

## DEFENSE NUCLEAR FACILITIES SAFETY BOARD

July 8, 1996

**MEMORANDUM**  
**FOR:** G. W. Cunningham, Technical Director  
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**FROM:** Cliff Moore  
**SUBJECT:** Trip Report - Initial Review of the Savannah River Site Consolidated Incineration Facility, June 10-12, 1996

1. **Purpose:** This trip report documents the initial review of the Savannah River Site (SRS) Consolidated Incineration Facility (CIF) by the Defense Nuclear Facilities Safety Board's (Board) staff. The review was performed on June 10-12, 1996, by Board staff members Cliff Moore, Roger Zavadoski, and David Hayes.
2. **Summary:**
  - a. The Westinghouse Savannah River Company (WSRC) recommends downgrading the CIF Hazard Categorization from a Category 3 facility to a Radiological facility. Such a downgrade gives the appearance of avoiding important safety requirements such as maintaining a Safety Analysis Report (SAR) per Department of Energy (DOE) Order 5430.23 and performance of an Operational Readiness Review (ORR) prior to startup. Based on previous incineration incidents involving the SRS and the close proximity of other facilities to the CIF, the Department of Energy's SRS Operations Office (DOE-SRS) should carefully evaluate the merit of the suggested downgrade.
  - b. The accuracy of the inventory control program is crucial for maintaining the CIF operations within the inventory limits specified in the authorization basis. This program has limited operational experience and relies heavily on accurate characterization of the feed and waste streams. Measurement uncertainties and material accumulation within the incineration system could impact the success of this program. The Board's staff will continue to follow the maturation of the inventory program and will compare it to programs at other DOE and commercial incinerators.
  - c. The offgas system degraded to unacceptable levels of performance in only 162 hours of burn time. Corrosion and erosion caused duct work thinning and cracking in the High Efficiency Particulate Air (HEPA) filter housings. The degradation rate was increased by poor pH control of the offgas and condensate accumulation in the HEPA filter housings. Given the rapid failure of the offgas system and the fact that this system is the primary accident prevention and consequence mitigation system at the CIF, its performance should be closely monitored following facility startup.
3. **Background:** The CIF is a rotary kiln incinerator with a secondary combustion chamber and is designed to treat low-level radioactive, hazardous, and mixed wastes in both solid and liquid forms. Feed materials for the CIF include contaminated gloves and coveralls, spent solvent from the canyon facilities, and benzene from the Defense Waste Processing Facility (DWPF). The CIF is located in H-Area between the DWPF and the Central Training Facility.

The CIF has received an initial Resource Conservation and Recovery Act (RCRA) Part B permit for incineration. As a part of the permitting process, the CIF must demonstrate compliance with temperature, residence time, and emission requirements while operating at maximum loading conditions. This evolution, known as a "trial burn," is scheduled for the third week of November and will use non-radiological feed. Following successful completion of the trial burn, the CIF can begin radioactive operations.

4. **Discussion/Observations:**

- a. **Incineration Experience Base:** Because the SRS has little experience in large-scale incineration, WSRC has taken several steps to rapidly establish an experience base for successful operation of the CIF. First, WSRC has hired mentors who have experience starting up and operating commercial incinerators. The mentors will be placed on shift through the trial burn to provide advice on technical and operational matters. The use of lessons learned is also prominent at the CIF. CIF personnel have visited four operating incinerators to learn about operational and maintenance problems and then determined what changes were necessary at CIF to avoid the same issues.
- b. **Facility Hazard Categorization:** CIF was originally assumed to be a Hazard Category 3 facility. Using the allowable dose consequences for a Hazard Category 3 facility, the source term required for this dose was back-calculated. This source term was used to develop the inventory limits in the SAR. WSRC recently initiated the CIF Hazard Baseline Review to determine whether the Hazard Categorization of the facility could be downgraded. The preliminary conclusion of the review is that the CIF should only be classified as a radiological facility and not as a Hazard Category 3 facility. However, WSRC personnel could not clearly define to the staff the benefits of a downgrade in categorization. In fact, a downgrade gives the appearance of avoiding important safety requirements such as maintaining a SAR per DOE Order 5430.23 and performance of an Operational Readiness Review prior to startup.

The Board's staff noted that the change in categorization should be thoroughly reviewed in light of past and present experience. An incident at the Beta-Gamma Incinerator (BGI) resulted in sending 130 DWPF construction personnel to a medical facility because they were exposed to irritating gases after HALON was inadvertently incinerated. In addition, SRS sent improperly characterized material to a commercial incinerator in Tennessee causing the incinerator to violate its operating license conditions. Careful scrutiny of the justification for reducing the Hazard Categorization is warranted considering these past accidents and the close proximity of the CIF to other facilities.

- c. **Inventory Control:** Inventory control is crucial in maintaining CIF operations within the authorization basis because many of the accidents analyzed in the CIF SAR explicitly assume that limits on waste inventory are maintained. CIF will process multiple solid and liquid feedstreams, each with its own unique combination of radioactive constituents. Some wastes will be pure weak beta emitters (tritiated oil), some mostly alpha emitters (FB and HB-line wastes), and others will be a mixture of alpha, beta, and gamma emitters (tank farms and

canyon wastes).

The uncertainties involved in measuring the isotopic and curie content in each feedstream must be included in determining the total radioactive loading of the facility for comparison against specified limits. These uncertainties can be particularly large for solid waste as it is often heterogeneous and difficult to assay. Material accumulation also complicates inventory control. The radioactive constituents can collect in the ash, scrubber and quencher effluent, HEPA filters, and refractory brick. Considering the precision of the data needed for inventory control, measurement uncertainties and accumulation bring into question the ability to adhere to inventory limits imposed by the Technical Safety Requirements. For example, the fissile material inventory limit for the facility is only 624 grams of U-235 equivalent, an extremely small number requiring precise assay of both feed and discharged materials.

The reliability of the CIF inventory control program is further reduced following a full cleanout, where any material not accounted for is assumed fixed to the refractory or other equipment and the inventory is effectively reduced to zero. Not knowing the nuclide and corresponding curie contents in the CIF system makes adherence to specified material limits difficult at best.

- d. ***Offgas System Corrosion:*** After only 162 hours of pre-trial burns, the offgas system at CIF was significantly degraded. The damage was particularly severe in the steel duct work between the reheater and the stack and in the stainless steel HEPA filter housings, where inter-granular stress corrosion cracking rendered the long-term repair of the housings impractical. The extensive degradation was due to the high concentration of salts and moisture in the offgas (byproducts of quenching and scrubbing), poor pH control of the offgas, and accumulation of water in the off-line housings.

The offgas duct work between the reheaters and stack has been sand blasted and coated with a protective polymer liner. The coating was selected for its chloride and abrasion resistance. The existing HEPA filter housings are being repaired for temporary use during the trial burn and drains have been added at the HEPA filter isolation valves to prevent water accumulation in the housings while they are off-line. However, the HEPA filters are still located at the lowest point in the offgas system and may be susceptible to collecting water if the drain system becomes plugged, which has occurred once already. Given the rapid failure of the offgas system and the fact that this system is the primary accident prevention and consequence mitigation system at the CIF, its performance should be closely monitored following facility startup.

- e. ***Transition to Radioactive Operations:*** Because operations to date have used non-radioactive simulants, CIF personnel have little or no experience performing operations and maintenance under radioactive conditions. The lack of an established radiological control program presents a situation similar to that at DWPF prior to its startup, where an immature radiological control program contributed to the suspension of the ORR. WSRC plans to implement

radiological controls prior to the trial burn to gain some experience in radiological practices before radioactive material is introduced to the system. The staff will monitor the development of the radiological control program at the CIF.

One area of immediate concern with respect to radiological control is the ash drumming station. This station, designed for use at another facility and retrofitted for application at the CIF, exhibits poor radiological planning. At this station, an operator must place a lid on a 55- gallon drum of radioactive ash slurry, slide the drum to the concrete addition enclosure, and then attach the drum to an overhead crane to move it out of the area. Small piles of ash were observed around the station and the area will most likely be designated as a contamination area once radioactive operations commence. Given the repetitive, manual nature of the drumming operations, the high potential for direct contamination, and the attention to detail observed on other CIF systems, a more thorough ALARA review of this area is warranted.

- f. ***Facility Control:*** In preparation for a total facility outage in March of this year, over 60 lockouts were performed. Subsequent walkdowns of these lockouts by the DOE facility representatives identified several serious lockout violations. In one case, a valve was locked in the incorrect position. In another instance, a valve was locked in the correct position but the keys were not in the lock box. The most serious violation occurred when an individual physically removed the handle from a locked valve to perform some work and then replaced the handle in an incorrect position on the stem. It is not clear if the valve had been manipulated. All of these lockouts were independently verified and signed off by the shift manager. Following the discovery of these violations, a field audit of all lockouts was performed. The audit identified another significant violation; this one concerned a valve on top of a blend tank which was required to be locked closed. The locking device had been removed and the valve was chained open.

As a result of the chronic lockout violations, all facility and construction personnel were reminded of the safety significance represented by a locked component and were informed that future lockout violations would result in termination. However, another significant lockout violation occurred at the CIF on June 28th. In this incident, a hand switch for the tertiary combustion fan was supposed to be in the "OFF" position but was found in the "AUTO" position. As with the previous incidents, this lockout had been independently verified. A potentially severe accident was prevented because the motor controller powering the fan was locked open.

During a walkthrough of the facility, the Board's staff made the following observations:

- Alarms in the box handling area for the area radiation monitors, continuous air monitors, and the box line stops all utilize red lights. Operators may respond improperly if the appropriate alarm cannot be identified (There are over ten of these red alarm lights in the box handling

area.). In addition to being the same color, the alarms are not clearly labeled.

- Electrical junction boxes were left open and unattended with stripped wires dangling from them.
- An electrical worker was observed attaching a safety restraint line to fire sprinkler piping and using a valve handwheel as a climbing aid.

#### **5. Future Staff Actions:**

- a. Review the documentation and assumptions used for changing the facility hazard classification when they are available.
- b. Review the inventory control program at DOE and commercial incinerators to facilitate assessing the adequacy of the program at CIF.
- c. Continue to follow progress in the repair and operation of the CIF offgas system, the development of the CIF radiological control program, and implementation of corrective actions concerning the chronic lockout violations.