS) cannot operate ventilation system fans during such events until the support systems return to normal. Differential pressures equalize by drawing air from the outside through both the ventilation intakes and the exhaust stacks. Once the pressure equalizes, the building is allowed to *breathe* through the intake and exhaust HEPA filters. Processing activities within PF-4 cease and the confinement system is relied upon to prevent the off-site release of radioactive material. Under such conditions, ventilation becomes a passive system. The confinement Ssystem, including the PF-4 structure and its SC confinement components, can withstand the effects of all evaluated external, operational, and natural phenomena events.

Features that control releases of liquid contaminants

There are three systems that control releases of liquid contaminants at PF-4: the Acid Waste System, the Caustic Waste System, and the Industrial Waste System. Each of these is described in this section.

Acid Waste System

The acid waste line receives process-related radioactive liquid waste from a variety of generating locations (for example, residual solution from aqueous processing operations which is concentrated in the 400 area evaporator or evaporator bottoms, acidified working fluid from the wet vacuum systems in various PF-4 mechanical rooms, and effluent streams from a number of 200 Area gloveboxes).[14] Acids present in the waste stream may contain individual acids or mixtures of acids including nitric acid, hydrochloric acid, hydrofluoric acid, and sulfuric acid. The acid waste also contains a variety of inorganic salts.

[14] Information is from "Acid Waste System—System Data Sheet, ML-3, TA-55-04," Unclassified Controlled Nuclear Information, SDS-TA-55-AWS, R0, August 12, 2010.

Acid Waste System-related equipment and piping in the PF-4 laboratory and basement level include: storage tanks or glovebox vessels containing acid waste, single wall piping, isolation valves (some with administrative locks), several flow meters, a short section of double-wall piping, and a connection to the sample air system before a PF-4 wall penetration. Outside of PF-4 in the TA-55 Yard, double containment piping located below grade drains acid waste to a subsurface pit south of PF-4. Double-containment piping is used to transfer acid waste from the subsurface pit at TA-55 to a subsurface pit at TA-50 where the RLWTF resides.

The Acid Waste System provides a monitored path for routing acid waste streams from glovebox operations and mechanical rooms to TA-50 for disposal. Administrative locks are utilized on acid waste line valves to maintain control over additions to the system. The locks have several functions:

- preventing indiscriminate discharge of acid waste to TA-50;
- ensuring that sources, amounts, and characteristics of acid waste are clearly identified prior to discharge (for example, by performing a chemical analysis on the waste or utilizing acceptable knowledge);
- providing a record that glovebox processes utilized for recovering plutonium resources are operating efficiently; and
- ensuring that TA-50 has the capacity to process the incoming waste.

Caustic Waste System

The caustic waste line receives process-related radioactive liquid waste from a variety of generating locations.[15] Some example processes that generate caustic waste include Pu238 residue solidification and hydroxide precipitation of a Pu238 low level waste stream. The caustic waste streams may contain potassium hydroxide, sodium hydroxide, and a variety of other inorganic salts.

Caustic Waste System-related equipment and piping in the PF-4 laboratory and basement levels include: storage tanks or glovebox vessels containing caustic waste, single wall piping, isolation valves (some with administrative locks), several flow meters, a short section of double-wall piping extending into the PF-4 structure, and a connection to the sample air system just before a PF-4 wall penetration. Outside of PF-4 in the TA-55 Yard, double containment piping located below-grade transfers caustic waste to a subsurface pit south of PF-4. Double-containment piping is used to transfer caustic waste from the subsurface pit at TA-55 to a subsurface pit at TA-50.

The Caustic Waste System provides a monitored path for routing caustic waste streams from glovebox operations to TA-50 for disposal. Administrative locks are utilized on caustic waste line valves to maintain control over additions to the caustic waste system. The locks have the same functions listed above for the acid waste line.

Industrial Waste System

The Industrial Waste System receives non-process liquid waste from a variety of generating

[15] Information is from "Caustic Waste System—System Data Sheet, ML-3, TA-55-04," Unclassified Controlled Nuclear Information, SDS-TA-55-CWS, R0, August 12, 2010.

locations (for example, condensate from the HVAC plenums in the PF-4 basement, effluent from janitors sinks, effluent from the personnel decontamination area in PF-4, effluent from the sumps in the PF-4 or TA-55-04 basement).[16] When the facility was designed during the 1970s, it was estimated that facility would generate 500 gallons per day of industrial waste.

Industrial Waste System-related equipment and piping in the PF-4 basement level includes pumps connected to HVAC plenums, drain tanks connected to HVAC plenums, and PF-4 sumps containing submersible pumps. Waste streams from the basement and laboratories are routed via a piping network (that is, pressurized and gravity drain piping networks) to Industrial Waste Tank TK-444. From the tank the waste is routed through a penetration in the top of a glovebox, which contains a sediment interceptor. The clarified effluent from the interceptor flows through a pipe which exits the glovebox and enters a transfer box (Alpha Counter Hood). The piping connects to a Non-Destructive Assay (NDA) System to monitor the radiological content in the industrial waste stream. Industrial waste effluent from the NDA monitoring system passes through a Positive Pressure Circulating Chilled Water (PPCCW)-cooled heat exchanger. From the heat exchanger, waste is transferred through double-containment piping in a basement-level wall penetration in the PF-4 confinement. A flowmeter in industrial waste service is located upstream of the wall penetration. A sample air system is installed inside PF-4 near the end of the double-containment piping. Outside of PF-4 in the TA-55 Yard, double containment piping located below-grade transfers industrial waste water to a subsurface pit south of PF-4. Double-containment piping is used to transfer the water from the subsurface pit at TA-55 to a subsurface pit at TA-50.

Overall, the three liquid waste systems have the following functions.

- Safety Function: Monitoring of the amount of plutonium or concentration of plutonium in the waste streams reduces the potential for a criticality event at the Radioactive Liquid Waste Treatment Facility (RLTWF) at TA-50.
- Radiation and/or Other Hazard Function: The waste lines are designed to minimize the harmful effects of corrosion, and have radiological air sampling systems to detect leaks.
- ALARA Function: The waste lines are designed with a pitch to reduce holdup of liquid and sediment.
- Industrial Hazards Function: The waste lines are located below gloveboxes on the laboratory level, and above workers heads in the PF-4 basement upper piping level. The integrity of the waste piping is maintained to prevent leaks that could potentially injure personnel and cause property damage.
- Mission Critical Function: Glovebox operations only have limited tank capacity for storage of waste. Loss of the capability to dispose of liquid waste at TA-50 will require a cessation of programmatic operations which generate waste.

[16] Information is from "Industrial Waste System—System Data Sheet, ML-3, TA-55-04," Unclassified Controlled Nuclear Information, SDS-TA-55-IWS, R0, August 12, 2010.

Features/procedures that prevent criticality

TA-55 has an Administrative Procedure that describes nuclear criticality safety practices at the TA-55 facility, including but not limited to responsibilities, requirements for developing new or changing existing criticality safety limits, and process review requirements.[17] Due to the nature of the work with fissionable materials at TA-55, the risk of a criticality accident is non-trivial; however, adherence to the criticality safety program reduces the likelihood of an accident to an acceptably low level.

This procedure applies to all personnel involved with handling or managing fissionable material operations, including housekeeping and maintenance within gloveboxes, at TA-55. The administrative practices are applicable to all fissionable material handling activities, i.e., transport, processing, staging, and storage.

Important procedural requirements that provide criticality safety at PF-4 are as follows. First, before a new operation is begun, an existing operation is changed, or an operation that has been in extended shutdown (one year or more) is resumed, a criticality safety evaluation is performed to establish that the entire process will remain subcritical under all normal and credible abnormal conditions through the determination and application of an appropriate set of criticality safety controls. Second, personnel must have current facility access authorization training, including criticality safety training commensurate with their duties as fissionable material handlers. Third, regular review of each fissionable material operation occurs to ascertain that procedures are being followed and that process conditions have not been altered so as to impact the criticality safety basis. A formal review report is written annually. Fourth, material control and accountability are high priorities and are essential to the implementation of a criticality safety program. And fifth, a Criticality Alarm System is installed and operating within PF-4.

Description of liquid and non-liquid waste processing.

There is minimal storage capacity for wastes at TA-55, so timely management of wastes generated by TA-55 activities is essential for maintaining facility capability. The goal of the TA-55 waste management program is to implement systems and processes that will minimize the risk of programmatic or facility impacts.

LANL maintains adequate staffing levels of qualified and authorized personnel and capabilities to manage waste including procurement of waste containers and operational equipment. Required support functions include Quality Assurance, Document Control, Records Management, Data Collection Interpretation Storage/Reporting, Procurement, Training, and Fiscal Management. A summary scope for radioactive waste management operations is provided below.

Before a new activity or change to an existing activity can be performed in PF-4 it must be vetted through an approval process that considers its potential impact to waste management including the types and volumes of waste to be generated. Before any waste can be generated, the waste originator must work with the TA-55 Waste Management Coordinator (WMC) to plan the life

[17] Information from "TA-Administrative Procedure—Nuclear Criticality Safety," TA55-AP-522, R5, August 22, 2011.

cycle for the wastes. Waste streams with no identified path to disposal may be generated only after gaining approval based on the following conditions: programmatic need, issues preventing the disposal of the waste, safe storage of the waste until disposal can be achieved, and activities and plans for achieving final disposal of the waste. The TA-55 WMC works with waste originators to complete documentation that characterizes all waste streams to ensure compliance with treatment, storage, disposal facility (TSDF) waste acceptance criteria (WAC).

All waste areas at TA-55 have limited access due to their location in TA- 55. In addition the TRU and LLW radioactive waste areas are further restricted by PF-4 access controls.

Low Level Radioactive Waste

Low level radioactive waste (LLW) generated (or previously generated) from activities at TA-55 is identified, characterized, handled, packaged, certified, safely and securely stored, and transported. LLW is managed in registered radioactive waste areas. Radioactive liquid waste (RLW) discharges from TA-55 travel to the TA-50 RLWTF via a piping system described above. All liquid discharges meet the RLWTF Waste Acceptance Criteria. Waste storage sites, including treatment, storage, and disposal sites (TSDs), throughout TA-55 produce waste packages that meet LANL, State, and Federal criteria for handling and storage, and ensure waste items/packages meet TA-54 LLW disposal and offsite waste acceptance criteria.

LLW is packaged in several areas of the PF-4 basement. Compactable LLW, which is primarily room trash, is staged on the southeast side of the basement in aluminum transfer carts. When enough material is accumulated, it is moved to the northeast side of the PF-4 basement for packaging into reusable 4’ x 4’ x 6’ metal boxes. A wide corridor on the northeast side of the basement is used to package compactable and non-compactable LLW. Only four waste containers are in use at any time to avoid congestion in the corridor. LLW operations are spread throughout the PF-4 basement with waste being moved between the north and south basements, east and west ends, for packaging, radiological assay, weighing and staging. Despite the current space limitations, approximately 20,000 cubic feet of LLW can be processed on a yearly basis. Low level radioactive waste is managed in accordance with procedure FFS-DOP-014 *Low Level Radioactive, Mixed Low Level Radioactive, Nonradioactive Chemical, Hazardous and Non Hazardous Waste Management at TA-55.*

Hazardous Waste

All hazardous and mixed wastes generated (or previously generated) from activities at TA-55 are identified, characterized, handled, packaged, certified, safely and securely stored, and transported. Waste storage sites include TSDs, Satellite Accumulation Areas (SAAs), <90 day storage areas, New Mexico Special Waste storage areas, Universal Waste storage areas, and PCB storage areas. TA-55 produces waste packages that meet LANL, State, and Federal criteria for handling and storage and ensure waste items/packages meet TA-54 and offsite waste acceptance criteria.

TRU Waste

TRU waste processing at TA-55 begins with observation of the item in the glovebox. Visual examination (VE) is used at Los Alamos as waste items are placed into a drum. The drum is weighed before and after the move (tare weight plus the packed items). Once TRU packaging is

complete, drums and Pipe Overpack Containers (POCs) have a confirmation assay. Then drums/POCs are moved to one of the two permitted TA-55 waste storage areas.

Evaporator operations generate an evaporator bottoms TRU waste stream that is solidified with cement into 55-gallon drums. The cemented drums are assayed and then moved to the PF-4 basement for storage in a non-permitted storage area adjacent to the PF-4 vault. As currently configured, approximately 1000 drums/POCs of solid TRU waste can be processed on a yearly basis.

Items too large to be packaged in either a drum or POC are packaged in an open area of the PF-4 basement. The large items are either packaged into a standard waste box (SWB) or in metal overpack containers until they can be transported offsite for decontamination or size reduction. Solid TRU wastes are managed in accordance with FFS-DOP-004 *Inspecting, Packaging, and Remediating Transuranic Waste for WIPP and for TA-54 Safe Storage*, FFS-DOP-004 *Visual Inspection of TRU Waste*, FFS-DOP-011 *Packaging TRU Waste in Drums*, FFS-DOP-012, *Packaging TRU Waste in POC Drums*, and P930-2 *Waste Certification Program*.

B. Plutonium Metal and Oxide Production Schedule

Expected output of metal and/or oxide (peak annual and total)
Projected start year and total number of operational years

Operations would begin immediately after NEPA and program approval, likely with a ramp-up to a peak output of 2.5 MT(Pu)/y as equipment is installed and certified for production use. Operational years are currently estimated to be eighteen years (beginning in FY2013 and ending in FY2030) for a ~25 MT(Pu) total mission. An additional 9 MT(Pu) is expected to be declared as excess to National Security, and its conversion would require operations to continue until FY2034 at 2.5 MT(Pu)/y.

C. Emissions of PDC Equipment

Describe increase, if any, in the type and quantity of air pollutant emitting equipment that may be required to support this effort, and frequency and duration of use.

Table 5 lists current equipment under the No Action alternative (300 kg) and total equipment (current plus new) for the Action alternative (34 MT), whether the equipment should be considered as an emitter of an air pollutant, and the frequency and duration of use.

The designation of Air Pollutant Emitting in Table 5 is associated with any furnace-type activity that operates at a temperature above ambient conditions. However, actual emission of a volatile plutonium, uranium or other actinide-bearing chemical species by these machines is highly unlikely. In any case, these are primary pollutants in that they could be emitted from an identifiable source.

TABLE 5
Air Pollutant Emitting Equipment for Both Alternatives

Equipment Description	No Action (# units)	Action (# units)	Frequency/ Duration	Air Pollutant Emitting	Waste Generation
Pit Disassembly	2	6	Daily	No	Solid
Hydride/Dehydride	0	2	Monthly	Yes	Solid
DMO/muffle	4	6	Daily	Yes	Solid
Inner Can Pu Packaging {1}	2	3	Daily	No	Solid / Liquid
Milling/Blending	2	3	Daily	No	Solid
By-Product Processing	1	1	Monthly	Yes	Solid
Radiography	1	3	Weekly	No	None
NDA	1	2	Daily	No	None
Uranium EDC {2}	1	2	Weekly	Yes	Solid / Liquid
Uranium Mill/Blend/Packaging	1	1	Weekly	No	Solid
Oxide Characterization	1	1	Daily	Yes	Solid / Liquid
Parts Storage/In Line Storage	1	5	Daily	No	No
Size Reduction	1	3	Daily	No	Solid
Metal Prep Furnaces {3}	1	3	Daily	Yes	Solid
Outer Can Pu Packaging	1	2	Weekly	No	Solid

{1} Includes container welding and leak testing.

{2} Includes EDC and oxide conversion.

{3} Includes LCASTS under planned for installation.

Emission release parameters:

- *For any stack releases - release location (latitude & longitude), stack height, stack diameter, stack exhaust velocity or flow rate, exhaust air temperature*

PF-4 has two air stacks. The north stack (ES-15) handles the 100 and 200 areas, and the south stack (ES-16) handles areas 300 and 400. Stack location is 106° 18’ 8.90” W 35° 51’ 50.17” N for ES-15 and 106° 18’ 11.26” W 35° 51’ 48.27” N for ES-16.[18] Both stacks have a release height of 9.5 meters above ground level. The measurement of the rectangular stack is 30” x 48”, an equivalent of 0.93 meters in diameter. Exit velocity was 7.80 meters per second for ES-15 and 10.45 m/s for ES-16 during measurements in 2010.[19] Temperature of flow during the most recent reading was 75.8 degrees F for ES-15 and 69.3 degrees F for ES-16.[20]

[18] Katelyn Booth, ENV-Environmental Stewardship, personal communication, December 14, 2011.
[19] David P. Fuehne, “2010 LANL Radionuclide Air Emission Report,” LA-14441, p. 30.
[20] Richard Sturgeon, “Velocity Measurement Input Form for TA-55-0004-15,” and “Velocity Measurement Input Form for TA-55-0004-16,” December 13, 2011.

- *Air emissions (point source and fugitive):*
  - *Criteria Pollutants (metric tons/yr)*
  - *HAPs (kilograms/yr)*
  - *Radioisotopes (curies/yr)*

Based on PDC operations identified and compared to the expanded operations associated with the 2008 SWEIS at TA-55 (normalized to the quantity of material processed), conservative limits for possible air pollutants are presented in Table 6. As shown in Table 4 above, actual stack releases are much lower than the SWEIS limits: PF-4 radioisotope particulate air emissions are maintained well below one micro curie per year (plutonium equivalent).[21]

There is expected to be no change in the identified criteria pollutants (carbon monoxide, nitrogen dioxide, and sulfur dioxide) as these species are neither handled nor produced during the process operations. Similarly, the operations that use certain chemicals (e.g., nitric acid or sulfuric acid in the EDC processes) do not use quantities significantly greater than current operations currently analyzed in the SWEIS. There will be no fugitive emissions associated with either of the alternatives. The limit for all of LANL site for each hazardous air pollutant (HAP) is eight tons per year, and 24 tons per year for all HAPs combined. PF-4 is an insignificant contributor to this total, and neither alternative will emit any HAPs. Tritium emissions for both alternatives will be within the existing limit of 1,000 curies of tritium per year as listed in the existing SWEIS.

It should be noted that in the Action alternative there will be no increase in the emissions identified in the SWEIS that are specific to CMR. This is because the alternative does not greatly expand the frequency or samples necessary for chemical analysis of the product.

Describe increase, if any, in the type and quantity of noise producing equipment that may be required at PF-4 to support this effort, and frequency and duration of use.

There will be no increase in noise (external to PF-4) associated with the Action alternative.

Describe increase, if any, in the type and quantity of liquid effluents:

- *Location(s) of discharge(s)*
- *Rate(s) of discharge(s) (units/day)*
- *Concentrations of contaminants (picocuries/liter or micrograms/liter)*

The Action alternative will increase the volume of liquid discharged from PF-4 to RLWTF located at TA-50. Caustic liquid waste is associated with electrolytic decontamination (EDC) activities for Pu packaging (to meet the 3013 requirement) and HEU processing. The other liquid source is the discard of isoton solution for particle size characterization. The total for the 34 MT mission is estimated at 70,000 liters of liquid LLW, i.e., about 3,000 liters per year on average over the 22-year project. This annual volume does not significantly increase the current No Action Alternative in the 2008 SWEIS for 15,000,000 liters of radioactive liquid waste.

[21] David Fuehne, personal communication, December 14, 2011.

TABLE 6
Annual Air Pollutant Limits Under Both Alternatives

Pollutant	No Action (curies)	Action (curies)
Tritium {1}	1,000	1,000
Am-241	4.2×10^{-6}	8.4×10^{-6}
Pu {2}	0.0000195	0.000036
U {3}	0	2.6×10^{-6}
Be {4}	0	0

{1} 2008 SWEIS Table C-14.

{2} In the 2008 SWEIS (Appendix C-21, Table C-14), Pu emissions are split between stacks ES-15 (0.0000025 curies/y) and ES-16 (0.000017 curies/y). The PDC Action alternative adds 0.0000165 to this total as shown in the table.

{3} No value is presented in the SWEIS for uranium at TA-55, but as a site, LANL projects 0.15 curies per year (2008 SWEIS, p. 5-60). The value for the alternative is conservatively estimated to be comparable to the value for plutonium at TA-55 given the quantity to be processed annually, adjusted for the activity of Pu-239 versus U-235. The uranium to be processed is HEU (93% U-235).

{4} Beryllium (Be) is a nonradioactive pollutant that will be handled as part of this alternative in quantities approximately equal to that currently allowed in operations at PF-4. It is expected that additional notification under the current NESHAPS permit will be required as part of the preparation to support the alternative. The Be permit limits at TA-55 stacks are (2008 SWEIS Ch5, p. 52, Table 5-10): ES-15 is 0.003 pounds per year and ES-16 is 0.0042 pounds per year. The operations which could produce Be particulates are performed in gloveboxes with HEPA filtration with an efficiency of 99.95%, the potential increase in Be emissions for the alternative is estimated to not exceed that currently permitted. The value is conservative as the 2008 SWEIS values are for the machining of Be, which can produce fine particulates as opposed to the operations associated with disassembly in the PDC mission.

D. PDC Staffing and Radiological Exposure

What is the expected employment (FTEs) at LANL to support this effort? Is this an increase over current employment?

Staffing estimates for both alternatives are shown in Table 7. Staffing estimates are 215 FTEs for the Action alternative versus 87 for No Action. The delta for the 34 MT mission represent an increase in current employment at TA-55 of 128 workers.

TABLE 7
Staff Resources (FTEs) Required for Both Alternatives

Resource	No Action (2 MT)	Action (34 MT)
Manufacturing Manager	7	15
Technical Project Manager	3	4
Project Controls	2	4
Budget Controls	1	2
Radiological Control Tech	2	8
Production Engineer	8	14
Ops Manager	1	2
Engineering Support	2	16
Process Support Engineering	4	6
Industrial Hygienist	1	1
Operator	34	101
Training	1	4
Production Controls	2	6
Work Planning	0	1
MC&A Custodian	2	4
Maintenance	5	10
Analytical Chemistry	10	15
Manager, Other	2	2
Total	**87**	**215**

Note: Highlighted resources will be exposed to ionizing radiation.
Source: Steven McKee, December 22, 2011.

Number of radiological workers and estimated annual worker radiological exposure –peak individual dose (rem), and total dose (person-rem).

The process analysis assumes full oxide production and no metal production as oxide production is generally the more conservative flowsheet relative to dose. Plutonium oxide, having a lower density than metal, is less self-shielding and thereby allows greater levels of gamma radiation to be emitted. Plutonium oxide also contains oxygen, which produces neutrons via alpha-n reactions. Metal would have a larger neutron multiplication than oxide, but this feature is smaller than the increase in gamma-ray emission from lower density oxide and from neutron emission from alpha-n reactions in oxide.

The number of workers exposed to radiation is shown by the highlighted rows in Table 7: 45 for No Action and 129 for the Action alternative. (Although not highlighted, analytical chemistry workers will also receive a low dose.) Peak individual dose will remain at or below the Los Alamos administrative limit of 2 rem per year under both alternatives. Maximum expected average whole body dose per worker for the Action alternative is 1.3 rem per year, with a maximum expected total dose of 330 person-rem per year.

Based on the FY2011 dose data, a 300 kg per year mission (the No-Action alternative) would have a maximally-exposed worker receiving about 0.9 rem whole body dose per year. The total dose would be about 12 person-rem whole body per year.

E. Utilities Usage during Operations

Estimate utility use required to support operations related to this effort at PF-4 including: electricity (peak and annual in megawatts/megawatt-hours), water (in gallons), fuel (in gallons), and natural gas (million cubic feet).

There will be no increase in the quantities of fuel and natural gas as there are no new facilities associated with the Action alternative. Diesel fuel is used for electric generators to provide emergency electricity at PF-4. PDC operations will not function during an electrical outage, so no diesel fuel will be used. In any case, all operations at TA-55 together only represent approximately five percent of LANL's total use of these items.[22]

Water usage is also expected to not be significantly greater than current usage. Water usage by PDC is found in three areas. The first is associated with some of the equipment, which requires solutions for the processing. These operations are associated with the electro-decontamination steps (EDC) for packaging, and HEU operations. Periodically the chemical process solutions are replaced after a number of recycle steps. On an annual basis, the Action alternative water usage for these operations is expected to be an additional 1,000 liters (264 gallons).[23] No water use is associated with plutonium recovery operations. The second is associated with cooling loops for much of the process equipment. Given the equipment and volumes associated with the cooling equipment, approximately 100 liters (26 gallons) is expected to be required annually to refill or replace the cooling water. The final increase in water is associated with general water usage associated with increased staffing needs. Sanitary water needs for each worker will be about 25 gallons per day.[24] Assuming 1,730 hours per year and eight hour days, this is about 5,500 gallons annual per FTE (25 x 217). Additional water for the Action alternative's additional 128 workers is 700,000 gallons per year.

Electrical use (both annual usage and peak demand) under the Action alternative is expected to increase slightly compared to the overall usage at TA-55 to maintain facility systems such as ventilation. TA-55 electricity use in FY2011 is 1,200 megawatt-hours per month, with an average peak demand of 2.0 megawatts. PF-4 alone has consumption of about 8,300 megawatt hours in FY2011.[25] For PDC, the largest increase in electrical usage is associated with eight furnaces for metal casting and for metal-to-oxide conversion, which use about 0.005 megawatt-hours for each operation. Other equipment requires less power. Total electricity for 42 pieces of Action alternative equipment if each is assumed to consume 0.005 megawatt-hours (an overly conservative approximation) is 160 megawatt-hours per month, with a peak demand of 0.22 megawatts.[26]

---

[22] 2008 SWEIS, Ch 5, p. 134.
[23] Jane Lloyd, MET-1, personal communication, December 21, 2011.
[24] Mell Smithour, ES-Utilities and Infrastructure, personal communication, December 15, 2011.
[25] Maura Miller, UI-DO, email spreadsheet, November 4, 2011.
[26] Charles Richardson, MET-1, personal communication, December 21, 2011.

F. Waste Generation and Transportation

Estimate amount of waste generated to support operations related to this effort at PF-4 (in cubic meters for solid waste and liters for liquid waste): low-level radioactive waste, mixed low-level radioactive waste, transuranic waste, hazardous waste, and non-hazardous waste.

Transportation parameters for generated waste (per type of waste): containers (e.g., drums, boxes, none), transport vehicles and packaging (e.g., TRUPACT-II or TRUPACT-III for TRU waste; heavy combination trucks for LLW, MLLW, and hazardous waste; rolloffs for non-hazardous waste; etc.), waste destinations (e.g., NNSS or Area G for LLW, etc.), external radiation levels of packages or shipments of radioactive wastes (TI [or millirem/hour at 1 meter]), and bounding radionuclide-specific concentrations (as packaged) for radioactive wastes (curies per unit volume).

The waste and transportation information required by the NEPA data call is shown in Tables 8 and 9. As with construction waste in section III.E, LLW and MLLW are assumed to be packaged with 80 percent efficiency. Haz/Chem waste is in terms of five-gallon equivalents. Liquid-LLW is sent directly to RLWTF via underground pipes.

TABLE 8
Total Operational Waste and Shipment Parameters for No Action Alternative

Waste Type	Total Waste (ft3)	Total Waste	Container Type	Container Capacity	Concentration per Container {4}	Number of Containers {1}	External Radiation (mrem/hr	Transport Vehicle & Packaging	Waste Destination {2}
LLW	7,062	200 m3	ST-90	90 ft3	< 100 nanocuries/g	98	Limit: 200; actual <0.4 {3}	Flat bed Truck	NNSS
MLLW	71	2 m3	55 gal drum	7.4 ft3	< 100 nanocuries/g	12	Limit: 200 {3}	Box Truck	Commercial TSD, various locations
TRU		350 DE	55 gal drum equivalent	n/a	< 200 g of Pe	350	Limit: 200 {3}	TRUPACT II	WIPP
Haz/Chem		200 kg	5 gal equivalent	12.3 kg		16		Box Truck	Commercial TSD, various locations
Non Haz	-	-							
Liquid	-	4,000 L	none					none	TA-50, RLWTF

{1} Assume 80 percent packaging efficiency. Haz/Chem assumes one kg per drum.
{2} Definitions: Nevada National Security Site (NNSS); Treatment, Storage Disposal site (TSD); Waste Isolation Pilot Plant (WIPP); Radioactive Liquid Waste Treatment Facility (RLWTF).
{3} The regulatory limit is 200 mr/hr at any point on the external surface of the package, per Code of Federal Regulations Title 49, Part 173.441, "Radiation level limitations and exclusive use provisions." Actual value is very low, e.g., about 0.4 mr/hr for LLW.
{4} LLW: alpha-emitting transuranic elements or actinides with half-lives of greater than 20 years and a combined activity of less than 100 nanocuries per gram of waste. TRU: package limit is 200 grams of Pu239 equivalent nuclear material per drum.

The number of transportation vehicles can be estimated by understanding the average load. Assuming eight LLW ST-90s per load, about twelve (98/8) flat-bed truck loads will be needed for No Action and 245 (1,962/8) for the Action alternative. If we presume that a WIPP truck contains 42 drums (seven drums/layer, two layers, three TRUPACTs/truck), then we would have a total of nine (350/42) WIPP trucks shipping TRU waste during the course of the program for No Action and 143 (6,000/42) for the Action alternative. Los Alamos currently schedules six pickups per year (two subcontractor trucks each) to collect Haz/Chem from all its operations.

The insignificant additional Action alternative waste volumes for MLLW and Haz/Chem should not require additional pickups.

TABLE 9
Total Operational Waste and Shipment Parameters for Action Alternative

Waste Type	Total Waste (ft3)	Total Waste	Container Type	Container Capacity	Concentration per Container {4}	Number of Containers {1}	External Radiation (mrem/hr	Transport Vehicle & Packaging	Waste Destination {2}
LLW	141,240	4,000 m3	ST-90	90 ft3	< 100 nanocuries/g	1,962	Limit: 200; actual <0.4 {3}	Flat bed Truck	NNSS
MLLW	1,059	30 m3	55 gal drum	7.4 ft3	< 100 nanocuries/g	179	Limit: 200 {3}	Box Truck	Commercial TSD, various locations
TRU		6,000 DE	55 gal drum equivalent	n/a	< 200 g of Pe	6,000	Limit: 200 {3}	TRUPACT II	WIPP
Haz/Chem		3,000 kg	5 gal equivalent	12.3 kg		244		Box Truck	Commercial TSD, various locations
Non Haz	-	-							
Liquid	-	70,000 L	none					none	TA-50, RLWTF

{1} Assume 80 percent packaging efficiency. Haz/Chem assumes one kg per drum.
{2} Definitions: Nevada National Security Site (NNSS); Treatment, Storage Disposal site (TSD); Waste Isolation Pilot Plant (WIPP); Radioactive Liquid Waste Treatment Facility (RLWTF).
{3} The regulatory limit is 200 mr/hr at any point on the external surface of the package, per Code of Federal Regulations Title 49, Part 173.441, "Radiation level limitations and exclusive use provisions." Actual value is very low, e.g., about 0.4 mr/hr for LLW.
{4} LLW: alpha-emitting transuranic elements or actinides with half-lives of greater than 20 years and a combined activity of less than 100 nanocuries per gram of waste. TRU: package limit is 200 grams of Pu239 equivalent nuclear material per drum.

G. Other Resources

Resources needed to support operations related to this effort at PF-4: metals – individual metals in pounds/yr (e.g., stainless steel for 3013 containers), chemicals – individual chemicals or compounds in pounds or gallons/yr, gases – individual gases or compounds in volume/yr, and other materials (units/yr).

Plutonium is packaged in a 3013 container for shipment to SRS, which is a triply-contained set of stainless steel cans. The Cogema convenience can is a crimped-lid container, whereas both the inner- and outer-3013 containers are welded cans. The total package empty weighs approximately 2.4 kg. The total quantity of stainless steel required to construct 6,100 3013 containers to handle 34 MT Pu mission is about 15,000 kg, or 700 kg per year.[27]

Chemical usage on an annualized basis for the Action alternative (2.5 MT/y) is approximately the following.[28]

- 5 L NaOH in 0.1M solution for pH adjustment of electro-decontamination process solution;
- 12 L of 16M nitric acid for the electro-decontamination process solution;

[27] Total containers includes ten percent rejection/rework rate and the necessary "dummy" cans to support periodic weld inspection as required for long-term storage of plutonium in a 3013 configuration.
[28] Data are extrapolated from actual data provided by subject matter experts (Jane Lloyd, Brad Schake, and Dave Wayne) for the operations, December 12-21, 2011.

- 500 g sodium sulfate for electro-decontamination process solution;
- 500 g sodium nitrate for electro-decontamination process solution;
- 4 L of 18M sulfuric acid for electro-decontamination process solution; and
- 100 gallons of isoton solution (commercially available) for particle size characterization.

Actual volume required on an annual basis may be less because the processes have recycle systems that allow for the reuse of solutions, thereby extending solution lifetime. The total quantities do not appreciably add to the overall chemical usage annually at Los Alamos as documented in the 2008 SWEIS.

Other materials (gypsum and NIST Standards) are used and replenished on an annual basis (less than 100 grams) for calibration of equipment to support the physical characterization of the product oxide.

Gas usage on an annualized basis in support of the Action alternative (2.5 MT/y) is approximately the following.[29]

- Argon 94%/Hydrogen 6% - 300 CF (in gas cylinders);
- Argon, Liquid Trailer Tank – 38000 CF;
- Helium, Liquid Trailer Tank – 12500 CF;
- Helium – 4000 CF (in gas cylinders);
- Nitrogen, liquid dewar – 500 CF;
- Nitrogen, Liquid Tank Trailer – 1100 CG;
- Nitrogen – 1000 CF (in gas cylinders); and
- Oxygen, Liquid Trailer Tank – 5000 CF.

The bulk of the gas usage is for the maintenance of glovebox atmospheres. Oxygen, for example, is used in the metal-to-oxide conversion process, and helium and nitrogen (in gas cylinders) is used for some of the oxide characterization equipment.

H. Safety Basis Accidents

Radiological accidents that would need to be considered associated with operations at PF-4:

- *Accident description (include release pathways and mitigating factors)*
- *Accident frequency*
- *Material at risk*
- *Material characteristics*
- *Source term released to environment (curies by isotope)*
- *Release parameters: damage ratio (DR), release fractions (RF and ARF), release timing, location, release height, release duration, and heat of release*

See Table 10 for a listing of accidents associated with the PDC processes and the corresponding bounding accidents from the TA-55 documented safety analysis (DSA). Accident frequency, material characteristics and quantity, release parameters, and source term are also identified in the table. MAR values are for the No Action alternative and can be scaled to the Action alternative values. The release pathway for the identified accidents would primarily be the PF-4 exhaust stacks with some additional leakage assumed through the facility confinement boundary doors.

[29] Data are extrapolated from actual facility data for TA-55 provided by Judy Eglin, December 15, 2011 and discussions with subject matter experts for operations equipment.

TABLE 10
Safety Basis Accident Impact Parameters (Continued for three pages)

Accident Type	Bounding DSA Accident {1}	Frequency (per year)	Material Type {2}	Chemical and/or Physical Form	MAR (g)	Release Parameters				Source Term (g)	Dose to Noninvolved Worker (rem) {3}	Dose to MEOI (rem) {4} {6}	Mitigators
	ARIES Accident {5}					DR	ARF	RF	LPF (unmitigated/mitigated)				
Criticality	3.4.6, Criticality	Unlikely	WG-Pu	Salt	1,000 (or 100 L of solution at 10g/L)	1	5E-04	1	-	0.100	Immediate health effects or loss of life	1.01	• Criticality Alarm System (SS)
	ARIES Robotic Lathe (ARL)	Unlikely	WG-Pu	Metal or Oxide	N/A - bounded by solution criticality	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Spill	3.4.3, Pu Container Handling Accident	Very unlikely to Improbable	HS-Pu	Oxide	50	1	2E-03	1	1/0.05	0.500	Long-term health effects, disability, or severe injury (nonlife-threatening)	0.13	• Containers for nuclear material outside of gloveboxes (SS) • PF-4 Confinement (SS) • PF-4 Ventilation System and Ductwork (SS) • MAR limit (SAC)
	ARIES Canning Module (ARCA)	Very unlikely to Improbable	WG-Pu	Oxide	4,500	1	2E-03	0.3	1	2.7	Long-term health effects, disability, or severe injury (nonlife-threatening)	N/A	N/A
	ARIES Nondestructive Assay Module (ARNA)	Very unlikely to Improbable	WG-Pu	Oxide	4,500	1	2E-03	0.3	1	2.7	Long-term health effects, disability, or severe injury (nonlife-threatening)	N/A	N/A
	ARIES Robotic Integrated Packaging System (RIPS)	Very unlikely to Improbable	WG-Pu	Oxide	4,500	1	2E-03	0.3	1	2.7	Long-term health effects, disability, or severe injury (nonlife-threatening)	N/A	N/A
	3.4.16 Generic Glovebox Accident	Unlikely	WG-Pu	Oxide or Molten Metal	3E4	1	Varies depending on material form	Varies depending on material form	1/0.05 – 0.1	7.5 - Fire (molten metal) 1.8 – Fire (oxide) 18 - Spill	Long-term health effects, disability, or severe injury (nonlife-threatening)	0.13	• PF-4 Confinement (SS) • Fire Suppression System (SS) • PF-4 Ventilation System and Ductwork (SS) • Glovebox (SS) • MAR limit (SAC)
	ARIES Direct Metal Oxidation (ADMO)	Unlikely	WG-Pu	Molten Metal	4,500	1	1E-2	1	1	45	Long-term health effects, disability, or severe injury (nonlife-threatening)	N/A	N/A
Deflagration	3.4.4, Hydrogen Deflagration in the Full-Scale Test Facility	Beyond extremely unlikely	WG-Pu	Hydride	454	1	1	5E-4	1/0.05	0.227	Immediate health effects or loss of life	1.9E-3	• PF-4 Confinement (SS) • PF-4 Ventilation System and Ductwork (SS)
			WG-Pu	Bulk Metal	11,546	1	0	0	1/0.05	0			

	3.4.5, Hydrogen Deflagration from Dissolution of Pu Metal	Very unlikely to Improbable	WG-Pu	Salt	1,040	1	0.2	1	1/0.05	208	Long-term health effects, disability, or severe injury (nonlife-threatening)	4.6	• PF-4 Confinement (SC) • PF-4 Ventilation System and Ductwork (SS) • Glovebox (SS) • Acid addition control (SAC) • MAR limit (SAC)
			WG-Pu	Oxide	1,040	1	5E-03	0.3	1/0.05	1.56			
	RIPS	Very unlikely to Improbable	WG-Pu	Oxide	0.59	1	0.1	0.7	1	4E-2	Long-term health effects, disability, or severe injury (nonlife-threatening)	N/A	N/A
Fire	3.4.9, Glovebox Fire, Pyrochemical Metal Preparation	Remote	WG-Pu	Salt	9,000	1	5E-4	0.5	1/0.1	2.25	Long-term health effects, disability, or severe injury (nonlife-threatening)	0.10	• PF-4 Confinement (SC) • PF-4 Ventilation System and Ductwork (SS) • Fire Suppression System (SS) • Molten Pu Metal Containment (SS) • Glovebox (SS) • MAR limit (SAC)
	3.4.12, Fire in TA55 Vault	Remote	WG-Pu	Oxide	1.5E-6	1	5E-04	0.5	1/0.05	375	Immediate health effects or loss of life	3.3	• PF-4 Confinement (SC) • Fire Suppression System (SC) • PF-4 Ventilation System and Ductwork (SS) • MAR limit (SAC)
	3.4.16, Generic Glovebox Accident	Unlikely	WG-Pu	Oxide or Molten Metal	3E4	1	Varies depending on material form	Varies depending on material form	1/0.05 – 0.1	7.5 - Fire (molten metal) 1.8 – Fire (oxide) 18 - Spill	Long-term health effects, disability, or severe injury (nonlife-threatening)	0.13	• PF-4 Confinement (SS) • Fire Suppression System (SS) • PF-4 Ventilation System and Ductwork (SS) • Glovebox (SS) • MAR limit (SAC)
	ADMO	Unlikely	WG-Pu	Metal	4,500	1	3E-5	0.04	1	0.01	Long-term health effects, disability, or severe injury (nonlife-threatening)	N/A	N/A
				Oxide	14,020	1	6E-3	0.01	1	0.84		N/A	N/A
	ARL	Unlikely	WG-Pu	Metal	6,520	1	5E-04	0.5	1	1.63	Long-term health effects, disability, or severe injury (nonlife-threatening)	N/A	N/A
				Oxide	4,500	1	6E-3	0.01	1	0.27		N/A	N/A

NPH (Seismic)	3.4.13, Seismic Impact on PF-4	Extremely unlikely	Pu-equivalent	Oxides and Salts	2.6E6	1	Varies depending on material form	Varies depending on material form	1/0.05 – 0.18	Spill w/Fire 1001 (Oxides) 96 (Salts) Spill 704 (Oxides) 29 (Salts)	Immediate health effects or loss of life	23	• PF-4 Confinement (SC) • PF-4 Ventilation System and Ductwork (SS) • Glovebox (SS) • Molten Pu Metal Containment (SS) • MAR limit (SAC)
	ARL	Extremely unlikely	WG-Pu	Oxide	4,500	1	1E-3	0.1	1	0.45	Immediate health effects or loss of life	N/A	N/A

{1} Number refers to the accident reference number in Chapter 3 of the TA-55 DSA.
{2} WG-Pu = weapons grade plutonium. HS-Pu = heat source plutonium.
{3} Dose to the noninvolved worker was determined from the Hazard Analysis and conservatively assumed to be the same as dose to the immediate worker.
{4} Identified values are the mitigated committed effective dose (CED).
{5} Accident parameters for ARIES events were taken from the process-specific PrHAs.
{6} Mitigated dose was not calculated in the ARIES-specific process hazard analysis (PrHA).

Scaling needs to be considered for the Action alternative for facility-wide accidents such as a seismic event. The MAR quantities for both alternatives by form are shown in Table 11. These are conservative values assuming all SPD activities are fully engaged with maximum material. Material in qualified safes or the PF-4 basement is ignored, as is uranium, which makes up less than one percent of the total and has very low radioactivity. The vast majority of material is in the form of bulk powder. Oxide production under the Action alternative is used as the bounding case for safety basis because the powder form has a higher release fraction (ARF x RF) than bulk metal. As noted in the table, impact factors are taken from the most recent TA-55 DSA.

TABLE 11
Material at Risk and Safety Basis Accident Factors

	Pu-EQ in Various Forms			
	Bulk Powder	Bulk Metal	Molten Metal (Casting)	Total
MAR, No Action Alt (kg)	349	12	18	379
MAR, Action Alt (kg)	523.5	63	54	640.5
MAR Delta (kg)	174.5	51	36	261.5
Delta Factor	50%	425%	200%	69%
Unmitigated Seismic Spill {1}				
Airborne Release Fraction	2.00E-03	{4}	1.00E-02	
Respirable Fraction	0.3	1.0E-06 {4}	1.0	
Unmitigated Seismic Fire {2}				
Airborne Release Fraction	6.00E-03	3.00E-05	1.00E-02	
Respirable Fraction	0.01	0.04	1.0	
Dose/Source Term Ratio (Rem/g) {3}	0.189	0.189	0.189	

{1} 2011 TA-55 DSA, Table 3-39.
{2} Ibid., Table 3-40.
{3} Ibid., Table 3-44
{4} ARF x RF for Pu-EQ as Bulk Metal is 1.0E-06. Ibid., Table 3-41.
Note: The leak path factor (LPF) for mitigated effect is 0.05 (spill) and 0.18 (fire) per Table 3-46. The damage ratio (DR) is assumed to be 1.0 per p. 3-238.

The overall increase in MAR between No Action and Action alternatives as shown in the table is about 70 percent (261/379). The Pu-EQ limit for PF-4 used in the 2011 TA-55 DSA is 2,600 kg. The Action alternative would hypothetically add about ten percent to this total. However, under current PF-4 safety controls the Action alternative material would be handled through careful project/activity scheduling and storage of additional material of various projects in qualified containers so as to stay within 2,600 kg limit. Therefore, there would be no increased exposure to the public (i.e., the mitigated consequences associated with a significant seismic event (PC-3) would remain less than the 25-rem DOE Evaluation Guideline). In addition, safety upgrades now underway at PF-4 to improve glovebox stands and fire suppression capabilities are expected to reduce the mitigated consequences of 2,600 kg to less than half the 25-rem value. Consequently,

adding 260 kg of MAR to the 2,600 kg limit after the upgrades are completed would not increase exposure above 25 rem.

- *Filtration (type and efficiency)*

Filtration that is credited as part of the PF-4 confinement is covered by the Technical Safety Requirements (TSRs) including Limiting Condition for Operation (LCO) 3.1.3, Ventilation System – Confinement, and Design Feature (DF) 6.1.1, Confinement. The specific performance requirements associated with the PF-4 Ventilation Systems including credited filtration are specified in LCO 3.1.3 and DF 6.1.1.

- *Number of involved workers*

TA55 operates under a "two-person" rule for operations involving nuclear material, and other designated activities. Hence, it can be assumed that the number of involved workers that would be affected by a given accident would be consistent with the two-person rule.

Provide citations for any safety documentation (e.g., safety assessments, safety analysis reports) forming the basis for the accident information provided. We may have older versions of these documents and may need to request the latest versions.

The information provided in the attached table is based on Revision 1.0 of the 2011 TA-55 DSA and TSR and the applicable PrHAs for ARIES. Information related to PF-4 seismic capability was obtained from the Seismic Analysis of Facilities and Evaluation of Risk (SAFER) analysis, SAFER:11-008LG, dated May 31, 2011.

Chemical inventory for chemical accidents that would need to be considered associated with these operations:

- *List chemicals, total facility inventory, and annual usage of the chemical*
- *Size and location of largest tank (storage container) for each chemical.*
- *Concentration of chemical in largest tank (identify if this is the highest concentration of the chemical being stored). If not, also list the other storage locations, size of tank and concentration of chemical being stored.*

Chemical accidents associated with the proposed operations would be consistent with those evaluated in the TA-55 DSA. No significant changes to the facility chemical inventory or installed storage capability are anticipated as a result of either alternative.

Earthquake frequency that would result in loss of structural integrity at PF-4. In CMRR SEIS, we evaluated an earthquake with a peak horizontal ground acceleration of 0.47 g and a peak vertical ground acceleration of 0.51 g for TA-55. Would an earthquake of this magnitude result in a loss of structural integrity at PF-4? If so, what would be the postulated RF, DR, ARF, etc. at PF-4 for such an earthquake?

The PF-4 confinement structure is analyzed to meet or exceed the PC-3 performance goal of $1x10^{-4}$.

Other natural phenomena that would result in loss of structural integrity at PF-4 and their frequency. Volcano? Wildfire?

As documented in the TA-55 DSA, no other evaluated natural phenomena events will result in the loss of PF-4 structural integrity.

Aircraft crash frequency for PF-4.
The probability that an aircraft will crash into PF-4 in a given year was calculated to be 5.6E-6.[30] Only fixed-wing, single-engine, and small commercial aviation air taxis contributed to this number.

The identification by LANL of concerns regarding the use of the SASSI code has led to scrutiny by DOE, DNFSB, and others of certain analytical methods used in the code as well as quality assurance procedures. Provide, if possible, a summary of measures taken to date to address concerns with the use of SASSI, particularly regarding its use for analysis of PF-4.
Concern with the SASSI code centers on the use of "the subtraction method that produces unrealistic responses when analyzing structures with wide and shallow foundations."[31] This method is one of four sub-structuring techniques to ease required computing resources during solution of soil-structure interaction (SSI). In view of this issue, recent seismic analyses of PF-4 used the flexible volume method, rather than the subtraction method. Specifically,

> SASSI was used to calculate the response of the PF-4 structure using soil-structure interaction analysis to the ground motion associated with a PC 3 seismic event. Two separate evaluations were done, one a deterministic evaluation which incorporated 6 different analysis which results enveloped the responses from the six different analyses. The other was a probabilistic evaluation which incorporated 64 different analyses which the result represented in the 86th percentile non-exceedance probability. SASSI was used in each of the individual analyses. The peer review team was engaged throughout with peer review sessions held at points where analysis results were available and validation was needed before moving forward.[32]

I. Transportation of Material

Transportation requirements associated with these operations:

- *Pits from Pantex to LANL*
- *Plutonium oxide from LANL to SRS*
- *Plutonium metal from LANL to SRS*
- *HEU from LANL to Oak Ridge*
- *Any other material (e.g. tritium?) from LANL to an offsite destination (please specify).*

The production schedule, coupled with the packaging assumptions, allows us to compute the trucking requirements for operational material. The total number of truck (SGT) shipments per year for pits (Pantex to LANL), oxide and metal (LANL to SRS), and HEU (LANL to Y-12) ranges from 60 to 210 at a peak production rate of 2.5 MT/y. The total over the whole 34 MT program is about 2,000 shipments.

---

[30] SB-DOCALC-08-027.
[31] Defense Nuclear Facilities Safety Board Staff Issue Report, "Issues Related to the SASSI Computer Software," Memorandum for T. J. Dwyer, Technical Director, March 3, 2011.
[32] Larry Goen (Conduct of Engineering Office), e-mail to Jennie Richardson, December 13, 2011.

Data needs are summarized in the table below, along with our assumptions about some shipment parameters based on the existing SPD SEIS analysis. Please review the assumptions in the table, and fill in question marks with appropriate data.

Parameter	***Pits from Pantex to LANL***	***Pu oxide from LANL to SRS***	***Pu metal from LANL to SRS***	***HEU from LANL to Oak Ridge***	***Other material from LANL to offsite***
Package	*MD-2*	*9975*	*9975*	*ES-3100*	*?*
Assumed quantity per package	*6.5kg WG Pu/MD-2*	*5kg PuO_2/9975 Polished*	*5 kg WG Pu/9975*	*12.3 kg U_3O_8/ES-3100*	*?*
Transport mode	*SGT*	*SGT*	*SGT*	*SGT*	*?*
Assumed packages per vehicle	*? [a]*	*?*	*?*	*?*	*?*
Number of shipments (total)	*? [a]*	*?*	*?*	*?*	*?*
Assumed dose rate (mrem/hr) at 1 meter from package	*2*	*2 Need percentage of dose related to neutron dose*	*2*	*2*	*?*
Total quantity of material	*? [a]*	*?*	*?*	*?*	*?*

[a] In the current draft SPD SEIS, it was assumed for the action alternatives that it would require 1,250 shipments of pits and metal from Pantex to LANL (approximately 35 MT of Pu); the number of shipments was determined by prorating the number of shipments analyzed in the 1999 SPD EIS.