



Department of Energy
Albuquerque Operations Office
P.O. Box 5400
Albuquerque, New Mexico 87185-5400

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14 JAN 1999

The Honorable John T. Conway
Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, N.W., Suite 700
Washington, D.C. 20004

Dear Mr. Chairman:

Enclosed is the Los Alamos National Laboratory (LANL) Site Assessment Report that summarizes information developed from initial inspections and assessments of material containing uranium-233 at LANL. The report represents the deliverable for Commitment 4 of the Department of Energy's Implementation for addressing the Defense Nuclear Facilities Safety Board's Recommendation 97-1, concerning the safe storage of Uranium-233 material.

The report describes the types of uranium-233 material in inventory, the facilities where the material is located, and the actions completed to date to determine any remediation efforts needed as we work toward consolidating the material in preparation for movement to a long-term storage location. We will provide progress reports on these consolidation activities as necessary.

We have completed the actions identified under this milestone and propose closure of this commitment. If you have any questions, please contact me, or have your staff contact Steve Payne at (505) 845-6300.

Sincerely,

A handwritten signature in black ink, appearing to read "Bruce G. Twining", with a long, sweeping underline.

Bruce G. Twining
Manager

Enclosure

cc w/enclosure:
M. Whitaker, S-3.1, DOE HQ

LA-UR-98-5823

DNFSB 97-1 PROGRAM

Revision 1

December 18, 1998

**Los Alamos National Laboratory
Final Site Assessment Report:
Uranium 233 Storage and Disposition**

Prepared by

Jon B. Nielsen, NMT-2

Prepared for the

U.S. Department of Energy

TABLE OF CONTENTS

1. Site Specific Description: Los Alamos National Laboratory	3
1.1. Inventory	3
1.2. Material forms	3
1.3. Facility Description	3
1.3.1. TA-55	3
1.3.2. Chemistry and Metallurgy Building (CMR)	3
1.3.3. TA-18	4
2. Observations	4
2.1. Material Characterization Data	4
2.2. Packaging	5
2.2.1. Visual Inspection	5
2.2.2. Remediation	5
2.3. Facility	6
2.3.1. TA-55	6
2.3.1.1. Safety Analysis	6
2.3.1.2. Facility Measurements	7
2.3.1.3. Condition Assessments	7
2.3.2. CMR	8
2.3.2.1. Safety Analysis	8
2.3.2.2. Facility Measurements	9
2.3.2.3. Condition Assessments	11
2.3.3. TA-18	11
2.3.3.1. Safety Analysis	11
2.3.3.2. Facility Measurements	12
2.3.3.3. Condition Assessments	12
3. Evaluation of Observations	12
4. Path Forward	13
TABLE 1. Los Alamos 97-1 inventory by item count	14

1. Site Specific Description: Los Alamos National Laboratory

1.1. Inventory

The Los Alamos Uranium-233 inventory consists of 110 items (TABLE 1). The material is currently stored in the TA-55 vault, the Chemistry and Metallurgy Building (CMR) vault, and at the Hillside vault at TA-18 (Los Alamos Critical Experiment Facility, LACEF).

The inventory has been static during the past 5 years because there is no programmatic need or use for this material at this time. Our plans are to consolidate the material in preparation for movement to a final long-term storage location.

1.2. Material forms

The total reportable inventory at Los Alamos is 7.2 kgs of uranium-233. The major physical forms are metal and oxides. There are small amounts of other forms which total less than 10% of the inventory by number of items. Table 1 summarizes the material forms by number of items. The variety of items at Los Alamos arises from the research atmosphere of the institution. In order to deal with the material currently on site we will attempt to stabilize the material to an oxide or metal form.

Several of the items also contain a variety of other actinides. These mixed items are packaged such that they pose no risk workers, public, or environment. However, these items will require special handling and different disposition pathways than the pure U-233 items

1.3. Facility Description

1.3.1. TA-55

The TA-55 complex began operating in 1978. This seismically designed facility performs primarily state-of-the-art Pu processing, but also has some HEU inventory and handling operations. While TA-55 operations involve primarily Pu in liquid and solid forms, operations involving uranium and other actinides are also carried out inside the TA-55 facility. Facility activities include fabricating, testing, and disassembling of solid components, and various aqueous processes involving both uranium and plutonium.

1.3.2. Chemistry and Metallurgy Building (CMR)

The CMR Building is a large, reinforced concrete building with a basement, a first floor, and an attic. The facility is centered on a single main corridor with eight wings. An administration wing and seven laboratory wings extend from the corridor. The laboratory

wings have change rooms and filter towers located at the end of each wing. In addition, a waste assay facility is located at the loading dock between Wings 1 and 4.

The CMR Building was completed in 1952 to house research and experimental facilities for analytical chemistry, Pu and uranium chemistry and metallurgy, and some engineering design and support functions. At the time it was built, the facility represented state-of-the-art instrumentation and engineered safety controls for a modern chemistry laboratory. The design of the facility is still considered a preferred configuration for a chemistry laboratory. However, it was built to Uniform Building Requirements and does not meet many of today's standards or requirements. In 1960, a 54,000-square-foot addition (Wing 9) was constructed to support Laboratory programs requiring hot cell facilities. The Wing 9 addition brought the total square footage of the CMR Building to approximately 555,000 square feet.

1.3.3. TA-18

TA-18 houses the LACEF and serves as the primary facility at LANL for critical experiments. TA-18 is remotely located at the Pajarito Site within canyons that can provide radiation shielding in the event of a local release. Critical experiments are conducted there at low-power levels for extended periods, and at high-power levels for burst operations. These experiments generate negligible fission product or activation product inventories, and need no special cooling. The experimental critical assemblies are situated in Laboratory buildings called Kivas, which also contain storage areas for SNM. An additional storage area exists at TA-18 in the hillside vault. This area is where the U-233 is stored at this location. The critical assemblies are the only assemblies currently authorized to operate using HEU. Safety analyses of these assemblies are well documented and have been reviewed by several organizations.

2. Observations

2.1. Material Characterization Data

Material characterization data for the U-233 inventory (form and quantity) can be found with our material accountability data. The majority information that currently exist are measurements performed by the institution that of the shipped the material to Los Alamos. Los Alamos currently is unable to complete NDA because no instrumentation or traceable standards exist to calibrate and certify NDA instrumentation. Of the items in inventory, 37% are currently listed at measurement based on weight alone. Another 16% have invalid measurement codes, 17% are considered difficult to measure items, 13% have values assigned by the shipper, and 17% have confirmatory measurements that are not quantified. Currently there are no items in the inventory with chemical analysis measurement codes. The characterization data or lack thereof needs to be addressed to fulfill the requirements of this program. Therefore, NDA measurements or chemical analysis of the material will be required to ship this material off site as part of this plan. Table 2 summarizes this information.

Measurement Code	# of items	% of Inventory
Balance Measurement	53	37
Difficult to Measure	25	17
Shippers Value	18	13
Confirmatory Measurement	24	17
Invalid Measurement Code	23	16
Total	143	100

As described in the Program execution plan, Los Alamos intends on shipping the majority of the U-233 inventory to ORNL. In order to accomplish this, it will be necessary to re-measure the items by gamma ray spectroscopy and obtain a mass by weight. The gamma spectroscopy and weight will allow both parties to meet the nuclear materials shipping requirements. As funding is made available, more detailed schedules will be developed to accomplish the re-measurement tasks.

2.2. Packaging

2.2.1. Visual Inspection

Over the past two years, a complete visual inspection of the containers has taken place. During these inspections, there was no visual evidence of degradation of the outer container.

Small amounts of U-233 have been stored in the Hillside Vault for more than 10 years. The U233 has not been repackaged because of high radiation levels (more than 20 R/hr at contact). Facility personnel believe that no plastic bags surround the U-233 samples. However, the packaging could be breached by a seismic event or by dropping the container on the floor during the semiannual vault inventories. The exteriors of the packages show no signs of decay. A recent radiography study also indicates that the contents are still intact and require no remedial action with respect to packaging.

2.2.2. Remediation

Based on the inspection conducted over the past two years, there seems to be no need for remedial action with respect to outer packages. However, the inner packaging is not well characterized and some remedial action may be required when the items are prepared for transport to the final storage location. There has been an example of a package of U-233 containing plastics in contact with a metal button. When this material was repackaged, the plastic was found blackened and brittle from radiological damage. Because of this finding, it is likely that we may find other containers that have plastic packaging material. However, they will be shipped as is to ORNL, where there exist a capability to deal with handling this type of material.

The Hillside vault storage location at TA-18 was also identified as an inadequate storage location because of its proximity to a public access road and the lack of ventilation and

HEPA filtration of the air handling system. The near term action to remedy this situation is to move a portion of the U-233 material from the Hillside vault to the CMR building floor hole storage area in wing 9.

In preparation for moving the TA-18 material, a radiography study of the material was completed. The results of this study did not identify any critical safety concerns. However, it did provide information regarding the contents of each package. Many of the larger packages contain a variety of smaller containers. The smaller container was identified as containing glass, plastic, and metal containers. This information will be used when opening the containers for repackaging. It is now known that these contain packaging material not suitable for storage of U-233.

A neutron streaming study was also complete on the floor hole storage array in the CMR building. This was done to verify that the material to be stored in the floor holes would be adequately contained to minimize radiation fields outside of the storage locations. It is also used to ensure that there is no interaction of radiation fields between each storage location. The results of this study confirmed that these locations are suitable for storage of U-233. The radiation field measurement on top of the storage location was only background. This indicates that there will be no transient personnel dose from storage of material in these locations. Hole to hole neutron measurements were taken at a variety of depths ranging from unshielded reading at top of hole to readings at the bottom of the hole. The readings observed were approximately 1 mR/hr at top to 300 mR/hr at the bottom of the hole. Gamma radiation readings were only taken at floor level and no reading above background were observed. This also does not raise any concern for storage of U-233 in these locations.

2.3. Facility

2.3.1. TA-55

2.3.1.1. Safety Analysis

A DOE-approved SAR for TA-55 (DOE 5480.23) was approved in July 1996. Operational Safety Requirements (OSR) have been approved by DOE (1988, revised 1989), and a Basis for Interim Operation (BIO) for the processing facility was approved June 16, 1994. In the BIO, the consequences of a worst-case bounding and of an unmitigated accident are presented. Results for both scenarios are well below the DOE guideline for accidental releases of 25 rem whole-body committed effective dose equivalent at the site boundary.

Analysts who performed the preliminary hazard analysis (PHA) reviewed operations in all areas of TA-55. Approximately 850 scenarios were identified and were categorized based on the likelihood of occurrence and on the consequences likely to the public, workers, and the environment. The scenarios were grouped by likelihood and consequence to create a risk ranking. Those scenarios that were considered to be bounding were described in detail in the SAR. In the SAR accident analysis, U-233 was based on the materials current location. The analysis did not reveal any condition that would impact the safety envelope of the facility.

2.3.1.2. Facility Measurements

2.3.1.2.1. Ventilation and Off-gas Monitoring

Circulating air and makeup air (drawn from the outside into the building) are passed through high-efficiency particulate air (HEPA) filters. In-line air samplers are also located at various locations within the ventilation ducts to monitor for contamination. This protects workers from contamination that might originate from both inside and outside of the facility. The air in the laboratories is continuously replaced at approximately seven air changes per hour. The desired pressure differentials are monitored both automatically and visually in the Facility Operations Center. There is a 100-percent redundant system for standby to back up the ventilation system for the high-radiation areas (Zone 1).

Air that is being bled off to the outside of the facility passes through an additional two-stage HEPA filter, and is released through continuously monitored stacks.

2.3.1.2.2. Radiation Assessments

Uranium -233 is stored in the TA-55 main vault. Because of the locations, the radiation fields can be greater than 100 mr/hr. This dose rate is not from the U-233 alone. The TA-55 vault stores other material as well as the U-233.

2.3.1.3. Condition Assessments

Operations are controlled by the plan of the day and a daily work schedule. A morning meeting is used to review the work each day. These methods are used to coordinate between the Operations Center and the distributed Laboratory activities. The Operations Center is used to monitor the ventilation systems, electrical systems, and safety systems of TA-55. The Operations Center and the laboratories have written procedures for tasks. The processing areas use SOPS. The personnel are trained in the procedures.

A resident subcontractor conducts maintenance and minor construction activities. Maintenance work is controlled by a work control process, which includes written procedures and job packages.

Safety-related equipment and systems are subject to surveillance requirements defined in the OSRs. The surveillance requirements-which include monitoring, testing, and calibrating-apply to ventilation systems, exhaust filtration, recirculation filtration, fire detection, fire suppression, emergency alarms, the facility control system, instrument compressed air, and uninterruptible power supply. Generally, the systems are designed to allow operations to continue during testing and maintenance.

A configuration manager is responsible for maintaining facility configuration. Thorough reviews are conducted before the installation of new equipment or processes. Before replacing equipment in gloveboxes, an unreviewed safety question (USQ) screening is conducted along with independent reviews, including criticality safety reviews.

The formality of operations and maintenance has increased since the DOE Mentor program began in early 1993. Under this program, subject matter experts have worked toward increasing formalization of operations involving management and organization, the safety envelope, environmental compliance, safety, and the conduct of operations. This was identified as a noteworthy practice during the Plutonium Vulnerability Assessment.

A predictive maintenance program is in place at TA-55. On a monthly basis, a subcontractor performs vibrational testing on various types of equipment. Data have indicated that the mean time between failure for equipment under the program has increased significantly. Discussions with site personnel revealed the following:

In 1996, The backlog of corrective maintenance work orders is approximately 385. Completion of these work orders will require approximately 25,000 person hours to complete.

The TA-55, Fiscal Year-1998 budget called for \$150 million in equipment upgrades. Typically, only \$2 million per year is devoted to equipment upgrades.

One day in five is devoted to maintenance-related activities at TA-55.

2.3.2. CMR

2.3.2.1.

Safety Analysis

Status of CMR Safety Basis

The DOE approved the CMR Basis for Interim Operations (BIO) on August 31, 1998. DOE approval was communicated in a Management Evaluation Report (MER) that detailed the conditions of approval and set forth a schedule for completion of required actions. The BIO includes updated process descriptions and hazard analyses as well as detailed accident analyses. The corresponding Technical Safety Requirements (TSRs) have been submitted to DOE but have not yet been approved. Interim TSRs have been

developed to cover the two-year implementation schedule for the Final TSRs. The TSR requirements are being used to prioritize CMR upgrades.

The BIO describes the facility, the processes performed within the facility, and the hazards and risks to the workers and the public from the operations and from potential accidents. The focus of the BIO is on accident scenarios and off-site (public) consequences. The accident analyses included a variety of fire scenarios, explosions, spills of radioactive or chemical materials, aircraft accidents, and earthquakes. Standard risk analysis techniques were used to construct and evaluate fault and event trees and evaluate uncertainties in the evaluation of accident scenarios and consequences. During normal operation, worker exposures are below DOE administrative limits (2 rem/year), and public exposures are well within the evaluation guide limit of 25 rem CEDE (committed effective dose equivalent) to the maximally exposed off-site individual (MEOI). Under the most conservative assumptions, the bounding accident (seismically induced fire) causes the offsite dose to the MEOI to exceed the evaluation guideline. However, CMR has implemented a transient combustible control program to reduce the probability that a small fire could spread to a wing-wide fire, and is in the process of implementing a containerization program to reduce the amount of radioactive material that could be released during a catastrophic event. With the implementation of containerization and of transient combustible control, the off-site consequences are expected to be within the evaluation guide for all but the most severe accident scenarios. The facility is classified as posing a moderate hazard based on radiological considerations, and posing a moderate to low hazard based on chemical hazards.

2.3.2.2. Facility Measurements

2.3.2.2.1. Ventilation

The CMR Facility ventilation system moves air at a rate of nearly 100,000 cubic-feet-per-minute (cfm) through each laboratory wing. The average air change rate in a laboratory is Approximately 15 air changes per hour, but this varies depending on the use of the laboratory.

Ventilation systems in the wings are independent. The HVAC systems supply 100% outside air to the laboratories, offices, attic spaces, and basement areas. Except for the Administration Wing, the systems operate in a single pass-through mode without recirculation. The exhaust systems for Wings 1 and 9 and the Administration Wing are described separately. Descriptions of all the fan systems are included in "Los Alamos National Laboratory CMR Facility As-Builts," SM-29, TA-3 and "Test, Adjusting, and Balancing Report," Phase I and Phase II (Energy Masters Corporation, 1991 and 1992).

The main vault was designed and constructed in 1986 to the requirements of DOE Order 6430.1, General Design Criteria. The main vault is a reinforced concrete structure with three separate storage areas and an entry vestibule that is accessed from the basement

corridor. Two Class V vault doors control access; the door to the vault is insulated to the equivalent of a 2-hour fire-resistive rating.

The HVAC system for the main vault is completely independent of the building ventilation systems. The main vault is supplied with 100% outside air to provide seven air changes per hour (about 1200 CFM). Supply air is filtered through a pre-filter, then through dual HEPA filters. Approximately 1300 cfm of air is exhausted above the CMR Building through an exhaust stack. Exhaust air is filtered through a pre-filter, then through dual HEPA filters. An alarm panel located outside the main vault near the entrance alarms when the filters are dirty or clogged or when either supply or exhaust fans fail.

The Ventilation system in Wing 9 is a stand-alone system.

2.3.2.2.2. Off-gas Monitoring

A variety of radiation detection instrumentation is used at the CMR Facility to provide a comprehensive radiation protection and contamination control. This combination consists of constant air surveillance devices, a variety of radiation survey instruments for monitoring areas and equipment, and personnel monitors. Together, these instruments form an effective deterrent to radiation exposure and the spread of radioactive contamination.

Devices for detecting airborne contamination in the CMR Facility consist of CAMs and fixed air samplers (FASs) located in areas where there is a potential for airborne activity. CAMs constantly sample local air for contamination. Alarm scale and sensitivity are variable so a particular instrument can be set to alarm at low concentrations of plutonium, uranium, or other radionuclides. All CAMs provide a real-time alarm to the local area, signaling an immediate evacuation of the area. CAM instrumentation is located throughout the CMR Facility according to the potential for airborne contamination. The areas of highest potential receive the greatest degree of CAM coverage.

FASs are used as a critical part of the comprehensive contamination control and air monitoring system at the CMR Facility. They complement the CAM system, providing accurate measurements of actual conditions and airborne radioactivity in the laboratory wings. FASs are placed in strategic locations according to laboratory airflow, types of material handled and work conducted in the laboratory, locations of hoods, gloveboxes, and open-front boxes, and the location of personnel during normal working conditions. The ultimate goal in the placement of the FASs is to provide a "representative" sample of the air that workers breathe. FASs use air sampler vacuum pumps to pull samples of local air through a filter. The filter is removed once a week and analyzed for collected activity. This system does not provide real-time warning of contamination buildup or protection from potential accidents. The primary function of the FAS system is to provide a weekly check on normal operations.

FASs are also used for monitoring CMR Facility stack emissions, with one FAS per facility stack. These stack FASs are located near the sampling ports in the attic of the

CMR Facility. Stack FAS filters are changed and analyzed weekly. The results are used to determine compliance with DOE and EPA limits on exposure to the public resulting from normal operations.

Personnel monitors located at the exit of each laboratory module and each exit of controlled areas form a barrier to the spread of contamination in the CMR Facility. Portable hand and foot monitors capable of detecting alpha activity are available at these locations in addition to portable monitors for scanning other body extremities. Use of these monitors is required for all personnel as part of normal passage from buffer areas and controlled areas

2.3.2.3. Condition Assessments

The facility is fully functional and could be used as a staging area for shipment of U-233 to Oak Ridge National Laboratory.

The CMR is currently undergoing upgrades to bring many of the systems into compliance with various requirements and codes. These include electrical and ventilation system changes.

2.3.3. TA-18

2.3.3.1. Safety Analysis

A DOE-approved *Safety Analysis Report (SAR) for TA-18 (5480.23)*, dated May 1996 is in place and is the primary document forming the authorization basis for the facility. However, we understand that the facility is undergoing a major review and revision of the SAR. In particular they will be addressing storage of material at that facility. The U-233 residing at TA-18 will be included in all evaluations and analyses and it is not expected that this material will pose any significant impact on the safety basis of the facility.

A basis for interim operations was issued in October 1993. Only Kiva 2 is considered to be a Category 2 (moderate) hazard facility; all other operations at TA-18 are considered to be Category 3 (low). Safety analyses and experiment plans are reviewed by the Laboratory Reactor Safety Committee and reviewed and approved by the nonproliferation and International Security Division Director's Office (NIS/DO).

The SAR accident analyses accounted for both typical mechanistic accidents (e.g., loss of normal AC power, uncontrolled insertion of one control element, inadvertent criticality during fuel loading or maintenance), and extreme, hypothetical events leading to maximum consequences. The accident analyses completed for TA-18 covers all buildings and nuclear material storage locations including the hillside vault. The hillside vault was analyzed to cover typical storage inventories of U-235, Pu-239, and U-233. None of the

mechanistic accidents resulted in releases of radioactivity outside the operations boundary (defined as the area within 200 meters of the TA-18 site perimeter). However, local consequences could be severe, (including fatalities).

Hypothetical events (bounding accidents) were postulated to define an envelope of permissible experiments at LACEF by determining the maximum consequences, given the scope of operations that take place in the Kivas and storage areas. It should be noted that the physical mechanisms necessary to initiate these accidents require multiple, simultaneous failures, or catastrophic events. The consequences of this class of events results in significant calculated doses outside the TA-18 control boundary, but usually less than the radiological site guidelines of DOE 6430.1A (25 rem). The analyzed events included: a fire in the Hillside storage areas with the dispersal of the uranium and Pu inventories (the bounding accident with respect to consequences outside the facility) and the dispersal from a plutonium-fueled critical assembly in Kiva 2 due to a reactivity insertion.

2.3.3.2. Facility Measurements

2.3.3.2.1. Ventilation

There is no ventilation system in the Hillside vault where the U-233 material is currently stored. Radiation surveys are carried out on a regular basis as well as contamination surveys to maintain an uncontaminated vault. There is on portable continuous air monitor in the Hillside vault to measure for airborne contamination.

2.3.3.3. Condition Assessments

The Hillside vault is functioning, however, it does not meet the criteria for a storage location for nuclear materials. There is no ventilation system or HEPA filtration to minimize release of material outside of the vault.

3. Evaluation of Observations

The evaluation of the condition of U-233 material in the Los Alamos Inventory is consistent with the conclusions reached in the Highly Enriched Uranium Vulnerability Assessment. The material at TA-18 needs to be moved to a more suitable storage location while awaiting stabilization, repackaging and shipment. The other material is stored in adequate location until further action is taken to remove the material from inventory.

An issue also was identified concerning accountability measurement data on the U-233 materials. The measurement data is not adequate to verify quantities in each package. In many cases the measurements consist of balance readings only. It is obvious that during repackaging and preparation for shipment that this material needs to be measured either by destructive chemical analysis or by a certified NDA technique.

4. Path Forward

This assessment has identified that some of the U-233 material in the Los Alamos inventory is not stored in a practical or safe location. The material at TA-18 is in a vault without the proper ventilation system for a vault location. There is a plan in place to move the TA-18 material to the CMR Facility for interim storage and repackaging prior to shipment to its final storage location. TA-18 Personnel have identified material that is still required for programmatic use. This material is encapsulated and used in their critical experiment assemblies. All other oxide material will be sent to CMR for temporary holding in preparation for shipment to ORNL.

Material currently stored at TA-55 and the CMR is in locations suitable for storage of this type of material. It is not necessary to take any action at this time with this material until the repackaging and shipment process begins. At that time, the material will be moved to the CMR for repackaging and stabilization prior to shipment to its final storage location.

Future activities will be related to preparing the material for shipment to ORNL. The material needs to be segregated into shipment lots and appropriate actions need to be taken to meet both the shipper and receiver requirements. Plans are being developed to provide a shipping schedule and material lots that can be campaigned to de-inventory U-233 from Los Alamos.

At this time no detailed plans have been developed for meeting these goals. Los Alamos has submitted input to the Department's program execution Plan such that when approved and funding allocations are made this program can proceed. As funding becomes available, detailed plans with schedules, milestones, and resource requirements will be prepared to meet the goals of this program.

TABLE 1. Los Alamos 97-1 inventory by item count.

ID NUMBER	CHEMICAL PHYSICAL FORM	TOTAL QTY. U (G)	232U CONTENT (PPM 232U)	ASSAY 233U, (G)	NUMBER OF PACKAGES
C13P	OMPOUND/CARBIDE/PLUTONIUM 39	49	5 -<10	48	3
C211	OMPOUND/DIOXIDE/HIGH PURITY	522	5 -<10	509	3
C213	XIDE	1	5 -<10	1	1
C214	OMPOUND/SOURCE	234	5 -<10	230	7
C217	OMPOUND/DIOXIDE/IMPURE/NO MAJOR CONTAMINANT	1604	5 -<10	1573	29
C21P	OMPOUND/DIOXIDE/PLUTONIUM 39	463	5 -<10	451	8
C527	OMPOUND/NITRATE/IMPURE/NO MAJOR CONTAMINANT	271	5 -<10	265	2
C807	OMPOUND/TETRAFLUORIDE/IMPURE/NO MAJOR CONTAMINANT	1	5 -<10	1	1
C862	OMPOUND/TRIOXIDE/MULTIPLE CONTAMINANTS/SERIAL REMARK	240	5 -<10	236	3
C881	OMPOUND/U3O8/HIGH PURITY	4	5 -<10	4	2
C887	OMPOUND/U3O8/IMPURE/NO MAJOR CONTAMINANT	700	5 -<10	686	3
C88H	OMPOUND/U3O8/HISTORY/ARCHIVAL SAMPLE	1	5 -<10	1	1
K150	COMBUSTIBLE/CELLULOSE BAG(S)/NON-SPECIFIC	6	5 -<10	6	2
L523	NITRATE SOLUTION/STANDARD	1	5 -<10	1	1

M011	ETAL/HIGH URITY/HIGH URITY	165	5 -<10	165	20
M01E	ETAL/HIGH URITY/ENCAPSU ATED	3	5 -<10	3	1
M391	ETAL/HIGH URITY URNINGS/HIGH URITY	6	5 -<10	6	1
M447	ETAL/IMPURE/I PURE/NO MAJOR ONTAMINANT	2309	5 -<10	2270	30
M44P	ETAL/IMPURE/P UTONIUM 239	15	5 -<10	15	2
M467	ETAL/IMPURE URNINGS/IMPUR /NO MAJOR ONTAMINANTS	5	5 -<10	5	1
M46P	ETAL/IMPURE URNINGS/PLUTO IUM 239	2	5 -<10	2	1
M745	ETAL/SPEC LLOY/PART	188	5 -<10	183	1
M74E	ETAL/SPEC LLOY/ENCAPSUL TED	62	5 -<10	61	1
M74H	ETAL/SPEC LLOY/HISTORY/ RCHIVAL AMPLE	68	5 -<10	67	7
N310	ON OMBUSTIBLE/GR PHITE/NON PECIFIC	118	5 -<10	115	1
N550	ONCOMBUSTIBL /NON- CTINIDE/NONSPE IFIC	11	5 -<10	11	1
N67W	ON OMBUSTIBLE/PL STICS/KIM IPES/APPROVED ESIGNATED ASTE	0	5 -<10	0	1
R410	ROCESS ESIDUE/HYDROX DE RECIPITATE/NON SPECIFIC	183	5 -<10	179	2

R412	ROCESS ESIDUE/HYDROX DE PRECIPITATE MULTI- ONTAMINANT/R MARKS	4	5 -<10	4	1
R780	ROCESS ESIDUE/ WEEPINGS/ CREENINGS/NON- PECIFIC	7	5 -<10	7	3
R78P	ROCESS ESIDUE/SWEEPIN S/ CREENINGS/PLUT NIUM 239	2	5 -<10	2	1