

AUDIT  
REPORT

DISPOSAL OF  
TRITIUM RESIDUES AT THE  
LOS ALAMOS NATIONAL LABORATORY



U.S. DEPARTMENT OF ENERGY  
OFFICE OF INSPECTOR GENERAL  
OFFICE OF AUDIT SERVICES

JULY 1998



## DEPARTMENT OF ENERGY

Washington, DC 20585

July 15, 1998

### MEMORANDUM FOR THE MANAGER, ALBUQUERQUE OPERATIONS OFFICE

FROM: Terry L. Brendlinger, Manager  
Eastern Regional Audit Office  
Office of Inspector General

SUBJECT: INFORMATION: Audit Report on "Disposal of Tritium Residues at the Los Alamos National Laboratory"

#### BACKGROUND

In 1991 the Secretary of Energy directed the Assistant Secretary for Environment, Safety and Health to form a Task Group to review tritium facility management practices and identify measures to improve tritium operations. The Task Group issued a report in October 1991 stating that there was an overall lack of attention to managing tritium residues throughout the Department of Energy (Department) complex. The Task Group reported problems at specific Departmental sites, including the Los Alamos National Laboratory (Los Alamos). The Task Group stated that Los Alamos had not stressed the importance of maximizing tritium utilization; minimizing the generation of tritium residues, such as scrap and waste; or minimizing the loss of material through environmental releases. The Task Group found that wastewater containing tritium residues had been stored in the laboratory's operating facilities for as long as 2 years without authorization for its disposal, and that Los Alamos had not prepared a cost analysis to justify disposing of the tritium. One of the Task Group's concerns was that some of the stored residues represented a significant potential source of release to the environment. The objective of this audit was to determine whether Los Alamos disposed of wastewater containing tritium residues in a safe and cost-effective manner subsequent to the Task Group's report.

#### RESULTS OF AUDIT

Contrary to Departmental policy, Los Alamos did not dispose of wastewater containing tritium residues in a safe and cost-effective manner subsequent to the Task Group's report. Los Alamos had 73 containers with tritium residues, and 11 of the containers were stored for over 8 years. The tritium can be recovered from at least 31 of the containers using available technology. The remaining 42 containers may not be suitable for recovery because they may contain materials that could impair economic recovery or have tritium concentrations too low for economic recovery. However, Los Alamos did not develop a plan for the treatment and disposal of tritium residues. As a result, tritium worth about \$1 million was not recovered from the wastewater, and the safety and health risk to workers and the environment was unnecessarily increased.

We recommended that the Manager, Albuquerque Operations Office (1) direct Los Alamos to develop, obtain Departmental approval for, and implement plans to treat or dispose of wastewater containing tritium residues using the most cost-effective technology available; and (2) monitor Los Alamos' progress to ensure timely, safe, and cost-effective treatment and disposal.

MANAGEMENT REACTION

Management concurred with the finding and recommendations.

# DISPOSAL OF TRITIUM RESIDUES AT THE LOS ALAMOS NATIONAL LABORATORY

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# Overview

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## INTRODUCTION AND OBJECTIVE

In 1991 the Secretary of Energy directed the Assistant Secretary for Environment, Safety and Health to form a Task Group to review tritium facility management practices and identify measures to improve tritium operations. The Task Group issued a report in October 1991 stating that there was an overall lack of attention to managing tritium residues throughout the Department. The Task Group reported problems at specific Departmental sites, including Los Alamos. The Task Group stated that Los Alamos had not stressed the importance of maximizing tritium utilization; minimizing the generation of tritium residues, such as scrap and waste; or minimizing the loss of material through environmental releases. The Task Group found that wastewater containing tritium residues had been stored in the laboratory's operating facilities for as long as 2 years without authorization for its disposal, and that Los Alamos had not prepared a cost analysis to justify disposing of the tritium. One of the Task Group's concerns was that some of the stored residues represented a significant potential source of release to the environment.

The objective of this audit was to determine whether Los Alamos disposed of wastewater containing tritium residues in a safe and cost-effective manner subsequent to the Task Group's report.

## OBSERVATIONS AND CONCLUSIONS

Contrary to Departmental policy, Los Alamos did not dispose of wastewater containing tritium residues in a safe and cost-effective manner subsequent to the Task Group's report. Los Alamos had 73 containers with tritium residues, and 11 of the containers were stored for over 8 years. The tritium can be recovered from at least 31 of the containers using available technology. The remaining 42 containers may not be suitable for recovery because they may contain materials that could impair economic recovery or have tritium concentrations too low for economic recovery. However, Los Alamos did not develop a plan for the treatment and disposal of tritium residues. As a result, tritium worth about \$1 million was not recovered from the wastewater, and the safety and health risk to workers and the environment was unnecessarily increased.

\_\_\_\_\_/s/\_\_\_\_\_  
Office of Inspector General

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The audit identified internal control weaknesses that management should consider when preparing the yearend assurance memorandum on internal controls.

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Office of Inspector General

## TRITIUM RESIDUES IN WASTEWATER

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### **Los Alamos Stored Large Volumes of Wastewater Containing Tritium Residues**

As of January 1998, Los Alamos was storing 73 containers with tritium residues at its Tritium Science Fabrication Facility, Tritium Systems Test Assembly, and Weapons Engineering Test Facility. Eleven of the containers were stored for over 8 years. There were only two disposals of tritium-contaminated wastewater at Los Alamos subsequent to the Task Group's report. The first disposal, in May 1995, involved two containers. The second disposal, in September 1997, involved one drum that had leaked and three drums that showed signs of elevated pressure, thereby presenting a health and safety hazard. Los Alamos over-packed the four containers and buried them in the radioactive waste burial ground after more than 6 years of storage in the Tritium Science Fabrication Facility.

### **Available Technologies Were Not Used to Recycle Tritium Residues in Wastewater**

Los Alamos did not use available technologies to recover tritium from residues in the wastewater and to reduce the amount of wastewater requiring disposal. One technology available for this use is the Palladium Membrane Reactor, which was recently developed at Los Alamos. The technology consists of separating the hydrogen/tritium gas from the water. After separation, the tritium can be isotopically separated from the hydrogen gas and would be suitable for reuse. The process has been shown to be reliable without generating additional waste.

### **Department's Policy Is to Safely and Economically Treat Tritium Waste**

Departmental Order 5820.2A, *Radioactive Waste Management*, requires that radioactive waste be managed in a safe, cost-effective manner. It also states that the Department's policy is to reduce the amount of radioactive waste requiring disposal and to manage radioactive waste in a manner which assures protection of employees and the environment.

The *Corrective Action Plan to the Report of the Task Group on Operation of Department of Energy Tritium Facilities* (December 1991) established a milestone of March 1992 for Los Alamos to develop an action plan and begin implementation of the final disposal plan for its tritium residues. The report states that because residues vary widely in the quantity and concentration of tritium, current packaging, and overall compositions of the various containers, it is unlikely that all residues will be handled in the same manner. The report also states that the disposition will depend on such issues as safety, environmental impact, and cost effectiveness.

### **Complete Disposal Plan Was Not Developed**

Despite the direction provided in the Department's corrective action plan, Los Alamos did not develop a disposal plan for all 73 containers of its tritium residues. In 1996, Los Alamos did propose to recycle wastewater containing tritium residues at Los Alamos and other

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Departmental sites using a Palladium Membrane Reactor, however, the Department did not approve that proposal. Los Alamos has not developed any comprehensive plan for removing the wastewater containing tritium residues from its facilities.

### **Tritium Worth \$1 Million Was Not Recovered**

In the absence of a plan, tritium worth about \$1 million was not recovered from the containers. Of the 73 containers at Los Alamos, at least 31 were suitable for the recovery of tritium using the Palladium Membrane Reactor. The 31 containers were suitable because they exceeded the concentration level of 1,000 curies per liter, the point at which Los Alamos considered the tritium recoverable, and because they contained no other materials which would impair the cost effectiveness of recycling operations. For example, some of the other containers were packaged in a second container which contained stabilizing materials such as corn cob fractions and tar. We determined that the tritium in the 31 containers was worth about \$1 million based on the average sales price of \$2.77 per curie between FYs 1990 and 1996.

Recycling tritium residues would also reduce surveillance and maintenance costs because the Department could avoid the costs associated with long-term storage and occasional repairs to wastewater containers.

### **Safety and Health Risk Was Increased**

In addition to the economical benefits, Los Alamos could have reduced the safety and health risk to workers and the environment by recycling its tritium residues. Tritium in its water form is about 20,000 times more toxic than tritium gas. One of the risks associated with storing wastewater containing tritium is the buildup of pressure in containers caused by tritium decay. When tritium in water decays, it generates gases. The buildup of pressure can eventually lead to a leak in the container which allows tritium to escape into the atmosphere. This risk is illustrated by an October 1995 occurrence, when the Los Alamos Tritium Salt Facility had a release of tritium gas from a leak in a drum which contained contaminated water. During the investigation of the release, Los Alamos personnel determined that two other drums showed symptoms of pressure buildup, and all three containers had to be relieved of excess pressure.



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**RECOMMENDATIONS**

We recommend that the Manager, Albuquerque Operations Office:

1. Direct Los Alamos to develop, obtain Departmental approval for, and implement plans to treat or dispose of wastewater containing tritium residues using the most cost-effective technology available, and
2. Monitor Los Alamos' progress to ensure timely, safe, and cost-effective treatment and disposal.

**MANAGEMENT REACTION**

Management concurred with the finding and recommendations. Management stated that it expects Los Alamos to perform an analysis of alternatives for the recovery, disposal, or other disposition of the tritium by March 1, 1999. Also, management stated that the analysis should address issues of environmental and personnel risk and the future need for tritium as well as cost. The Department should then decide on a course of action and require Los Alamos to prepare a plan accordingly. Los Alamos' progress in implementing the plan would be monitored, taking into account funding limitations.

**AUDITOR COMMENTS**

Management's intended actions are responsive to the recommendations.

## Appendix

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### SCOPE

The audit was performed at Los Alamos National Laboratory from March 1997 through January 1998, and covered the storage and disposal of tritium-contaminated wastewater for FYs 1992 through 1997.

### METHODOLOGY

To accomplish the audit objective, we:

- Reviewed applicable Federal and Departmental regulations regarding management of radioactive waste,
- Researched Departmental studies and reports on technologies available for the treatment and disposal of tritium residues,
- Interviewed Department and contractor personnel familiar with the treatment and disposal of wastewater containing tritium residues, and
- Reviewed documentation concerning the Department's tritium-contaminated wastewater inventories and plans.

The audit was conducted in accordance with generally accepted Government auditing standards for performance audits, and included tests of internal controls and compliance with laws and regulations to the extent necessary to satisfy the objective of the audit. Because our review was limited, it would not necessarily have disclosed all internal control deficiencies that may have existed at the time of our audit. We did not rely on computer-generated data during this audit.

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