DOE/IG-0453

AUDIT REPORT

WASTE INCINERATION AT THE SAVANNAH RIVER SITE

OCTOBER 1999

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

October 13, 1999

MEMORANDUM FOR THE SECRETARY

FROM: Gregory H. Friedman (Signed)
Inspector General

SUBJECT: INFORMATION: Audit Report on "Waste Incineration at the Savannah River Site"

BACKGROUND

The Department constructed the Consolidated Incinerator Facility (CIF) at the Savannah River Site (Site) to reduce the toxicity, mobility, and volume of waste products generated at the Site. The facility was built at a cost of $102 million, and became operational in April 1997. Westinghouse Savannah River Company (Westinghouse) operates the facility for the Department at an average annual cost of $19 million. The objective of this audit was to determine whether Westinghouse was operating the CIF at the capacity permitted by the State of South Carolina.

RESULTS OF AUDIT

The audit disclosed that the CIF was not operating at its permitted capacity. The CIF was operated at about 8 percent of capacity in FYs 1997 and 1998 to minimize the risk of unexpected errors and equipment failures during system start-up, and to accommodate special handling and disposal requirements associated with burning chemicals listed in the Resource Conservation and Recovery Act (RCRA). However, in FY 1999 and beyond, Westinghouse planned to operate the CIF at no more than 32 percent of capacity. This occurred because the Department designed the CIF to incinerate more waste than the Site had available for treatment.

Although Westinghouse may never have sufficient waste available to operate the CIF at its permitted capacity, the audit disclosed several process improvements which could increase the efficiency of the CIF and significantly reduce its operating costs. Specifically, we found that the rate of PUREX and solid waste incineration at the CIF could be significantly increased. Westinghouse could increase the amount of PUREX incinerated per year by using a second blend tank and using less water and fuel oil to dilute the PUREX solution. These changes could reduce the cost of PUREX incineration and reduce the time required to complete the incineration. Also, Westinghouse could reduce the cost of solid waste incineration by increasing the feed rate. These four changes could reduce the total operating costs to incinerate the projected waste streams by $595 million.

MANAGEMENT REACTION

Management concurred with the finding and the first three recommendations. In terms of corrective actions, Management agreed to revise the performance incentive covering CIF operations to reward the incineration of undiluted PUREX only. Management also agreed to use a second dilution tank, and to reduce the dilution

ratio for PUREX, with a goal of 50:1 or lower. When completed, these three actions should save $576 million.

Regarding recommendation 4, to increase the feed rate for solid waste, management agreed with the intent but we found that its proposed alternative action was not fully responsive. Rather than increase the feed rate, management's alternative plan for improving the efficiency of solid waste burning was to study solid waste disposal methods other than incineration. This has the potential to reduce future costs, but will not reduce the immediate cost of burning solid waste.

Attachment

cc: Under Secretary
Deputy Secretary

WASTE INCINERATION AT THE SAVANNAH RIVER SITE

TABLE OF CONTENTS

Overview

INTRODUCTION AND

The Consolidated Incinerator Facility (CIF), located at the Savannah River Site (Site), was built at a cost of $102 million to reduce the toxicity, mobility, and volume of waste products generated at the Site. The CIF was designed to simultaneously incinerate liquid and solid forms of waste, including hazardous, low-level radioactive, and mixed (hazardous and radioactive) waste. The facility became operational in April 1997. The CIF is operated for the Department by the Westinghouse Savannah River Company (Westinghouse), at an average annual cost of $19 million, and is staffed with approximately 110 employees.

The CIF receives waste for incineration through four individual ports. Liquid waste is accumulated in the CIF tank farm and fed through the aqueous and organic feed ports. Solid waste is packaged in cardboard boxes and fed through the solid feed port. Benzene liquid waste is piped directly from the Defense Waste Processing Facility (DWPF) and fed through the benzene feed port.

The biggest challenge for the CIF is incinerating 869,000 pounds of undiluted liquid PUREX solvent at the Site. PUREX solvent is a liquid waste generated by the Site's Separation Facilities. To be incinerated safely, the PUREX must first be diluted. The current procedure is to dilute 250 gallons of undiluted PUREX with 25,000 gallons of water or fuel oil (100:1 dilution rate) in the single dilution tank that is connected to the CIF. Westinghouse planned to burn 13 batches of PUREX in FY 2000. Westinghouse expected it to take approximately 13 days to burn one batch of PUREX, followed by approximately 4 days of downtime associated with diluting and preparing the next batch for incineration.

The Office of Inspector General (OIG) recently issued a report on waste incineration. Report DOE/IG-0451, *Waste Incineration at the Oak Ridge Reservation* (August 1999), concluded that the Department did not operate the Toxic Substances Control Act Incinerator at the capacity permitted by the State of Tennessee. The audit determined that the Department could treat all of the Oak Ridge Reservation's incinerable waste by June 2000 and save $39 million by closing the incinerator 39 months earlier than planned. The OIG is also currently performing an audit of waste incineration at the Idaho National Engineering and Environmental Laboratory in Idaho Falls, Idaho.

The objective of this audit was to determine whether Westinghouse was operating the CIF at the capacity permitted by the State of South Carolina.

CONCLUSIONS AND OBSERVATIONS

Westinghouse was not operating the CIF at its permitted capacity. The CIF was operated at about 8 percent of capacity in FYs 1997 and 1998, and Westinghouse planned to operate the CIF at 32 percent of capacity or less in FY 1999 and beyond. This occurred because the Department designed the CIF to incinerate more waste than the Site had available for treatment. Also, in FYs 1997 and 1998, Westinghouse operated the CIF below capacity to minimize the risk of unexpected errors and equipment failures during system start-up, and to accommodate special handling and disposal requirements associated with burning chemicals listed in the Resource Conservation and Recovery Act (RCRA).

Although Westinghouse may never have sufficient waste available to operate the CIF at its permitted capacity, it could significantly increase the rate of PUREX and solid waste incineration at the CIF through process improvements. Westinghouse could increase the amount of PUREX incinerated per year by using a second blend tank and using less water and fuel oil to dilute the PUREX solution. These changes could reduce the cost of PUREX incineration and reduce the time required to complete the incineration. Also, Westinghouse could reduce the cost of solid waste incineration by increasing the feed rate. These changes could reduce the total operating costs to incinerate the projected waste streams by $595 million.

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

Signed

Office of Inspector General

Westinghouse Could Have Incinerated 13.3 Million Pounds of Waste Under the State Permit

The CIF could have operated at an annual capacity of 13.3 million pounds of waste materials (5.8 million pounds of aqueous liquid, 2.4 million pounds of organic liquid, 3.9 million pounds of solids, and 1.2 million pounds of benzene). The annual capacity of the CIF was determined by a combination of design operating utilities, permitted throughput rates, and the design thermal rate limit.

The operating utilities are defined as the time available for treating waste expressed as a percentage of a 24-hour day. The CIF was designed to achieve operating utilities of 70 percent for treating liquid waste and 50 percent for treating solid waste.

The throughput rates are defined as the amount of waste that can be fed into the incinerator through the individual feed ports. The State of South Carolina permitted the CIF to receive aqueous waste at a rate of 950 pounds per hour, organic liquid waste with suspended solids at a rate of 385 pounds per hour, solid waste at a rate of 900 pounds per hour, and benzene at a rate of 191 pounds per hour.

The thermal rate limit is based on the amount of heat that can be safely and effectively dissipated from the incinerator expressed in terms of British Thermal Units (BTU) per hour. The CIF was designed to operate at a maximum thermal capacity of 36.7 million BTUs per hour, which is controlled by tracking the combined thermal heat produced by the waste forms and auxiliary fuel oil present in the incinerator at any given time.

Westinghouse Operated the CIF Below its Permitted Capacity

Westinghouse did not operate the CIF at its permitted capacity. Westinghouse incinerated approximately 1.5 million pounds of materials during FYs 1997 and 1998, which was less than 8 percent of capacity. Further, Westinghouse planned to incinerate no more than 4.2 million pounds of materials in FY 1999 and future years. Thus, the maximum level of planned operations was about 32 percent of capacity.

Additionally, the amount of waste actually incinerated at the CIF was less than the 1.5 million pounds of materials reported by Westinghouse for FYs 1997 and 1998, and could be substantially less for future years. Westinghouse measured and reported on the weight of all materials burned in the CIF rather than waste materials only. In FYs 1997 and 1998, about 23 percent of the materials burned in the CIF were flush or dilution materials (mostly water) or solid waste generated by the CIF during the incineration process. Westinghouse planned to incinerate large amounts of PUREX in

future years using a process that would require large quantities of water or fuel oil to dilute and flush the solution during treatment. According to the current burn plan, these non-waste materials will account for 83 to 99 percent of the total material incinerated in future years.

In accordance with the Government Performance and Results Act of 1993, the Department established performance measures requiring Westinghouse to burn specific amounts of materials in support of the Site Treatment Plan and the Department's Complex Integration Initiatives. However, the performance measures were misdirected because they allowed Westinghouse to measure and report on all materials burned in the CIF rather than waste materials only.

Westinghouse Operated at Less Than Permitted Capacity for Several Reasons

Westinghouse was not operating the CIF at its permitted capacity because the incinerator was designed and permitted to treat more waste than the Site had available for treatment. Also, in FYs 1997 and 1998, Westinghouse operated the CIF below its permitted capacity to minimize the risk of unexpected errors and equipment failures during system start-up, and to accommodate special handling and disposal requirements associated with burning RCRA listed waste.

Incinerator Was Designed and Permitted to Treat More Waste Than Available

The CIF was designed and permitted to treat more waste than the Site had available for incineration. The CIF was designed and permitted to incinerate solid waste and benzene at a rate of 5.1 million pounds per year; however, Westinghouse expected to have only 0.5 million pounds of solid waste and benzene on-hand during FY 1999. Further, Westinghouse planned to have no more than 1.3 million pounds of solid waste and benzene on-hand in any future year.

One reason for the limited amount of waste available for incineration was the postponement of decontamination and decommissioning (D&D) work at the Site. Before the CIF began operations, Westinghouse expected to generate up to 12 million pounds of solid waste from the D&D of more than 600 surplus, contaminated facilities at the Site. However, the Savannah River Operations Office (Operations Office) had no plans to perform any of the D&D activities before FY 2007 due to funding limitations.

Another reason for the limited amount of waste available for incineration was the lack of benzene received from the Defense Waste Processing Facility (DWPF). The In-Tank Precipitation Facility was to process the soluble portion of the high level waste and send this processed waste as feed to the DWPF. In treating this portion of the waste stream, the DWPF would segregate cesium and products that produce benzene, of which benzene would be provided to the CIF for incineration. However, due to technical problems, the In-Tank Precipitation Facility is not operational, and the DWPF is operating on the insoluble portion of the high level waste only. The Department and Westinghouse are reviewing options for a replacement facility. In the meantime, the CIF will not receive any benzene for incineration.

Conservative Approach Was Used During System Start-Up

Even if sufficient waste had been available, Westinghouse used a conservative approach to operate the CIF during system start-up. Management carefully limited the amounts and types of waste incinerated to allow employees to develop lessons-learned from operating a new facility, and to minimize the risk of unexpected errors and equipment failures. This was a major consideration in FYs 1997 and 1998, but it should not be a major factor in future years.

Feed Rates Were Limited to Accommodate Special Handling and Disposal Requirements

Also, Westinghouse limited the amount of waste incinerated in FYs 1997 and 1998 to accommodate the special handling and disposal requirements associated with burning RCRA listed waste. RCRA listed waste must be handled and disposed of according to the RCRA Land Disposal Restriction Regulations. This disposal method was more expensive than disposing of non-listed waste. Therefore, Westinghouse limited the RCRA listed waste incinerated in FYs 1997 and 1998 to materials that would produce very little residue. For example, Westinghouse did not incinerate low-level solid waste during the listed waste campaign because it produced large amounts of residue. Westinghouse planned to operate a listed waste campaign once every 5 years, with the next campaign occurring in FY 2005.

Westinghouse Could Increase Feed Rates for PUREX and Solid Waste

Westinghouse may never have sufficient waste available to operate the CIF at its permitted capacity. However, Westinghouse could substantially increase the feed rates for PUREX and solid waste incinerated at the CIF. The feed rate for PUREX could be increased from 27,840 pounds to 79,230 pounds per year by using a second blend tank and reducing the dilution rate. These changes could reduce the cost of incinerating PUREX from $1,105 per pound to $442 per pound and reduce the time required to complete the incineration from 55 years to 23 years. Also, Westinghouse could increase the feed rate for solid waste, thereby reducing the cost of incineration from $8.04 per pound to $4.15 per pound. These changes could reduce the total operating costs to incinerate the projected waste streams by $595 million.

Westinghouse was using only one blend tank to dilute PUREX before feeding it to the CIF. The use of a single tank required Westinghouse to cease PUREX incineration for approximately 4 days between batches. The downtime was required to prepare a new batch of PUREX solution and complete laboratory tests prior to beginning the next incineration cycle. However, the CIF had a second tank in place that could be connected to the CIF at an estimated cost of $500,000. If the second tank were used, one tank could be used to feed diluted PUREX to the CIF while the other tank is prepared for incineration. The use of the second tank could eliminate downtime between batches and increase the amount of PUREX incinerated from 27,840 pounds per year (13 batches) to 39,610 pounds per year (18 ½ batches).

Further, through May 1999, Westinghouse diluted PUREX for incineration using at least 100 gallons of water for every gallon of undiluted PUREX. We discussed the possibility of reducing the dilution ratio with Westinghouse and Operations Office management during the audit. From our discussions, we believe Westinghouse could safely double the amount of PUREX it incinerates by reducing the dilution ratio from 100:1 to 50:1. Subsequent to our discussions, Westinghouse reduced the dilution ratio for its next batch of PUREX to 89:1 and stated that it planned to gradually reduce the dilution ratio below 50:1. If Westinghouse can safely reduce the dilution ratio to 50:1, the change could increase the amount of PUREX incinerated from 39,610 pounds per year to 79,230 pounds per year, provided a second blend tank is used.

Finally, Westinghouse could significantly reduce the cost of incinerating solid waste by increasing the existing feed rate. Westinghouse stated that its goal was to incinerate 640 boxes of solid waste per week using 2 shifts. However, Westinghouse planned to incinerate only about 405 boxes of solid waste per week using 2 shifts. After the majority of stored solid waste has been incinerated, which would take about 2 years, Westinghouse could incinerate all solid wastes generated by on-site activities using a single shift.

RECOMMENDATIONS

We recommend that the Manager, Savannah River Operations Office:

1. Revise performance measures for CIF operations to reduce waste inventories;

2. Direct Westinghouse to use two blend tanks to prepare and feed PUREX to the incinerator;

3. Direct Westinghouse to reduce the dilution ratio for PUREX to 50:1 or lower unless tests show that to do so would increase safety and health risks for workers or the public; and

4. Direct Westinghouse to increase the feed rate for solid waste to 640 boxes per week.

MANAGEMENT REACTION

The Savannah River Operations Office management concurred with the finding and recommendations 1, 2, and 3. Also management stated that it concurred with the intent of recommendation 4, but proposed an alternative action.

Management agreed that past performance incentives were not clearly written to reiterate its intent to only reward Westinghouse for reducing inventories of waste. However, management stated that in the past, Westinghouse had only received an incentive award based on actual reduction of waste inventories. Management proposed a draft version of the FY 2000 Performance Incentive stating that Westinghouse will only be rewarded for incinerating "undiluted gallons of PUREX treated."

Management agreed to proceed with the recommended facility modifications concerning a second blend tank. Management stated that there were technical problems and regulatory issues, concerning the

movement of some PUREX prior to incineration, that must be addressed before the full savings can be realized.

Management agreed that the dilution rate for PUREX needed to be reduced. Management stated that it was currently evaluating a 50:1 dilution rate as well as lower rates.

Finally, management agreed that the solid feed rate to the kiln is not optimal. Management is continuing to evaluate the most cost effective approach to solid waste disposal at the Site, and is committed to burning the maximum number of boxes at the CIF as possible. Management stated that it intended to utilize the Solid Waste System Plan as a management tool to evaluate disposition options for solid waste streams to determine the appropriate quantities of solid waste that should be treated at the CIF and staff appropriately.

AUDITOR COMMENTS

Management's draft FY 2000 Performance Incentive for the CIF is fully responsive to the intent of Recommendation 1. Also, management's plan to use the spare tank at the CIF to prepare and feed PUREX to the incinerator is fully responsive to Recommendation 2. Further, management's proposal to reduce the dilution rate to 50:1 or lower is fully responsive to Recommendation 3. When completed, these actions should save $576 million.

Management's response to Recommendation 4 is partially responsive. Management's alternative proposal is to study other disposal options. We agree that other options should be studied. However, until the studies are completed and a better course of disposal is identified, we believe that solid waste should be incinerated at a higher feed rate.

Appendix

SCOPE

The audit was performed from October 28, 1998, to July 12, 1999, at the Savannah River Site in Aiken, South Carolina. The audit covered waste incinerated at the CIF during FYs 1997, 1998, and 1999, as well as plans for incinerating waste in the future.

METHODOLOGY

To accomplish the audit objective, we:

- Reviewed the design utility rates, permitted feed rates, and waste feed limitations for the CIF;
- Analyzed the number of hours the CIF was available for burning waste;
- Evaluated the number of hours the CIF burned waste; and
- Determined the pounds of waste that were actually incinerated at the CIF.

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 Departmental and contractor policies, procedures, and performance measures related to the management and control of the CIF incineration activities. 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 assessed the reliability of computer generated data by comparing it to independently generated data sources and found the data to be reliable for the purposes of this audit.

We held an exit conference with officials from the Savannah River Operations Office on September 16, 1999.

IG Report No. DOE/IG-0453

CUSTOMER RESPONSE FORM

The Office of Inspector General has a continuing interest in improving the usefulness of its products. We wish to make our reports as responsive as possible to our customers' requirements, and, therefore, ask that you consider sharing your thoughts with us. On the back of this form, you may suggest improvements to enhance the effectiveness of future reports. Please include answers to the following questions if they are applicable to you:

1. What additional background information about the selection, scheduling, scope, or procedures of the audit would have been helpful to the reader in understanding this report?

2. What additional information related to findings and recommendations could have been included in this report to assist management in implementing corrective actions?

3. What format, stylistic, or organizational changes might have made this report's overall message more clear to the reader?

4. What additional actions could the Office of Inspector General have taken on the issues discussed in this report which would have been helpful?

Please include your name and telephone number so that we may contact you should we have any questions about your comments.

Name _____ Date _____

Telephone _____ Organization _____

When you have completed this form, you may telefax it to the Office of Inspector General at (202) 586-0948, or you may mail it to:

Office of Inspector General (IG-1)
Department of Energy
Washington, DC 20585

ATTN: Customer Relations

If you wish to discuss this report or your comments with a staff member of the Office of Inspector General, please contact Wilma Slaughter at (202) 586-1924.

The Office of Inspector General wants to make the distribution of its reports as customer friendly and cost effective as possible. Therefore, this report will be available electronically through the Internet at the following alternative address:

Department of Energy Management and Administration Home Page
http://www.hr.doe.gov/ig
or
http://www.ma.doe.gov

Your comments would be appreciated and can be provided on the Customer Response Form attached to the report.

This report can be obtained from the
U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, Tennessee 37831