

*Nuclear Materials Stabilization and Packaging  
Quarterly Status Report  
January 1 – March 31, 1996*

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*Edited by Nora Rink, Group NMT-4  
Photocomposition by Lynne Atencio, Group CIC-1*

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*Thomas E. Ricketts*

*Nora A. Rink*

*Mark A. Robinson*

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**John M. Haschke, David R. Horrell, Carl W. Hoth, Keith W. Fife,  
Jon B. Nielsen, Stanley W. Pierce, Thomas E. Ricketts,  
Nora A. Rink, and Mark A. Robinson**

**ABSTRACT**

**This report documents progress on the Los Alamos Nuclear Materials Stabilization and Packaging projects for the second quarter of FY 1996. It covers development and production activities for the Plutonium Packaging Project, the Plutonium Recovery and Processing Project, and the Uranium Recovery and Processing Project. In addition, it reports on quality assurance activities for the Plutonium Packaging Project.**

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**INTRODUCTION**

This report documents technical progress on, and plans for, the Los Alamos National Laboratory Nuclear Materials Stabilization and Packaging projects. Project Leaders are:

Nuclear Materials Stabilization and Packaging:	Kenneth M. Chidester (505-667-2358)
Plutonium Packaging:	Carl W. Hoth (505-667-2354)
Plutonium Recovery and Processing:	Keith W. Fife (505-667-2353)
Uranium Recovery and Processing:	Jon B. Nielsen (505-665-8763)

Quarterly progress reporting for these projects began in the second quarter of FY 1994. This report is the eighth to be issued.

Defense Programs management at DOE Headquarters and the DOE Albuquerque Office have agreed to provide incremental funding for an 8-year project to complete 94-1 stabilization activities at Los Alamos. A revised Los Alamos National Laboratory Site Integrated Stabilization Management Plan (SISMP) for Residue Remediation and Material Management, Volumes I and II, was submitted to DOE-EM in February 1996; their comments have been incorporated into the final version of that document.

On February 28, 1996, personnel from DOE and the Complex assembled in Los Alamos for a working group meeting on DOE-STD-3013, "Criteria for the Safe Storage of Plutonium Metals and Oxides." At that time, Los Alamos Plutonium Packaging Project personnel reported on the status of efforts to define the technology base and develop the procedures needed for compliance with the standard. Topics covered included stabilization, handling, and certification of the oxide, as well as the possible effects of residual water during storage and surveillance.

On February 29, 1996, Project personnel participated in the DOE working group meeting to consider modification of DOE-STD-3013. Several potential areas for revision were identified, and subgroups were assigned to develop the technical justifications required for the proposed changes. The working group's goal is to issue a revision of DOE-STD-3013 by August 1996. Key potential modifications to the standard include

- eliminating the primary containment vessel;
- defining the requirements for a container system consisting of a minimum of two nested, hermetically sealed containers, with an optional third container to facilitate handling of the material during packaging;
- imposing the American Society of Mechanical Engineers pressure-vessel code on the boundary (outer) container;
- requiring the material (inner hermetically sealed) container to be decontaminated; and
- adding a requirement to incorporate surveillance features in the package.

The project continues to be involved in developing the International Atomic Energy Association Safe Practices documentation. A draft was completed in January and has been sent to member states for comment.

## **PLUTONIUM PACKAGING PROJECT**

### **Packaging Operations**

A total of 25 long-term storage containers are complete through the end of the quarter. All the containers hold high-purity plutonium metal in the form of ingots, rings, or rods. Documentation on the containers has been submitted for quality assurance review. In March, throughput decreased because the purity of the helium atmosphere in the welding glovebox for the secondary container was compromised. Container-welding personnel tested the glovebox for leaking helium, found the leak, and repaired it, restoring the high-purity atmosphere. By the end of the month, throughput had returned to the prior levels of two to three long-term storage containers per week.

### **Laser Marking System**

In a March 5 meeting, Randy McKee of the Sandia Intelligent Systems and Robotics Center reported on progress with laser marking techniques for long-term storage containers. This work, done under contract to the Packaging Project, included corrosion testing of laser-marked 304 stainless steel by the Sandia Facility for Atmospheric Corrosion Testing. Sandia Robotics Center personnel provided training and orientation regarding the laser parameters that provide optimum corrosion resistance and machine readability. They will continue to work with Processing Project technical personnel to qualify the laser marking technique.

### **Design of Containers and Upgrade of Welding Equipment**

Spin Forge International completed its first trial fabrication of second-generation containers on March 27, 1996. These containers displayed excessive taper in diameter, owing to spring-back of the material, but Spin Forge has already addressed this problem by modifying the process parameters. Another, more important, problem was that the container surface was marked by numerous longitudinal striations, some of which were quite large, easily seen with the naked eye and easily detected by touch. The striations most likely arise from surface imperfections in the original hot-rolled plate stock from which the containers are formed. Spin Forge is confident that more precise specification of the surface finish of raw stock will resolve the striation problem. Their goal is to produce ten demonstration units by May 1, 1996. Whether or not the procurement continues will be decided through evaluation of these demonstration units.

The effort to find better welding equipment is continuing. Over the past three months, Project personnel have been evaluating the Dimetrics Centaur 150™ welding power supply to be used with the Sandia robotics demonstration project. It was used for full-penetration girth welding of a sample of the low-sulfur stainless steel from Spin Forge; as expected, because of surface-tension-driven fluid flow, the



weld current had to be increased from 100 A to 120 A to produce an acceptable weld having an internal width similar to that attainable with the high-sulfur stainless steel. The increase in required current is not a problem, but it does reinforce the need to characterize material heats to be used in production. The Centaur equipment was used to establish a baseline parameter set for the square-butt weld on the second generation container.

In addition, a comparatively inexpensive Miller Electric Company Intellitig 4<sup>TM</sup> controller and Maxstar 175<sup>TM</sup> power supply have been purchased and are being evaluated. Other welding equipment options will be explored at the American Welding Society Exposition in April.

A weld fixture that will align the container and lid at the weld joint and position the welding torch is currently being designed and built. A prototype is expected to be completed by early May 1996.

### Design and Fabrication of an Aluminum Can for Plutonium Oxide

An aluminum can to contain the plutonium oxide during loading operations is being designed and fabricated. The can will be equipped with a friction-fit lid and porous metal filter to lower the risk of extreme contamination of the glovebox and the equipment used to weld the inner container. Initial design of the can is progressing, with vendor participation. Prototypes are to be fabricated and tested by May 1996.

### Quality Assurance

**Project Review.** A quality assurance review of the Packaging Project by the DOE Albuquerque Operations Office (DOE-AL) was postponed and must be rescheduled. Because of scheduling difficulties, the QA review was not conducted concurrently with the technical project review during the DOE-STD-3013 working group meeting on February 28, 1996.

The status of August peer-review action items that were open at the time of the last quarterly report is shown in the table below.

**Table I. Peer-Review Action Items**

• ESH-14 will provide an issues paper on DOE-STD-3013-94.	Complete.
• Project personnel will prepare an administrative procedure for the welding of bellows to the container lids. This will be done by MST Division, using MST-6-approved safe operating procedures.	Open. Due May.
• Project personnel will develop a procedure for the container package data base and implement the data base operation.	Draft complete. Final due in May.
• Concurrent with the procurement of the radiography equipment, Project personnel will prepare, review, and approve procedures for its use.	Draft complete. Final due in May.
• Project personnel will procure and install shelving in the QA cage in Bldg. 5.	Complete.
• The project leader will determine the number of containers to be set aside for quality destructive tests of the welds. The procedures for these tests must be documented.	Draft complete. Final due in May.

**Documents.** Work on documents this quarter is summarized below.

1. Documents in preparation:  
PAK-QP-025, "Inventory Control Plan"  
PAK-QP-026, "Plutonium Packaging Project Description"
2. Documents in final draft:  
PAK-QP-021, "Data Base Plan"  
PAK-QP-022, "Container Weld Destructive Test Plan"
3. Documents reviewed and revised as necessary:  
PAK-QP-001, "Quality Assurance Plan"  
PAK-QP-003, "Document Control Plan"  
PAK-QP-004, "Records Management Plan"  
PAK-QP-005, "Procedure for Controlling Nonconformance Activities and Documents"  
PAK-QP-006, "Calibration and Measurement Control Plan"  
PAK-QP-008, "Procurement Plan"
4. Document archived:  
PAK-QP-002, "Project Execution Plan."

### **DOE Storage Criteria**

**Investigation of Pressurization Processes.** Kinetic measurements of the oxide-water reactions and catalyzed oxygen-hydrogen reactions continue. Results of the recombination experiments are being applied to other issues related to plutonium storage. Knowledge about the facile recombination process has been a key factor in the recent development of conceptual and empirical models for moisture-enhanced corrosion of plutonium metal during handling and storage.

Microbalance studies of the oxide-water reaction continue to provide data on the properties of superstoichiometric plutonium oxide ( $\text{PuO}_{2+x}$ ). The products obtained by reacting process oxide with water are also being characterized by powder x-ray diffraction. Samples of  $\text{PuO}_{2-x}$  were obtained by exposing dioxide to fifteen torr of water vapor at elevated temperatures for extended periods. Values of  $x$  in excess of 0.2 have been observed. Evaluation of diffraction data show the superstoichiometric oxide remains face-centered cubic; formation of a lower-symmetry phase is not indicated. The relatively large composition changes far exceed possible error in the initial stoichiometry and confirm the results of pressure/volume/temperature (PVT) studies showing that residual water on the oxide may generate hydrogen during storage.

Precise determination of stoichiometry during microbalance experiments is not possible because of uncertainty in the composition of the starting oxide. Efforts to prepare a known-composition starting material for *in situ* production of oxide by thermal decomposition on the microbalance are progressing. Crystals of hydrated plutonyl nitrate have been grown from aqueous solution. Single-crystal x-ray diffraction methods are being used to determine the structure and precise composition of the plutonyl compound.

**Evaluation of Data Relevant to Oxide Storage.** Conceptual and empirical models for describing moisture-enhanced corrosion of unalloyed plutonium have been developed. Kinetic measurements of the reactions of the metal with water vapor and oxygen in the 35°C to 400°C range show that moisture enhances the corrosion rate only at temperatures below 200°C. In combination with kinetic data from literature sources and measurements in air at 25°C, the data define a rate-temperature envelope within which the corrosion reaction accelerates as water pressure increases. The lower boundary of the envelope is defined by an Arrhenius relationship based on rates measured in the moisture-independent regime above 200°C and in the moisture-dependent regime at lower temperatures. The upper envelope boundary, as defined by experimental data and the equilibrium vapor pressure of water, indicates that moisture dependence is confined to the -25°C to 200°C range, with a rate maximum near 110°C. Activation

energies within the envelope vary systematically with water pressure, from 17.9 kcal/mol in dry (< 1 ppm H<sub>2</sub>O) air to 34.4 kcal/mol in water-saturated air.

This work defines the corrosion kinetics at conditions of interest for handling and storing plutonium. For example, the results provide a quantitative explanation for the dramatic reduction in corrosion rates achieved by storing the metal in a freezer. They show that the corrosion rate is independent of oxygen pressure and has a square-root dependence on water pressure. The chemistry of moisture-enhanced corrosion is explained by PVT data showing that plutonium oxide catalyzes the combination of hydrogen and oxygen. Hydrogen formed by the inherently rapid reaction of water with plutonium catalytically recombines with oxygen at the gas-oxide interface of the reacting metal. Kinetic anomalies found in earlier studies and attributed to reaction of beta-phase plutonium correlate with the presence of trace amounts of moisture in the experimental systems. A manuscript describing the results has been submitted to the *Journal of Alloys of Compounds*. It discusses accelerated corrosion in moist argon and compares the effects of alloying on the corrosion rate with those of humidity.

### Processing Metal and Oxide

**Metal Packaging.** During the second quarter of 1996, NMT-2 Repackaging personnel created 16 plutonium metal items. These were sent to NMT-4 to be weld-sealed in the approved long-term storage containers and were then sent to the vault for long-term storage.

**Criteria for Long-Term Packaging: Thickness and Specific Surface Area** The packaging of plutonium metal for long-term storage must meet the standard DOE-STD-3013, "Criteria for the Safe Storage of Plutonium Metals and Oxides." The standard states that the metal pieces shall have a thickness greater than 1.0 mm (0.04 in.) or have a specific surface area less than 1.0 cm<sup>2</sup>/g (71 in.<sup>2</sup>/lb). Metal pieces with greater surface areas shall be converted to an oxide form.

At Los Alamos, in addition to the 1.0-mm thickness criterion, a >50-g mass requirement has been implemented as a measurable criterion for the processing technicians. This requirement provides an efficient method for ensuring that the specific surface area of each stored metal piece is consistent with the DOE standard. A further requirement is that no unusual shapes, sizes, foils, or wires shall be packaged for long-term storage without supervisor approval. The rationale behind the >50-g mass requirement is detailed below.

The specific surface area (SSA) is defined in the standard as the ratio of the surface area to the mass:

$$SSA = \frac{S}{m} .$$

Mass is related to volume (V) as follows:  $m = \rho V$ , where  $\rho$  is the density of the metal piece. The SSA then becomes

$$SSA = \frac{S}{\rho V} . \tag{1}$$

Since the specific surface area must be less than 1.0 cm<sup>2</sup>/g, the condition can be stated as follows:

$$1.0 \text{ cm}^2 / \text{g} > \frac{S}{\rho V} . \tag{2}$$

The density of alpha metal is 19.84 g/cm<sup>3</sup>, so the final restriction for alpha metal is

$$19.84 \text{ cm}^{-3} > \frac{S}{V} . \tag{3}$$

Using this condition, several common geometries can be analyzed to determine the minimum dimension(s) of that particular shape.

*Sphere* (pieces of metal that are approximately spherical). The surface area of a sphere is  $S = 4\pi R^2$ , where R is the radius of the sphere. The volume of a sphere is  $v = 4/3 \pi R^3$ . Substituting into Equation 3 gives

$$19.84 \text{ cm}^{-1} > \frac{3}{R}. \quad (4)$$

Equation 4 is satisfied by a particle with  $R > 0.15$  cm. If R is greater than 0.15 cm, the specific surface area requirement will be satisfied. The corresponding mass for a metal piece with this dimension is 0.29 g.

*General Rectangle* (rectangle parallelepiped: pieces of metal approximately the shape of a foil, cube, or broken electrorefining ring, depending upon curvature). The limiting ratio is

$$19.84 \text{ cm}^{-1} > \frac{2}{L} + \frac{2}{W} + \frac{2}{H}, \quad (5)$$

where L is the length, W is the width, and H is the height. Equation (5) is satisfied when L, W, and H are each greater than 0.30 cm. A metal piece with these dimensions has a mass of approximately 0.55 g.

*Right circular cylinder* (pieces of metal that are approximately the shape of a rod or disk). The limiting ratio is

$$19.84 \text{ cm}^{-1} > \frac{2}{v} + \frac{2}{R}, \quad (6)$$

where R is the radius and v is the height. Equation (6) is satisfied when R and v are each greater than 0.20 cm; the corresponding mass is approximately 0.51 g.

*Right circular cone* (pieces of metal approximately the shape of broken metal buttons or broken rods). When a similar analysis is done for a right circular cone, a mass of 0.37 g is calculated.

*Spherical Sector* (one base: pieces of metal approximately the shape of a button or a piece that is thick in the middle and thinner at the edges). When similar analysis is done for a spherical cone, a mass of 0.48 g is calculated.

*Right Wedge* (pieces of metal approximately the shape of a broken button-thick in the middle and thin at the outermost edge). When a similar analysis is done for a spherical cone, a mass of 0.24 g is calculated.

In summary, the metal pieces that would fail the storage criteria will generally be small in size and mass (excluding foils and wires). They will typically have dimensions of 1.0 cm or less and a mass of approximately 1 g. Pieces of metal with such dimensions and mass will be difficult to handle within a glovebox and will be a flag to the processing technician. From the examples presented above, the >50-g mass requirement is more than adequate to ensure that standard shapes and sizes of plutonium metal are not inappropriately packaged for long-term storage. Metal pieces weighing less than 50 g and/or having an unusual shape or size can be packaged for long-term storage only with supervisor approval.

## Surveillance Experiments

Approximately one year ago, surveillance experiments were initiated to monitor the behavior of pure plutonium metal and oxide sealed in surveillance containers with a helium atmosphere. Five containers were used for the experiments, one containing metal and four containing oxides having different loss-on-ignition (LOI) and process histories (see Table II). The surveillance containers were modified to accommodate the surveillance instruments: two thermocouples, one measuring the air temperature at the top of the container and the other measuring the air temperature at the surface of the material; pressure (0 - 10 in. water) and vacuum (0 - 15 in. water) gauges; and a gas-sampling port. The containers and the instruments were submitted to a rigorous testing and evaluation program before being used in the experiments. For further details, see "Quarterly Status Report for the Packaging and Vault Work-off Projects, First Quarter, FY 1995" (LA-UR-94-152).

A baseline gas sample was obtained immediately after the containers were sealed. Thereafter, temperature, pressure, and vacuum readings were recorded daily. After approximately one year, no notable increase has been seen in pressure or vacuum. Daily fluctuations in both readings did occur, but these are consistent with the measured temperature fluctuations. Resampling and analysis of the head gas in the surveillance containers is planned for the near future; the results will be reported in an upcoming quarterly status report.

## Inspection and Surveillance of Containers

**Real-Time Radiographic System.** A real-time radiographic system from VJ Technologies has been installed in the Plutonium Facility, and Packaging Project personnel have been trained on the system by the vendor representatives; however, for the near term, the equipment will be operated mainly by

**Table II. Surveillance Experiments: Contents of Containers**

Container No.	Material	Quantity (kg)	LOI (%)	Pu Factor (%)
1	Pure metal	2.1	---	99.93
2	Oxide A (as received)	1.0	0.60	87.7
3	Oxide A (600°C for 12 hrs)	1.0	0.11	87.7
4	Oxide A (980°C for 2 hrs)	1.0	0.05	87.7
5	Oxide B (980°C for 2 hrs)	1.3	0.07	87.9

A - Obtained by decomposition of Pu<sup>+3</sup> oxalate precipitated from a plutonium nitrate solution.

B - Obtained by hydride-catalyzed oxidation of plutonium metal in air at room temperature.

certified Engineering Sciences and Applications (ESA) Division personnel. The system was used to make preliminary measurements on long-term storage containers. Packaging Project and ESA personnel will draft a plan to qualify the system for packaging surveillance.

Following qualification of the radiographic system, qualification of bellows will continue: comparison measurements will be made on a set of bellows that has been previously tested by the vendor by shadowgraph and at Los Alamos by film radiography. Packaging personnel are collaborating with TSA-1 statisticians to develop a method for these measurements and with VJ technologies on software changes to enhance the data.

When the system was used to examine two older containers from regular vault storage, suspected packaging problems were confirmed, demonstrating the utility of the system for this purpose.

Project personnel plan to house the radiographic equipment in a room near the vault that currently holds an isostatic press destined for disposal. The room and the press are contaminated. Project personnel met to discuss cleaning the room and disposing of the oil remaining in the press. The room will be swiped and the oil sampled; then disposal and cleanup will proceed.

**Bellows Development.** Packaging Project personnel will issue a report in April on the performance of the current bellows. The bellows were evaluated at Mini-Flex using shadowgraph measurements, which were then compared with radiographic measurements made at Los Alamos using a mock-up of a double-wall, long-term storage container. The results show the bellows to be an excellent indicator of pressure changes.

In the next series of tests, these measurements will be compared with the measurements made using the VJ Technologies real-time radiographic equipment. These tests have been initiated, and a formal testing approach is being formulated. Bellows development is related to the collaborative Savannah River Site joint radiographic research and development endeavor, which will test the capabilities of the equipment and optimize the parameters used for surveillance measurements.

New bellows designs are to be tested at Mini-Flex in May of this year. These new designs will be shorter and larger in diameter for operation over a wider range of pressure, and they will be more robust. A filter will eliminate convolution exposure to plutonium oxide, and a stainless-steel sheath will add structural integrity. Bellows will also be fabricated from materials other than 304 stainless and tested for improved linearity. A report on bellows development will be issued in August.

#### **Automated Glovebox Can-Out—Sandia Collaboration**

Work is continuing with Sandia National Laboratories-New Mexico on the robotics system for an automated glovebox can-out system for the Plutonium Facility. So far, robots have been identified for the job, glovebox sizes and styles have been determined, and preliminary drawings have been completed. The design change package is being prepared by Sandia and Packaging Project personnel.

#### **Electrolytic Decontamination**

A design change for the material container that will be used for glovebox demonstration of the electrolytic decontamination process is being evaluated. In the new configuration, the bottom weld is eliminated, and the top weld is moved from the corner to the side of the container, about 1 in. below the top. A prototype has been fabricated locally; but before it undergoes electrolytic testing, the operating parameters of the electrochemical processes for decontamination will be examined further, and an ultrafiltration system will be added to the hot testing system. More new containers should be delivered by the vendor next quarter; additional tests will be carried out as the containers are received.

The glovebox configuration for the electrolytic decontamination demonstration in the Plutonium Facility has been selected. It incorporates an off-center, longitudinally split decontamination fixture connected to a vertical partition. Clam-shell-type doors swing open into both sides of the glovebox to provide access into and out of the fixture. A mock-up was fabricated and hydrostatically tested to evaluate the structural integrity of the system and to explore fabrication schemes. The results indicate that this configuration should meet the requirements of both the initial demonstration and the follow-on integrated electrolytic decontamination and automated glovebox can-out demonstration. Plans for fabrication and incorporation into a glovebox are under way.

## **RCRA Issues—Plutonium Disposition Methodology and Related Issues**

The Nuclear Materials Technology (NMT) Division has refined its methodology for determining discard limits for special nuclear material (SNM). The Plutonium Disposition Methodology (PDM) optimizes the parameters of SNM recovery, waste generation, personnel exposure, and costs for both recovery and waste management. It also addresses proliferation concerns by using safeguards termination criteria as ceilings below which discard limits may be established. The methodology, including a strawman discard limit for hydroxide cake residue, is currently under review by DOE-AL. Replacement of the earlier (1989) Economic Discard Limits—which were based solely on the costs of SNM production versus cost of recovery—with discard limits based on these ES&H and recovery/waste management criteria is essential to the success of ongoing stabilization efforts at TA-55.

One of the purposes of the PDM is to clarify the application of RCRA to residue processing. The PDM clearly differentiates between residue processing for programmatic purposes, that is, residues are ingredients for production processes and therefore are not subject to RCRA, and processing for disposal, that is, discardable items are clearly solid waste and therefore are subject to RCRA. Clarification of the RCRA issue is one very important outcome of the PDM.

The first draft of an Implementation Procedure for the PDM is also currently under review by DOE-AL. Once it has approved the PDM Implementation Procedure, DOE-AL plans to present the rationale for the methodology to the New Mexico Environment Department.

## **PLUTONIUM RECOVERY AND PROCESSING PROJECT**

### **Project Management**

During the first quarter of FY96, we have reversed the previous quarter's slowdown. We are in the process of increasing the staff assigned to the project to support the accelerated 8-year schedule. We have secured the services of three technical staff members from other divisions on a temporary basis through the Laboratory's Form-B process. This option allows us to buy their services without any obligation for future support, although we believe that this investment in training, including Personnel Security Assurance Program qualification, is justified in that support will continue beyond the fiscal year for at least some individuals.

In addition to exercising Form-B opportunities, group NMT-2, the Nuclear Materials Technology Actinide Process Chemistry group, is planning to hire three additional staff members and six technicians, a large fraction of which will be assigned to this project. It will probably take the remainder of the current fiscal year, as a minimum, to advertise for, interview, select, and train the personnel needed to effectively accelerate the schedule. In FY 1996, the schedule for various portions of the work will continue to reflect priority decisions on deployment of resources.

### **Operations**

We continue to process high-risk plutonium metal items by thermal stabilization (oxidation) and corrosive and reactive items using aqueous nitrate and chloride. We recover the plutonium as an oxide (>50% Pu) and place it in a queue for packaging in accordance with DOE-STD-3013. We also continue to stabilize currently generated residues to prevent their accumulation in either process areas or in the vault. These materials include Pu-238-contaminated cellulose rags, machine turnings and chips from surveillance and manufacturing operations, hydroxide cakes from aqueous chloride operations, and analytical chemistry solution returns. This type of operational flexibility is encouraged and will be maintained for the safe operation of our facility.

In response to the Defense Nuclear Facilities Safety Board (DNFSB) recommendation to stabilize legacy materials, through the end of this quarter (year to date) we have

- evaluated 212 reactive, high-surface-area metal items for stabilization. Some of these items were not

processed because of incompatibilities with our current processing sequence. Those not processed were determined to be stable in their current forms; they were repackaged and returned to the vault for later recovery. Our goal for this quarter was 71 items, and the year-to-date goal was 144 items; 238 items were completed, of which 13 were currently generated metal turnings items.

- processed 45 high-priority process residues. Our goals were 58 items for the quarter and 129 items year-to-date. Sixty-eight were completed through the second quarter.
- processed 4 high-priority compound items. Our goals were 12 items for the quarter and 24 items year-to-date. Four items were completed through the second quarter.
- processed 45 currently generated solution items.
- processed 36 combustible items, all of them Pu-238 contaminated rags. Our goals were to process three legacy items this quarter, six year-to-date. Fifty-six currently generated items were completed.
- processed 53 items from the miscellaneous process residue list. The goal through the second quarter was 13 items; 63 were completed.

We processed no items from the "other compounds" or "noncombustibles" categories. Goals for those categories through the second quarter were seven items each.

### **Process Development and Demonstration**

By the end of the fiscal year, a polishing method for acidic chloride waste streams will have been successfully demonstrated, with the development of new, more selective ligands for extracting americium and plutonium from the solutions. Not much progress has been made in demonstrating ultrafiltration for treating caustic effluents or in developing shielded equipment for handling high-exposure materials. The other development projects—salt distillation and pyrolysis—that are key to Los Alamos's success are being supported by the 94-1 R&D effort. Status reports on those projects are forthcoming.

### **URANIUM RECOVERY AND PROCESSING PROJECT**

The ventilation construction project for the glovebox system in Wing 4 of the CMR building was completed during this quarter. The readiness assessment for Wing 4 operations was also completed, and the facility management team authorized operation of the glovebox system.

The following items were stabilized and repackaged:

- three high-priority enriched uranium items. The goal for the fiscal year is 13; through the second quarter, 53 are complete.
- one high-priority depleted uranium item. The goal for the fiscal year is six; through the second quarter, two are complete.
- six enriched uranium gas items. The goal for the fiscal year is 28; through the second quarter, 19 are complete.
- eighty-two enriched uranium oxide items. The goal for the fiscal year is 154; through the second quarter, 110 are complete.
- nine DU/NU gas items. The goal for the fiscal year is nine, so all items in this category are complete.
- one U-233 item, completing the fiscal year goal of one.
- four fuel assembly items, completing the fiscal year goal of four.

We completed arrangements to transfer six normal items and three depleted  $UF_6$  items to Portsmouth. These items are ready to be shipped. We also combined and repackaged 90 enriched uranium items (84 oxide items, 2 solution items, and 4 nonirradiated extruded fuel elements) into 14 items, which are ready for nondestructive analysis.



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**Los Alamos**  
NATIONAL LABORATORY  
Los Alamos, New Mexico 87545