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Cleanup of a Department of Energy Nonreactor Nuclear Facility: Experience at the Los Alamos National Laboratory High Pressure Tritium Laboratory

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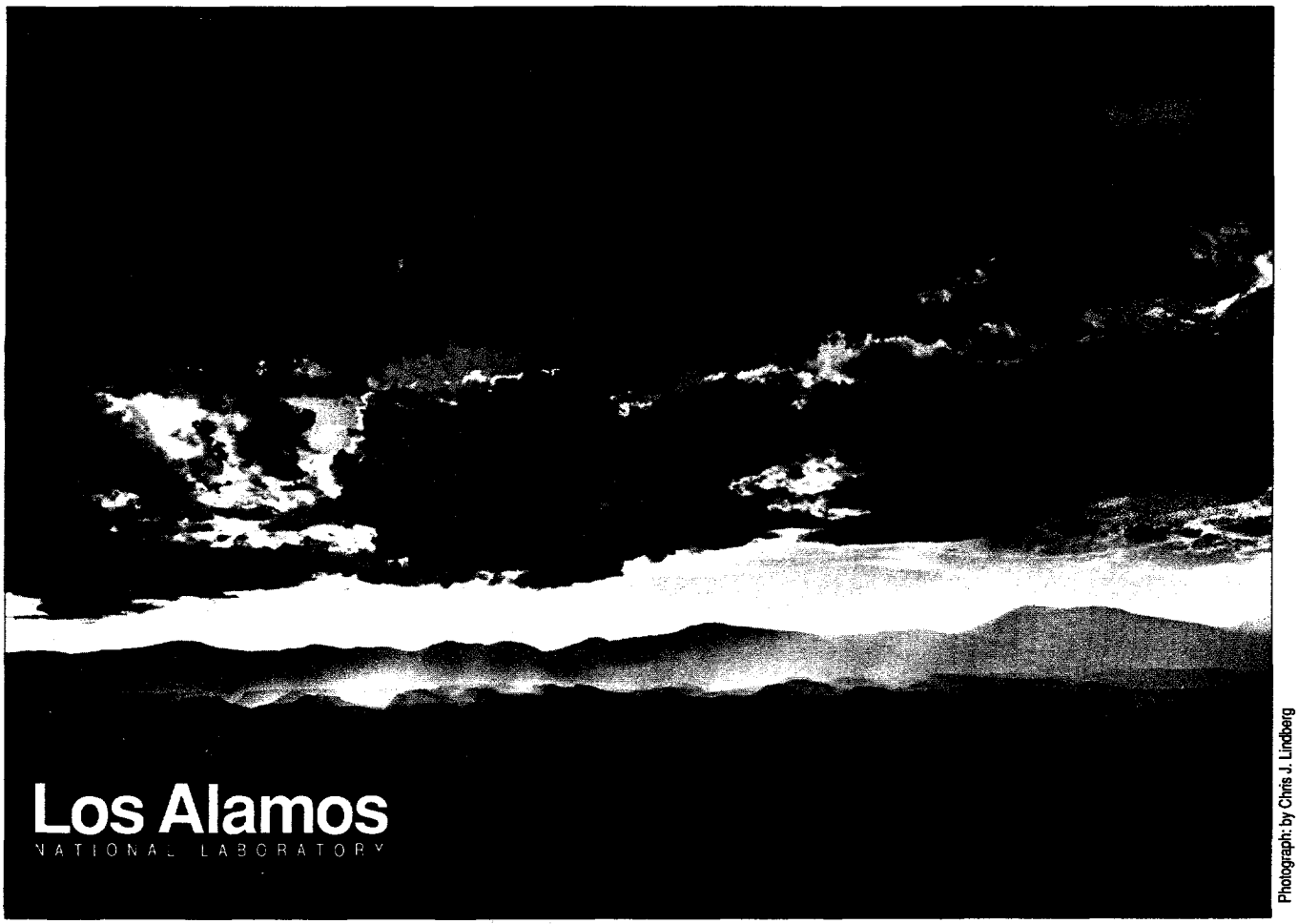

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CLEANUP OF A DOE NONREACTOR NUCLEAR FACILITY: EXPERIENCE AT THE LOS ALAMOS NATIONAL LABORATORY HIGH PRESSURE TRITIUM LABORATORY

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ABSTRACT

On October 25, 1990, Los Alamos National Laboratory (LANL) ceased programmatic operations at the High Pressure Tritium Laboratory (HPTL). Since that time, LANL has been preparing the facility for transfer into the Department of Energy's (DOE's) Decontamination and Decommissioning Program. LANL staff now has considerable operational experience with the cleanup of a 40-year-old facility used exclusively to conduct experiments in the use of tritium, the radioactive isotope of hydrogen. Tritium and its compounds have permeated the HPTL structure and equipment, have affected operations and procedures, and now dominate efforts at cleanup and disposal. At the time of shutdown, the HPTL still had a tritium inventory of over 100 grams in a variety of forms and containers.

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INTRODUCTION

On October 25, 1990, Los Alamos National Laboratory (LANL) ceased programmatic operations at the High Pressure Tritium Laboratory (HPTL), an outdated experimental facility whose design does not meet the requirements of the modern Department of Energy (DOE) complex. The tritium operations formerly conducted at the HPTL will be conducted at the Weapons Engineering Tritium Facility (WETF) at TA-16-205. WETF enables LANL researchers to handle tritium using modern equipment and up-to-date procedures. The Engineering Sciences and Applications Division (ESA) has no further use for the HPTL and plans to remove the accountable tritium and make the facility available for decontamination and decommissioning (D&D), thereby eliminating the risk and cost of operating this now-surplus facility. Early, close communication with DOE led to an approach different from the one originally planned. The revised approach resulted in a reasonable cleanup of the facility and satisfied more stakeholders.

APPROACH

Statement of the Problem

The cleanup process must ensure that the HPTL

- poses a minimal risk to the environment and the safety and health of workers and the public,
- requires a minimum of support and maintenance, and
- is acceptable to DOE Environmental Restoration and Waste Management (EM) for D&D.

Safe shutdown required close attention to a number of critical factors.

- The HPTL is an old, tritium-contaminated facility housing outdated tritium process systems.
- The HPTL contained a large (>100 g) tritium inventory stored in unusual and uncertified containers
- Tritium contaminated equipment was in place for operation and stored in drums.
- A number of other hazardous materials were present at the facility.
- The HPTL had several potentially contaminated outfalls.
- Management consisted of informal oversight and inadequate staffing.
- The HPTL faced serious issues in regulatory and order compliance.
- The HPTL had inadequate documentation and operational procedures.
- The maintenance and surveillance were inadequate

Description

The 7500-square-foot HPTL had potential tritium contamination everywhere. In particular, the tritium-contaminated process systems that had evolved during its 35 years of operation were still in place and in use at shutdown. These systems were a high-pressure fill system, a low-pressure gas transfer system, and an experimental system. The systems consisted of pumps, valves, tubing, cryotraps, cylinders, instrumentation, and so forth.

The HPTL's tritium inventory of over 100 grams resulted in its designation as a Category II Nonreactor Nuclear Facility - the highest possible hazard category for tritium facilities. The inventory was approximately half tritium gas and half tritiated water on molecular sieve. This tritium inventory was in custom-made molecular sieve towers, experimental apparatus (such as a fish float), and uncertified shipping containers consisting of LP-50 and LP-12 gas containers and an AL-M1 tritiated water shipping container. Other tritium-contaminated equipment also remained at the site, including 36 drums of highly contaminated equipment ready for shipment to the waste area pending resolution of a mixed-waste issue. Other hazardous materials at the site included lead, mercury, caustics, flammables, and Class C explosives. The site had four potentially contaminated outfalls: a septic system, a National Pollutant Discharge Elimination System (NPDES) outfall, an acid sump, and a roof drain. The facility had performed a tremendous amount of work over the years, but as the WETF approached startup, the HPTL was no longer viewed as an important experimental resource and received little attention from management and minimal staffing. At shutdown, the HPTL staff consisted of a full-time staff member operator, a part-time operator technician, a full-time radiation control technician (RCT), and a part-time custodian. This staff was inadequate to operate the facility in accordance with DOE-required formality of operations. The facility design antedated the new DOE for the weapons complex and was used to meet temporary demands until WETF became operational, at which time plans for final D&D of HPTL could be implemented.

Proposed Solution

LANL's prioritized approach for cleanup of the HPTL consisted of removing the tritium inventory, the highly contaminated process systems, the hazardous and mixed wastes, and other contaminated items. We also proposed to clean up the facility using the existing systems and documentation. Our plan included operation of the old process system and reprocessing and recovery of as much of the tritiated water as possible. Stressing technological issues, the original proposal comprised the following major elements.

- Consolidation and transfer of tritium gas to the WETF for repackaging and measurement
- Recovery of tritiated water and shipment of the tritiated water to Mound for recovery
- Removal of contaminated equipment
- Disassembly and removal of the contaminated process system
- Removal of waste
- Compliance with the National Environmental Policy Act (NEPA)
- Preparation of updated Technical Safety Requirements (TSRs)
- Improvement in facility management

At the time the HPTL was shutdown, EM-60 had not been organized, so HPTL cleanup began with DOE Defense Programs (DP) Research, Development, and Testing (RD&T) funding. Defense Programs through DP652 has been the funding source to date.

RESULTS

To address regulatory issues,

- An environmental assessment (EA) was written and then included in the site-wide environmental impact statement (EIS).
- Two categorical exclusions from NEPA were obtained.
- Stack monitoring was brought into compliance.
- National Emission Standards for Hazardous Air Pollutants (NESHAP) were addressed.
- Hazardous materials were stored correctly.
- Most of the drains were plugged; only two outfalls remain.

To address operations issues,

- A Management Control Plan, embodying a graded approach, was developed and implemented.
- A project leader and full-time building manager were assigned to the facility.
- Maintenance control increased and maintenance improved.
- A general housecleaning was accomplished and maintained, and custodial work was minimized.
- A modern liquid scintillation analyzer was installed on site.
- Radiological postings and surveys were improved.
- A bubble suit system was made available.

To address documentation issues,

- A draft graded Safety Analysis Report was written but deferred.
- Safe Shutdown Procedures were written.
- A Building Emergency Plan was prepared.
- Entry procedures were established.
- A hazard communication (HAZCOM) was established.
- A Waste Management Plan was written.
- Routine Monitoring Instructions were updated.
- A draft Maintenance Implementation Plan was written but deferred.
- Work was done under Standard Operating Procedures (SOPs), Operational Instructions (OIs), Special Work Permits (SWPs), and Radiation Work Permits (RWPs).
- Five process system schematics were developed.

To address technical issues,

- More than 70 grams of tritium were removed from the HPTL.
- Two thirds of the containers of accountable tritium have been removed.
- Thirty-six drums of previously packaged tritium contaminated hardware were removed.
- Approximately 50 drums of other contaminated items were removed.

DISCUSSION

Early inspections and other interactions with DOE indicated that LANL would be expected to operate the facility in as close to the new (and evolving) DOE philosophy as possible. Deviations at the sole discretion of the DOE. To accommodate the DOE needs, we inverted our original approach of addressing technical problems first and procedural problems last. Another critical factor in the HPTL cleanup was the end of the Cold War which changed LANL's operating environment in a number of ways: funding was reduced, the need for tritium was diminished, and tritium-supporting elements of the DOE complex were becoming unavailable. We, therefore, to changed and constantly revise our plan to follow evolving DOE guidance.

Regulatory Issues

NEPA was addressed with two categorical exclusions and an EA. The two categorical exclusions were for interim storage of the molecular sieve towers and for removal and interim storage of the process systems. The draft EA included both transition and D&D and was approved by the Albuquerque Operations Office. DOE Headquarters was reviewing the EA when the decision was reached to prepare a site-wide EIS for Los Alamos. In the course of review and as a result of the categorical exclusions, the EA for the HPTL had been reduced to only the D&D work. Continuing ongoing operations and the two categorical exclusions covered the transition work. The D&D work will be covered in the LANL site-wide EIS.

Stack monitoring was brought into compliance by upgrading the stack tritium monitoring system almost completely. This activity was part of a Laboratorywide compliance agreement with the EPA. The HPTL now has a state-of-the-art stack monitoring system with a bubbler and two real-time monitors. A NESHAP interpretation of stack emissions was obtained. We did not have to perform a preconstruction review because we planned to keep our tritium emissions well below historical levels. In fact, during cleanup such emissions have been about 5% of historical levels. There are no nonradioactive emissions.

Hazardous materials were dealt with correctly. We identified the hazardous materials at the facility and categorized them as either in-use or waste. The in-use materials were stored according to the type of hazard they posed(such as flammable). The waste was considered mixed because of the potential tritium contamination. It was stored according to its hazard potential in satellite accumulation areas and when possible, shipped to the Laboratory's mixed waste storage area.

As a result of a survey of the HPTL outfalls, we plugged most of the drains and obtained an agreement with the New Mexico Environmental Division to operate those we still needed. We retained a septic system, an NPDES outfall, and a roof drain. The NPDES outfall will soon be plugged because we plan to discontinue its use.

Operations Issues

The Laboratory operates the HPTL under a Management Control Plan that was negotiated with DOE. This plan addresses the various sections of DOE Order 5480.20. In developing this plan, graded approach was used whenever possible. A project leader, a building manager, and an RCT carry out the increased formality of operations. The project leader guided the project, developed much of the documentation, and served as liaison with DOE and other outside organizations. The building manager oversaw the day-to-day operation of the facility. Maintenance and its control improved as a result of ESA-TSE and Labwide initiatives. A general housecleaning was accomplished and has been maintained. Waste minimization procedures were established. The custodial work was minimized by evaluating the effectiveness of mopping on reducing floor contamination. The RCT upgraded the on-site liquid scintillation analyzer to improve posting and surveys. The existing contaminated supplied air (bubble) suit system was replaced with a portable system. Specific operations were staffed on a case-by-case basis using the previous system operators (now retired) and personnel from other Laboratory tritium facilities, such as the WETF.

Documentation

A graded approach was followed to documentation. Operation basis, routine operations, and specific tasks were addressed in that order.

A draft graded Safety Analysis Report (SAR) was written. The DOE Albuquerque Operations Office evaluated the status of the facility and deferred the complete approval of the SAR and associated Technical Safety Requirements. We are operating the facility according to the Operational Safety Requirements written before the shutdown.

Our Safe-Shutdown Procedures were approved by DOE/Defense Programs. These conformed to the procedure format that was uniform across Los Alamos tritium facilities.

The Building Emergency Plan was upgraded to meet modern standards and to reflect improvements and other changes in the facility. Entry procedures were written for normal and non-normal conditions. Site-specific HAZCOM was established. A Waste Management Plan and Routine Monitoring Instructions were written to supplement Los Alamos policies and administrative requirements. The Maintenance Implementation Plan was deferred by DOE based on the cleanup status of the facility.

Non routine tasks were performed under SOPs, OIs, SWPs, and RWPs. SOPs were used for operation of the process system, maintenance of the process system, supplied air (bubble) suit operations, and so forth. OIs were used for decontamination and packaging of nonstandard tritium containers and similar activities. SWPs were used for decontamination and preparation for shipment of containers and equipment. RWPs were used for the remainder of the operations involving tritium. Process system schematics using industrywide notation were drawn to document the system and guide its disassembly.

Technical Problems

The major technical emphasis in the HPTL cleanup was the removal of the tritium inventory. We started with over 100 grams in 50 containers. We have removed over 70 grams of accountable tritium in two thirds of the containers from the HPTL. Approximately half of the tritium was in the form of gas and half in the form of tritiated water adsorbed on molecular sieve.

The gas was contained in uncertified shipping containers (LP-12s and LP-50s) and experimental vessels. The shipping containers were packaged using an SOP as if for normal shipment but were then shipped over a closed road to WETF. The experimental vessels were secondarily contained and also sent over a closed road to WETF. This gas will be consolidated and sent to Savannah River for reuse.

The tritiated water on molecular sieve was in one uncertified shipping container (an AL-M1), in traps and cryopumps, and in several custom containers called towers. The molecular sieve towers were previously used to trap the effluent from the process system. The amounts of tritium in these molecular sieve towers were determined by plotting the pressure rise over time caused by helium-3 generated by tritium decay. The amount was confirmed by a mass spectrometer analysis of the gas in each tower at a given time. The other items will be put in a calorimeter.

Contaminated hardware was sent to the waste disposal facility at Los Alamos. Thirty-six drums of previously packaged tritium-contaminated hardware were removed. These drums had to be radiographed using Los Alamos Accident Response Group (ARG)/Nuclear Emergency Search Team (NEST) video radiography equipment to determine that no lead was in the drums. Other contaminated hardware was packaged as required by Los Alamos policies and administrative requirements and shipped to the disposal area.

RECOMMENDATION

In the process of transition, proceed with formality first and address technical issues second. In particular, communicate with DOE early, before safe shutdown, to establish the level of formality required under a graded approach. Establish safe shutdown procedures early. Plan ahead and document. Doing so establishes credibility and gives stakeholders confidence in the cleanup effort. Such a process leads to a safe, expeditious transition.