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AUDIT REPORT

WASTE CHARACTERIZATION AT OAK RIDGE

JUNE 2000

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

DEPARTMENT OF ENERGY
Washington, DC 20585

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MEMORANDUM FOR THE MANAGER, OAK RIDGE OPERATIONS OFFICE

FROM: Terry L. Brendlinger, Manager (Signed)
Eastern Region Audit Office
Office of Inspector General

SUBJECT: INFORMATION: Audit Report on "Waste Characterization at Oak Ridge"

BACKGROUND

Waste characterization is a series of steps performed to determine the weight, volume, and physical characteristics of radioactive waste. The Department of Energy (Department) uses data obtained from waste characterization to evaluate treatment and disposal options for the waste. The characterization process begins when the generator of the waste prepares a general description of the waste produced. The extent of work performed for the final characterization is dependent on the amount and quality of information provided by the generator and the proposed treatment or disposal option for the waste.

In December 1997, the Department awarded a management and integration contract to Bechtel Jacobs, LLC (Bechtel Jacobs) for managing the Department's radioactive waste at Oak Ridge. As of September 1999, about 84 percent of the mixed and low-level waste in the inventory reporting system was generated before Bechtel Jacobs assumed responsibility for waste management. The objective of this audit was to determine whether Bechtel Jacobs and its predecessor contractors at Oak Ridge accurately characterized the Department's waste.

RESULTS OF AUDIT

Bechtel Jacobs and its predecessor contractors at Oak Ridge did not accurately characterize the Department's waste. Specifically, the contractors misstated the weight, volume, and physical descriptions of the waste in inventory. The errors occurred because the Department and its contractors did not develop procedures for determining accurate weights, volumes, and physical descriptions of containerized waste. As a result, the Department could not rely on waste characterization data to make informed decisions regarding the amount of waste to be treated or disposed. Also, the Department will incur about $480,000 in FY 2000 to visually inspect 6,500 containers of waste that were previously characterized at Oak Ridge.

MANAGEMENT REACTION

Management agreed with the audit finding and recommendation and initiated corrective actions.

Attachment

WASTE CHARACTERIZATION AT OAK RIDGE

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OVERVIEW

INTRODUCTION AND OBJECTIVE

The Oak Ridge Reservation is managed by the Oak Ridge Operations Office (Operations Office) and currently has three major management contractors: Lockheed Martin Energy Systems, Inc. at the Y-12 Plant; University of Tennessee-Battelle, LLC at the Oak Ridge National Laboratory; and Bechtel Jacobs at the East Tennessee Technology Park. All three of these contractors generate low-level[1] and low-level mixed[2] waste at their respective facilities and are responsible for the accurate characterization of the waste they generate.

Waste characterization is a series of steps performed to determine the weight, volume, and physical characteristics of radioactive waste. The Department uses data obtained from waste characterization to evaluate treatment and disposal options for the waste. The characterization process begins when the contractor that generates the waste performs an initial characterization to identify basic waste information such as gross weight, physical description, and estimated radiological and chemical characteristics. The generator enters this information into a waste inventory system, where the net weight and volume of the waste can be calculated. The Department's contractors use the inventory records to assign waste with similar physical and chemical characteristics to a waste population. The waste population undergoes a final characterization that usually requires sampling. The amount of sampling is dependent on the amount and quality of information provided by the generator and the waste acceptance criteria of the proposed treatment or disposal facility. The final results are used as defensible support for the treatment or disposal action.

In December 1997, the Operations Office awarded a performance-based contract to Bechtel Jacobs for the management and integration of environmental programs at the Oak Ridge Reservation. Bechtel Jacobs is responsible for characterizing and disposing the legacy waste that was generated by previous contractors and stored on the Oak Ridge Reservation in addition to the waste generated by Bechtel Jacobs operations. Also, Bechtel Jacobs is responsible for maintaining and operating the Oak Ridge Reservation's Waste Information Management System. The inventory records in this system contain characterization

[1] Low-level waste has a wide range of characteristics, but most of it contains a small amount of radioactivity in large volumes of material.

[2] Low-level mixed waste is low-level radioactive waste that contains a hazardous component. Throughout this report, low-level mixed waste will be referred to as mixed waste.

data, which provides the basis for reports to the Department and regulatory agencies, such as the Tennessee Department of Environment and Conservation. During our audit, Bechtel Jacobs implemented a Waste Certification Program that established requirements for generators to characterize waste properly before it is accepted for storage or disposal. As of September 1999, about 84 percent of the mixed and low-level waste in the inventory reporting system was generated before Bechtel Jacobs assumed responsibility at Oak Ridge.

The Office of Inspector General (OIG) recently issued three reports related to waste characterization. Report DOE/IG-0434, *Waste Inventory Data at Oak Ridge and Savannah River* (December 1998), concluded that the volume of waste stored at the Oak Ridge Reservation was overstated in FY 1998 inventory records, and the locations of many waste containers at the Savannah River Site were recorded inaccurately or incompletely. As a result, the Department could not rely on the waste inventory data at the Oak Ridge Reservation to make informed decisions regarding the amount of waste to be treated or disposed. Report DOE/IG-0451, *Waste Incineration at the Oak Ridge Reservation* (August 1999), concluded that current incineration operations were limited because the majority of on-site waste was not sufficiently characterized for the development of an effective burn plan. Also, DOE/IG-0454, *Waste Incineration at the Idaho National Engineering and Environmental Laboratory* (December 1999), concluded that current operations were limited because the majority of on-site waste was not sorted, segregated, and characterized for incineration.

The objective of this audit was to determine whether Bechtel Jacobs and its predecessor contractors at Oak Ridge accurately characterized the Department's waste.

CONCLUSIONS AND OBSERVATIONS

Bechtel Jacobs and its predecessor contractors at Oak Ridge did not accurately characterize the Department's waste. Specifically, the contractors misstated the weight, volume, and physical descriptions of the waste in inventory. These conditions occurred because the Department and its contractors did not develop procedures for determining accurate weights, volumes, and physical descriptions of containerized waste. As a result, the Department could not rely on waste characterization data to make informed decisions regarding the amount

of mixed and low-level waste to be treated or disposed. Also, the Department will incur about $480,000 in FY 2000 to visually inspect 6,500 containers that were previously characterized at Oak Ridge.

The audit identified issues that management should consider when preparing its yearend assurance memorandum on internal controls.

(Signed)

Office of Inspector General

Weights, Volumes, and Physical Descriptions Were Inaccurate

Oak Ridge contractors did not accurately determine the weight, volume, and physical description of mixed and low-level waste. Specifically, the contractors (1) overstated the weight, (2) understated the volume, and (3) provided inaccurate physical descriptions of the waste in inventory.

Weight Was Overstated

The inventory of mixed waste was overstated by at least 1.1 million pounds because contractor employees included the weight of storage containers in their weight calculations. Also, the inventory of low-level waste was overstated by at least 1.2 million pounds because employees did not update inventory records when containers were emptied.

Department policy requires that container weight be excluded from mixed waste inventories unless the waste will remain containerized at its final disposition. When mixed wastes are removed from containers before treatment or disposal, container weight should be excluded from mixed waste inventories. Despite the Department's policy, Bechtel Jacobs and its predecessor contractors included the weight of containers that were to be emptied prior to treatment or disposal when reporting mixed waste inventories. Bechtel Jacobs could not determine the weight of the waste in most containers because it could not determine the weight of the container in which the waste was stored. In fact, contractor employees knew the container weight for only 12,735 of 28,028 mixed waste containers included in the September 1999 inventory. The combined weight of the 12,735 containers was approximately 1.1 million pounds.

Bechtel Jacobs also overstated the inventory of low-level waste because employees did not update inventory records when containers were emptied. Containers that previously held mixed or low-level waste were classified as low-level waste when emptied. The containers should have been added to the low-level inventory at their actual weights. However, the weights were often reported as though the container still held the waste. For example, an empty container weighing about 62 pounds was reported to weigh 5,981 pounds. We reviewed characterization records for 7,356 empty containers that previously contained waste to determine whether the reported weights were reasonable. We determined that 3,029 containers were reported to weigh 1.2 million pounds more than the combined weight of the empty containers.

Volume Was Understated

In addition to weight, contractors also miscalculated the volume of waste in the Oak Ridge inventory. Contractor employees overstated the volume of mixed waste by 1,854 cubic meters and understated the volume of low-level waste by 3,600 cubic meters in the March 1999 inventory reports. Thus, the contractors understated the overall volume of mixed and low-level waste by 1,746 cubic meters.

Bechtel Jacobs overstated the volume of mixed waste in the March 1999 inventory by 1,854 cubic meters. Employees calculated the volume of mixed waste by dividing the weight of the waste by a conversion factor, representing the density of the waste. However, the conversion factors were inaccurate about 48 percent of the time. We considered the conversion factor inaccurate if the calculated volume exceeded the maximum volume of the container. To illustrate, when the conversion factor was used to determine the volume of waste in a 55-gallon drum, the calculated volume was 132 gallons. We determined that the calculated volume exceeded the maximum volume of the container for 13,317 out of 28,028 mixed waste containers.

We discussed the overstatement of mixed waste volumes with Bechtel Jacobs during the audit, and recommended that management limit the volume reported to the maximum volume of the container. Bechtel Jacobs agreed with the recommendation and made appropriate adjustments for the September 1999 inventory. Although the total volume of waste might still be overstated due to conversion factor inaccuracies, the adjustments made by Bechtel Jacobs reduced the amount of the overstatement.

While it overstated the volume of mixed waste, Bechtel Jacobs understated the volume of low-level waste. Specifically, 24,179 low-level waste containers had inaccurate container volumes, resulting in a net understatement of 3,600 cubic meters. In most cases, the reported container volume was less than the actual container volume. For example, the report showed a container had a volume of 5 gallons, when in fact, it was a 55-gallon drum. Waste management personnel stated that the incorrect volumes were due to system conversion errors. Bechtel Jacobs changed the system conversion process to correct the container volume errors identified during the audit.

Physical Descriptions Were Inaccurate

In addition to the errors made by Bechtel Jacobs when determining weights and volumes, other contractors provided inaccurate physical descriptions of waste when performing initial characterizations. In FY 1999, Bechtel Jacobs visually inspected the waste in 1,180 containers and determined that the physical descriptions of the waste were inaccurate for 452 of the containers. For example, a waste population of 75 containers was reported to contain carbon. However, visual inspections revealed that only 1 container held carbon and the remaining 74 containers held trash and personal protective equipment. Based on an estimated 30-percent error rate in waste descriptions, Bechtel Jacobs issued a work release for the visual inspection of 6,500 additional containers of waste.

Departmental Order Requires Accurate Characterization

Departmental Order 435.1 and its predecessor, Order 5820.2A, require that waste be characterized with sufficient accuracy to permit proper segregation, treatment, storage, and disposal. The orders state that waste characterization data will include an accurate record of the weight, volume, and physical characteristics of the waste. The Department created this requirement to establish the minimum data necessary for safe and effective management during the life cycle of the waste.

Procedures Were Not Developed to Ensure Accuracy

The Department and its contractors did not develop procedures for determining accurate weights, volumes, and physical descriptions of wastes at the Oak Ridge sites. Specifically, procedures were not developed to (1) determine the actual weight of mixed waste, (2) update the weight of waste when containers were emptied, (3) develop volume conversion factors based on accurate data, and (4) accurately describe waste during initial characterization. The Department and its contractors were not aware of the magnitude of the errors being made.

Characterization Data Could Not Be Relied Upon and Avoidable Costs Were Incurred

The Department could not rely on the Operations Office's waste characterization data to make informed decisions regarding the amount of mixed and low-level waste to be treated or disposed of, and avoidable costs were incurred. Accurate weights, volumes, and descriptions are needed for the Department to make appropriate decisions regarding how to treat and dispose of mixed and low-level waste, and to evaluate proposed costs and prices for the treatment and disposal of waste under commercial contracts. However, errors made at the Oak Ridge Reservation have limited the Department's

ability to make appropriate decisions. Also, the Department incurred about $99,000 in avoidable costs when Bechtel Jacobs had to visually inspect the waste in 1,180 containers to determine their actual contents in FY 1999. Additionally, the Department plans to spend $480,000 in FY 2000 to visually inspect another 6,500 containers to ensure their contents are accurately characterized.

RECOMMENDATION

We recommend that the Manager, Oak Ridge Operations Office direct Bechtel Jacobs to develop procedures for determining accurate weights, volumes, and physical descriptions of mixed and low-level waste.

MANAGEMENT REACTION

Management agreed with the finding and recommendation. Management stated that Bechtel Jacobs recently implemented procedures that require waste generators to properly characterize waste for the targeted disposal facilities as the waste is being packaged. Waste profiles have been developed for all of the major waste streams that are being generated, and packaging requirements and characterization information are specified to be met prior to Bechtel Jacobs' acceptance of the waste from the generators. These procedures, if properly implemented, should correct the deficiencies for all newly generated waste. However, for legacy waste, further work will need to take place to properly characterize waste for disposal. The Operations Office will continue to monitor the contractors' activities to ensure that the procedures are implemented.

AUDITOR COMMENTS

We considered management's comments to be responsive to the recommendation. Although management did not provide an action plan with estimated dates of completion, Bechtel Jacobs has developed a waste verification program to independently confirm the accuracy of the waste characterization data submitted by a generator.

Appendix

SCOPE

The audit was performed from August 19, 1999, to May 8, 2000, at the Oak Ridge Reservation in Oak Ridge, Tennessee. The audit scope was limited to tests of inventory data used to track and report containers of mixed and low-level waste in FY 1999. The table below identifies the number of waste containers, weight, and volume of mixed and low-level waste in inventory as of September 30, 1999. Mixed waste containers with polychlorinated biphenyls (PCB) were not included in our analysis.

	Number of Containers	Weight (Pounds)	Volume (Cubic Meters)
Mixed Waste	28,028	53,831,637	25,271
Low-Level Waste	30,488	58,589,761	50,100
Totals	58,516	112,421,398	75,371

METHODOLOGY

To accomplish the audit objective, we:

- Reviewed Department requirements for waste characterization;
- Reviewed contractor methods for determining basic characterization data for mixed and low-level waste at Oak Ridge;
- Analyzed the September 30, 1999 Mixed Waste Inventory Reporting System records to determine whether reported waste weights and volumes were determined correctly; and
- Held discussions with Operations Office and contractor personnel regarding waste characterization.

The audit was performed 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 audit objective. Accordingly, the assessment included reviews of Department and contractor policies and procedures. 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.

As part of our review, we evaluated the Department's expectations and performance measures for waste characterization at Oak Ridge. We did not identify any instances where the Department was in noncompliance with the Government Performance and Results Act of 1993.

In completing the audit, we tested the accuracy and reliability of computer-processed waste inventory data at Oak Ridge. As discussed in the body of the report, we concluded that the data was not accurate or reliable.

Management waived the exit conference.

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