



Department of Energy

Washington, DC 20585

May 23, 1997

Ms. Elizabeth Cotsworth, Mail Code 5301W
Acting Director, Office of Solid Waste
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Dear Ms. Cotsworth:

On March 10, 1997, representatives of the Environmental Protection Agency (EPA) and the Department of Energy (DOE) met to discuss DOE concerns related to the proposed rule establishing air emission standards for hazardous waste combustors (HWCs) (61 FR 17358; April 19, 1996). The purpose of this letter and enclosures is to provide written, detailed follow-up to issues raised at the meeting. Highlights from the enclosures are summarized below.

- As summarized in Enclosure 1, DOE continues to advocate that EPA establish a separate subcategory for radioactive mixed-waste (MW) combustors for purposes of regulation under §112 of the Clean Air Act. DOE continues to believe that MW incinerators are sufficiently different from conventional HWCs to warrant a separate subcategory. Moreover, the currently-proposed MACT standards are not based on emission or compliance-cost data from MW combustors.
- Enclosure 2 provides information on the design and configuration of the three existing DOE MW incinerators. This responds to EPA Headquarters staff's interest regarding the formation of dioxin/furan (D/F) in DOE's MW incinerators which, based on available technical publications (e.g., CETRED¹) and the units' design and configuration, is unexpected from an engineering perspective.
- Enclosure 3 contains site-specific risk assessment information for two of DOE's three MW incinerators. This information, previously submitted in Resource Conservation and Recovery Act (RCRA) Part B permit applications to the respective States, illustrates that the existing standards governing DOE MW incinerator emissions provide a level of control that ensures protection of human health and the environment. For the remaining MW incinerator, voluntarily-agreed-to, metals-feed rates that are based on 40 CFR 266 Subpart H [Boiler and Industrial Furnace (BIF)] regulations and typical operations (versus maximum possible loading) serve to protect human health and the environment².

¹ EPA, 1994. "Combustion Emissions Technical Resource Document (CETRED)", EPA/530-R-94-014, Office of Solid Waste and Emergency Response, Washington, D.C.

² DOE notes that, to ensure the unit remains protective of human health and the environment, the Tennessee Department of Environmental and Conservation (TDEC) issued a December 12, 1995 permit modification that: (1) imposed metal feed limits, (2) required that a heavy metals trial burn be conducted, and (3) directed that air dispersion modeling of the forthcoming trial burn results be performed.

- Representative data regarding the prevalence of mercury-contaminated legacy wastes that are identified as potentially incinerable at DOE MW incinerators are included in Enclosure 4. This enclosure further discusses DOE concerns regarding radioactively-contaminated, carbon injection/carbon bed wastestreams that also equal or exceed EPA's land disposal restrictions (LDR) High Mercury-Inorganic Subcategory threshold (260 mg/kg). DOE anticipates that this type of wastestream will be generated as a result of applying controls to meet the proposed beyond-the-floor (BTF) D/F MACT standards. High Mercury-Inorganic Subcategory secondary wastes are subject to an existing LDR specified treatment technology standard (retorting/roasting) prior to land disposal, regardless of the treatment technology or treatment trains that are previously applied. If BTF D/F standards applicable to MW incinerators are issued, DOE recommends that EPA consider concurrently issuing a new subcategory for Radioactive High Mercury-Inorganic wastes under the LDR program. Establishment of such a subcategory under the LDR program is warranted as DOE believes that its efforts to achieve compliance with the HWC standards will generate a prohibited waste that differs significantly from the wastes utilized to establish the LDR standard. Moreover, DOE is not aware of any retorting/roasting facilities that have successfully demonstrated that they can treat radioactively-contaminated, high-mercury and D/F-bearing waste.

The Department is committed to responsible environmental stewardship in its waste management program, including the use of state-of-the-art demonstrated technology for its hazardous waste incinerator controls (for instance, when the DOE MW incinerators were designed and constructed, all regulatory standards were not only met, but were exceeded). DOE, however, has serious concerns that these proposed standards do not adequately consider the mixed-waste issues which are most relevant to the DOE air sources to be regulated by this rule. We would be pleased to work cooperatively with you and your staff to resolve these concerns.

DOE appreciates the time taken by EPA staff to meet with DOE staff on March 10 and the time spent considering these comments. The Department also plans to comment on EPA's May 2, 1997, proposed rule, "Revised Technical Standards for Hazardous Waste Combustion Facilities" (62 FR 24212). If you have any questions related to this letter or the enclosures please contact Ted Koss (202-586-7964) or Beverly Whitehead (202-586-6073) of my staff.

Sincerely,

Raymond F. Pelletier
Director
Office of Environmental Policy and Assistance

Enclosures

cc: F. Chanania, EPA

**U.S. DEPARTMENT OF ENERGY FOLLOW-UP COMMENTS RELATED TO THE
MARCH 10, 1997, MEETING WITH EPA ON THE HAZARDOUS WASTE
COMBUSTOR PROPOSED RULE (61 FR 17358; APRIL 19, 1996)**

**ENCLOSURE 1. PRINCIPAL REASONS UNDERLYING DOE'S REQUEST FOR A
SEPARATE SUBCATEGORY WITH FOR MIXED-WASTE
INCINERATORS**

DOE's principal reasons for supporting a separate subcategory for mixed-waste (MW) incinerators are summarized in the following bullets:

- EPA has the ability and discretion under §112(c) of the Clean Air Act (CAA), as amended, to establish a separate subcategory for MW incinerators.
- Based upon available risk assessments for two of the three existing DOE MW incinerators, using existing emission controls, MW incinerators pose a negligible threat to human health and the environment. Accordingly, there will be minimal risk to the public if EPA establishes a separate subcategory and defers the Maximum Achievable Control Technology (MACT) standards until an appropriate MW incinerator MACT standard can be promulgated.
- MW incinerators have significant differences and concerns when compared to conventional hazardous waste combustors (HWCs). These include the need for protecting occupational workers from radiation exposure, the use of high efficiency particulate air (HEPA) filters, and the need to replace and appropriately dispose of contaminated testing and pollution control equipment/residues.
- Compliance costs for MW incinerators are estimated to be much higher than for conventional HWCs. These additional costs will result from such factors as precautions to reduce occupational exposure during HWC-driven compliance activities including feedstream analysis, more frequent replacement of HEPA filters, and disposal of additional quantities of radioactive mixed waste generated by the application of pollution controls (e.g., carbon beds) to MW incinerators, some of which may require long-term maintenance and storage involving significant cost outlays far into the future.
- EPA will be able to establish more informed MACT standards for MW incinerators by considering emission data from such incinerators and establishing the standard based on emission data and compliance costs particular to MW incinerators. Costs of compliance with MACT standards and simultaneously with the National Emission Standards for Hazardous Air Pollutants (NESHAPs) for radionuclide emissions at 40 CFR 61 Subparts H and I can also be taken into account. DOE will have available trial burn data from two MW incinerators later this year, which it will make available to EPA.
- EPA has in the past noted the unique aspects of sources with radionuclide emissions and treated them separately for the purpose of rulemaking. For example, in a December 6, 1994 rulemaking, EPA exempted waste management units that are used solely for the management of MW from complying with organic air emission controls because the 40 CFR 264/265 Subpart CC provisions were viewed as incompatible with Nuclear Regulatory Commission requirements for safe handling of MW (59 FR 62914).

- Schedules and existing milestones set forth in previously negotiated Site Treatment Plans (STPs) and their associated Consent Orders under the Federal Facility Compliance Act (FFCA), as well as site-specific agreements [e.g., Interagency Agreements (IAGs)] under § 120(e) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) govern DOE MW incinerators. DOE believes that the amount of time necessary to contend with: (1) radioactive operational/administrative controls (related to complying with MACT standards), and (2) the Federal appropriation/procurement processes may result in DOE's MW incinerators missing the compliance deadline of the MACT rule. EPA has proposed to prohibit HWCs from burning hazardous waste except when the HWC is in compliance with MACT standards [40 CFR 63.1207(a)]. Therefore, as an indirect consequence of missing the MACT deadline, DOE could be compelled to deactivate noncompliant HWCs until any necessary air pollution control device construction is complete and compliance with MACT is achieved. In the interim, the DOE sites with HWCs as well as DOE sites that have negotiated with Federal and State regulators to send their incinerable waste to such sites may miss the legally enforceable milestones prescribed in the STPs/agreements. DOE recognizes that STPs and agreements often contain an overriding provision which permits the Department to renegotiate agreements based upon Congressional reductions. However, as noted in a 1995 report titled *Improving Federal Facilities Cleanup; Report of the Federal Facilities Policy Group* (<http://www.whitehouse.gov/WH/EOP/OMB/html/miscdoc/iffc-1.html>), as budgetary constraints become more significant, the cost of renegotiating milestones on a site-by-site basis has already begun to impede rational and systematic priority setting.
- The Department's site-specific STPs and IAGs provide EPA and/or States with an additional avenue for overseeing DOE's waste inventory management and treatment processes, which is not present at commercial entities.
- Use of carbon injection and carbon beds, which DOE believes will be necessary to comply with the D/F and mercury beyond-the-floor (BTF) limits as proposed, conflicts with a major premise of radioactive operations, which is to minimize the amount of radioactive waste generated. For example, the injection of 5-20 lbs/hr of carbon violates this principle. In the course of one year, assuming 7200 hours of operation, the amount of additional radioactive waste generated is between 36,000 lbs and 144,000 lbs.
- EPA estimates that approximately 25% of all hazardous waste incinerators may cease burning hazardous waste as a result of this rule. Therefore, the wastes currently being burned in those facilities will be transported to other facilities (61 FR 17386-17387). Due to the radioactive nature of mixed waste, however, DOE does not possess this option. Only a limited number of mixed-waste incinerators are or will be available as an alternative means of compliance.

Some of the preceding bullets highlight urgent problems that may have a direct impact on both the DOE budget and its mixed waste management compliance strategies. Relative to the budget, for example, Section 6001(a) of RCRA (as amended by FFCA) waives sovereign immunity for civil and criminal penalties as well as State enforcement actions taken when a Federal agency fails to comply with hazardous waste management requirements. Likewise, Section 118(a) of the CAA, as amended, contains a waiver of sovereign immunity. When funding shortfalls occur, Federal agencies must resolve the conflicting priorities set via enforcement actions imposed by the multiple jurisdictions to which the Department is subject, or risk civil penalty awards that might result from noncompliance, which threaten a further drain on available resources.

**U.S. DEPARTMENT OF ENERGY FOLLOW-UP COMMENTS RELATED TO THE
MARCH 10, 1997, MEETING WITH EPA ON THE HAZARDOUS WASTE COMBUSTOR
PROPOSED RULE (61 FR 17358; APRIL 19, 1996)**

**ENCLOSURE 2. DESIGN/CONFIGURATION OF DOE MIXED WASTE
INCINERATORS**

Unlike conventional incinerators, two of DOE's mixed-waste (MW) incinerators use high efficiency particulate air (HEPA) filters to control radionuclide emissions. One of these units [the Waste Experimental Reduction Facility (WERF) at Idaho National Engineering and Environmental Laboratory (INEEL)] uses a dry off-gas system while the Consolidated Incineration Facility (CIF) at DOE-Savannah River (SR) uses a wet scrubber. CIF flue gases are heated to approximately 240°F before passing through the HEPA filters to prevent condensation on the filters. Although unexpected from an engineering perspective, three recent mini-burns (pre-trial burns) conducted at the DOE-SR CIF indicate that this reheating step may result in dioxin/furan (D/F) formation. Mini-burn data demonstrating that the facility may have difficulty meeting the *proposed* D/F standards are provided in Exhibits 1 - 3 and include the following:

CIF Mini-Burn Data

- Feed Rates: Exhibit 1 (Table 1-1) summarizes the feed rates for the Pre-Trial Burn. The chlorine feed rate was consistent across all runs at about 200 lb/hr.
- Operating Parameters: Exhibit 2 (Table 1-2) summarizes the operating conditions for the Pre-Trial Burn runs.
- Pre-Trial Burn Results: Exhibit 3 (Table 10).

The D/F and mercury results, while meeting *current* standards, were not so low as expected. The mercury emissions varied greatly, which have been attributed to a need to mix the metal suspension longer and more vigorously during the trial burn. The trial burn scheduled for April 1997 will measure mercury emissions per 40 CFR, 266, Appendix IX.

As illustrated in Exhibit 3 (Table 10), the D/F emissions were unexpected in that the emissions in the high temperature run and the low temperature run were the same at about 2.8 ng/dscm. The low temperature, high liquid run was the highest at about 6.8 ng/dscm. It is possible that the aqueous stream at 950 lb/hr created niches of cool zones that could have created a *de novo* synthesis range. The vendor literature as well as CETRED³ would suggest that temperature in the kiln and secondary combustion chamber (SCC) should influence D/F formation. Also, the literature indicates the quick quench systems do not have dioxins above the *proposed* standard. DOE-SR did not find that to be true. However, the published literature does not discuss incinerator systems which use reheaters and HEPAs. HEPAs are designed to remove fine particulate, specifically radioactive isotopes and metal mists. The absence of literature on D/Fs and HEPAs is undoubtedly attributable to the fact that

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EPA, 1994. Combustion Emissions Technical Resource Document (CETRED), EPA/530-R-94-014, Office of Solid Waste and Emergency Response, Washington, D.C.

many of the MW incinerators are new and have not as of yet completed a trial burn. Note that the DOE incinerator at Oak Ridge has completed a trial burn, but that incinerator does not use HEPA filters. Both the INEEL WERF and DOE-SR CIF incinerators will be completing trial burns in 1997 with the results to be available by early fall.

The ash from the kiln was also tested for D/F with average results of 0.6 ppb. This level would indicate that some additive could be used (e.g., sulfur flakes). Sulfur acts as a reducing agent that forces the equilibrium further toward HCl, thereby minimizing the amount of free chlorine in the combustion chambers. Some literature postulates the view that sulfur poisons the catalytic surface. However, any additive does not meet good radiological practices of minimizing the amount of waste generated.

As was discussed during DOE's presentation to EPA on March 10, 1997, the design and configuration of the Department's incineration units may offer EPA some valuable insight regarding the formation of D/F and, hence, the appropriateness of DOE's request for a separate subcategory for MW incinerators and deferral of the MACT standards until an appropriate MW incinerator ACT standard can be promulgated. Accordingly, the following subsections present design/configuration information for DOE's three MW incinerators: 1) the CIF located at DOE-SR; and 2) the Toxic Substances Control Act (TSCA) Incinerator Facility at Oak Ridge Reservation (ORR); and 3) the WERF at INEEL.

Consolidated Incineration Facility (CIF)

CIF is a 27 MMBtu/hr rotary kiln, 8 ft by 25 ft, designed by John Zink. The kiln is designed for a 30 minute minimum residence time for solids. The kiln front wall has an auxiliary fuel burner (diesel), an organic burner, and an aqueous nozzle. The SCC is cylindrical, 7 ft by 21 ft, with both an auxiliary fuel burner and a radioactive organic waste burner. The SCC is followed by a quench vessel where the gases are quickly cooled from 1950°F to ~175°F. The quench scrubs the acid gas and removes the particulate. The quench is followed by a Hydrosonics scrubber where ~10,000 lbs/hr of steam is injected to atomize a scrubbing liquor for acid gas neutralization. A cyclone separator, mist eliminator, and reheater follow. The reheater is designed to heat the gases up to 240°F to prevent condensation on the HEPA filters which follow the reheater. Induced draft fans provide the motive force to pull gases through the system and discharge to the atmosphere via a 150 foot stack. Although unexpected from an engineering perspective, three recent mini-burns (pre-trial burns) conducted at the CIF indicate that the reheating step may result in D/F formation.

Toxic Substance Control Act (TSCA) Incinerator

The TSCA Incinerator is designed and permitted by the Tennessee Department of Environmental and Conservation (TDEC) to receive, store and thermally treat radioactively-contaminated polychlorinated biphenyls (PCBs) and RCRA hazardous wastes. The incinerator consists of a rotary kiln and a SCC, followed by a wet off-gas cleaning system. Waste and auxiliary fuel are injected into the primary chamber (rotary kiln), hot combustion gases then flow to the SCC, quench chamber, and other pollution control devices. Organic liquids and aqueous and solid wastes can be fed into the rotary kiln. Only high heat value organic liquid wastes are permitted to be fed to the SCC. The rotary kiln and SCC each have an auxiliary burner that utilizes natural gas or No. 2 fuel oil to control incineration temperatures.

The offgas cleaning system consists of a quench chamber, venturi scrubber, packed bed scrubber, two ionizing wet scrubbers (IWS) in series, an induced draft fan, and the exhaust stack. In the quench chamber, combustion gases are cooled from the SCC exit temperature of approximately 2200°F to approximately 180°F by contact with fresh water and recycle water streams. Excess water collects in the recycle tank at the base of the quench while the saturated gas stream is routed to the inlet of the venturi scrubber.

The automatic variable-throat venturi scrubber for particulate removal (greater than one micron) is between the quench chamber and the packed bed. The venturi assembly consists of converging and diverging cones with an adjustable throat to allow the pressure drop to be varied. Venturi pressure drop normally is controlled between the range of 9 to 12 inches of water-column. Scrubber solution is injected through a nozzle upstream of the throat. The venturi scrubber has a demister on the outlet section to remove entrained liquid droplets which are then drained to the quench recycle tank. HCl is removed from the gas phase by cross-current contact with recycled scrubber solution in the packed-bed scrubber. To control scrubber solution acidity, an alkaline solution is added. The addition rates are controlled by pH sensors on the outlet of the scrubber water recycle loops.

Two IWS units are included for removal of submicron particulate matter by providing cross-current contact of the flue gases with recycled scrubber solution. Each of the units consist of an ionizer module in which particles are electrically charged by energized wires and become attached on the wetted surfaces of the scrubber packing.

To protect the air pollution control (APC) system from damage caused by high inlet temperatures, a high temperature-actuated system infrequently bypasses the exhaust gas from the SCC to the atmosphere through a thermal relief vent. When bypass occurs, the waste feeds are automatically stopped, auxiliary fuel is used to maintain the temperature in the SCC, and an alarm sounds to notify the operator.

Waste Experimental Reduction Facility (WERF)

The Idaho National Engineering and Environmental Laboratory (INEEL) Waste Experimental Reduction Facility (WERF) mixed-waste incinerator is a dual-chambered, controlled-air, industrial waste combustion unit with a maximum rated combustion capacity of 5.0 million Btu/hr. The active incinerator system consists of the following:

- A solid waste feed system that conveys the solid waste containers of low-level waste, hazardous waste, and mixed low-level waste
- A primary (lower) chamber, where liquid and solid wastes are introduced and where combustion takes place at starved air conditions for solid waste and excess air conditions for liquid wastes
- A secondary (upper) chamber that acts as an afterburner for the unburned volatile gases from the wastes in the primary chamber
- A combination of two dilution air streams and a shell-and-tube heat exchanger for cooling combustion gas before it reaches the air pollution control equipment
- An air pollution control system using baghouse and HEPA filters
- A bottom-ash removal system to remove ash through a cooling hopper located in the bottom of the lower chamber

The incinerator is normally operated on a campaign basis (each lasting about 20 days) which minimizes the number of heat-up/cool-down cycles to prolong the refractory life. The incinerator may operate for up to approximately 5760 hours a year.

Solid wastes, typically packed in incinerable containers up to 2 x 2 x 2 feet, are charged at a rate currently limited to 400 lbs per hour. Solid wastes typically consist of clothing, rags, and plastic, as well as liquid wastes absorbed on corncobs. Secondary plastic packaging is provided for wastes containing volatile liquids. Ash and fixed carbon in the waste accumulate on the lower chamber hearth. Feed to the incinerator is stopped periodically to burn off the fixed carbon in the residue. As hot volatile gases enter the secondary chamber, excess air is injected for complete combustion. Residence time in the secondary chamber is approximately two seconds when burning solid low-level waste at a rate of 400 lb/hr at 2100°F maximum secondary chamber exhaust temperature.

Hot combustion gases undergo a three-stage cooling process prior to filtration. After leaving the secondary combustion chamber, the off-gas is cooled to less than 1,400°F by mixing with dilution air drawn from outside. The heat exchanger secondary cooling system uses outside air in a shell-and-tube design to further cool the gas to less than 750°F. Shell-side air is exhausted to the atmosphere through a separate stack. A second stream of dilution air is drawn from inside the facility into the off-gas system. This second stream mixes with gas exiting the heat exchanger to cool the off-gas to less than 450°F before entering the initial pollution control equipment. This three-step cooling process protects the filtration media in the air pollution control equipment.

After dilution and cooling, the off-gas enters the fabric baghouse filter system, forming a cake on the surfaces of the fabric and eliminating approximately 99% of the particulate. Pressure pulses are used to remove excess particulate cake from the bag surface as necessary to maintain the baghouse pressure drop at an acceptable level. Particulate material drops to a collection hopper.

Air exiting the baghouse system passes through a HEPA filter bank. Enclosed within this bank are roughing filters and HEPA filters. The roughing filters are used to further extend the life of the HEPA filters. The filter bank consists of 16 HEPA filters in a 4 x 4 array. Maximum pressure drop allowed across HEPA filters in general is 10 inches water-column (wc). A minimum removal of 99.97% is still maintained at this pressure. WERF is normally operated at a 4-in. wc pressure drop across the HEPA filters.

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**ENCLOSURE 3. CURRENT LEVEL OF PROTECTIVENESS PROVIDED BY DOE
MIXED WASTE INCINERATORS**

During the March 10, 1997 meeting between DOE and EPA personnel, one general issue raised was whether DOE incinerators which treat hazardous waste possessing a radioactive component pose a more significant threat to human health and the environment than do incinerators burning solely hazardous waste. This enclosure addresses this issue.

The information provided in this enclosure is based on site-specific screening risk assessment reports that have undergone review as part of the RCRA Part B permit applications for the facilities. The Toxic Substances Control Act (TSCA) risk assessment has also undergone public review and comment. The source reports demonstrate that, absent additional controls, the level of protectiveness currently provided by air pollution control devices employed at DOE mixed-waste incinerators assures that the target risk level of 10^{-5} for the high end individual⁴ will not be exceeded.

Consolidated Incineration Facility (CIF): Preliminary Health Risk Assessment Information

A preliminary Health Risk Assessment for the Consolidated Incineration Facility at the DOE Savannah River Site was conducted by the Georgia Institute of Technology. The report, ERDA Task Order 94-041, was completed on June 28, 1995. The risk assessment used the EPA draft guidance on combustor health effects screening methodology⁵ and included public participation.

The health risks due to CIF chemical emissions were estimated using four different scenarios: an adult resident, a subsistence farmer, a subsistence fisher, and a child resident. The chemical toxin health risk assessment was based on thermodynamic modeling; the high emissions estimate was based on sensitivity studies and does not necessarily reflect the range of operating conditions of the CIF. The organic baseline emissions estimate was derived from a literature survey of incinerators with similar operating characteristics; the organic high emissions estimate was set a factor of ten above the baseline estimate.

⁴ For the purposes of evaluating the protectiveness of the proposed MACT standards, EPA uses a target risk level of 10^{-5} for the high-end individual risk (61 FR 17371, col. 1).

⁵ EPA, 1994. *Exposure Assessment Guidance for RCRA Hazardous Waste Combustion Facilities* (Draft), EPA530-R-94-021, Office of Solid Waste and Emergency Response, Washington, D.C.

EPA, 1990. *Methodology for Assessing Health Risks Associated with Indirect Exposure to Combustor Emissions* (Review Draft), PB90-187055, Office of Solid Waste and Emergency Response, Washington, D.C.

EPA, 1994. *Addendum to the Methodology for Assessing Health Risks Associated with Indirect Exposure to Combustor Emissions* (External Review Draft), EPA600/AP-93/003, Office of Solid Waste and Emergency Response, Washington, D.C.

Health risks for chemicals are characterized for carcinogenic and noncarcinogenic effects. Cancer risk is computed by multiplying the chemical intake by a carcinogenic slope factor which represents the carcinogenic potency of the chemical per unit intake. This risk is the probability of excess lifetime cancer from the exposure. The total cancer risk is computed by summing the cancer risks for each chemical.

Noncarcinogenic risks for chemical toxins are defined in terms of hazard quotients. The hazard quotient is the ratio of the chemical intake to the reference dose for that chemical. The reference dose is the estimated daily intake that is associated with the occurrence of the adverse health effect. The toxic endpoint for the reference dose varies from chemical to chemical. Total hazard indices are computed by summing the hazard quotients of chemicals with the same adverse health effect endpoint. For this study, as per EPA 1994 guidance, the hazard indices for liver effects and neurotoxin effects were calculated.

The representative lifetime health risks summarized in Table E3-1 are based on models of the transport of chemical toxicants from CIF air emissions to human receptors, and reflect estimates presented in two Georgia Tech studies⁶. For risks reported in Table E3-1, the assessment based its emission estimates on maximum CIF waste feedrates, worst-case feed compositions, and the minimum allowable operating efficiencies. It is expected that the average composition of waste feeds and anticipated operating efficiency of the CIF process systems will result in significantly lower emissions than the calculated estimates or those measured during the trial burn. Consequently, Table E3-1 reflect very conservative risk estimates.

Table E3-1. Lifetime Cancer Risks for the CIF Baseline and High Emissions: Chemical

	Baseline	High Emissions
Subsistence Farmer	3.0E-09	3.0E-08
Subsistence Fisher	3.4E-06	3.4E-05
Composite Individual (MEI)	2.3E-10	2.3E-09
Child Resident	4.9E-11	4.9E-10
Adult Resident @ 11,770 m	2.3E-10	2.3E-09

The subsistence fisher risks, which are driven by the bioaccumulation of toxins in fish, appear to be the highest. When one more closely examines the methodology used to estimate these lifetime cancer risk levels, one recognizes that these elevated levels may be attributable to two variables.

⁶ Georgia Institute of Technology, 1994. *Air Emissions Estimate for the Savannah River Site Consolidated Incineration Facility; Part 1: Metal and Radionuclide Emissions*, GT/ERDA-94041-002, Rev. 2, Environmental Engineering Program and Health Physics Program, Georgia Institute of Technology, Atlanta, GA

Georgia Institute of Technology, 1994. *Air Emissions Estimate for the Savannah River Site Consolidated Incineration Facility; Part 2: Organic Emissions*, GT/ERDA-94041-003, Rev. 2, Environmental Engineering Program and Health Physics Program, Georgia Institute of Technology, Atlanta, GA

First, the toxin level of the fish in the pond have been conservatively overestimated in this assessment by not including chemical toxin biodegradation in the water. For the principal risk-contributing chemicals, this can lead to a risk overestimation by a factor of at least 38 over a compartment model that includes biodegradation. Second, the bioaccumulation factors used in this assessment for the principal risk-contributing chemicals in the fisher scenario were about a factor of 200 larger than the values given by EPA for use in the health effects screening of combustors. Accordingly, the Department believes that eliminating conservative estimates and applying EPA values would yield results well below EPA's target risk level.

The representative lifetime health risks and the doses due to trace quantities of radionuclides in CIF air emissions are summarized in Table E3-2 and reflect estimates presented in a Georgia Institute of Technology Report⁷. For risks and doses reported in the table, a lifetime was assumed to be 70 years for the subsistence fisher, subsistence farmer, and the average individual. This assumes that these individuals live at the same location for 70 years. The beginning of their life coincides with the startup of CIF. The CIF is assumed to close after 30 years of operation. These individuals continue to live at the same location for another 40 years and are exposed to any residual radioactivity in the environment left from the operation of the CIF.

Table E3-2. Estimated CIF Lifetime Effective Dose Equivalent (mrem)/Representative Lifetime Risks

	Baseline Emissions	High Emissions
Onsite worker	2.4 / 1.2E-6	7.4 / 3.7E-6
Subsistence Farmer	0.44 / 2.2E-7	2.3 / 1.1E-6
MEI	0.24 / 1.2E-7	1.9 / 9.4E-7
Average Individual	0.20 / 0.1E-6	NA / NA

The risk estimates for the maximally exposed individual (subsistence fisher) on the site boundary for the radionuclide air emissions is at least 720 times less than the lifetime risk (1.3E-2) for being exposed to background radiation (360 mrem/yr) for an average member of the U.S. population.

The emission results from the CIF trial burn (expected to be available in the fall of 1997) will be used to update the preliminary health risk screening that was done to obtain a RCRA treatment, storage and disposal facility (TSDF) permit from the State of South Carolina and EPA Region IV.

⁷ Georgia Institute of Technology, 1995. *Health Risk Assessment for the Savannah River Site Consolidated Incinerations Facility; Part 1: Radionuclides*, GT/ERDA-94041-005, Draft, Health Physics Program and School of Civil and Environmental Engineering,, Georgia Institute of Technology, Atlanta, GA

Toxic Substance Control Act (TSCA) Incinerator: Status of Risk Assessment and Dispersion Modeling

EPA published its Combustion Strategy in 1994.⁸ This strategy proposed additional requirements to be imposed on hazardous waste combustors, including metals feed limits and risk assessment. The regulation of the metal constituents in waste has been previously unregulated in RCRA incinerator permits. EPA and the Tennessee Department of Environmental Conservation (TDEC) are currently developing regulations for the emission and feed rate of individual metals. Even though no regulations clearly impose such requirements, DOE-Oak Ridge Reservation (ORR) voluntarily agreed to metals feed rates based on 40 CFR 266 (BIF regulations) and typical operations (versus maximum possible loading). To ensure the limits remain protective of human health and the environment, a December 12, 1995 permit modification: (1) imposed metal feed limits on the TSCA Incinerator, (2) required a heavy metals trial burn be conducted, and (3) directed that dispersion air modeling of the trial burn results be performed. Although a multi-pathway risk assessment has not yet been performed, the established incinerator regulatory limits take potential impacts into account.

The hazardous waste permit (TNHW-015) for the TSCA Incinerator was issued by TDEC in 1987; a permit renewal application was submitted in March 1997. The application proposes a metals trial burn plan and risk assessment plan. As part of the permit renewal, personnel anticipate conducting both a trial burn (which also includes dioxin monitoring), and a risk assessment that addresses metals, organics, PCBs, and dioxins. The metals trial burn plan and dispersion modeling plan were submitted in March 1996 and are awaiting approval by EPA and TDEC. Upon approval, the metals trial burn and dispersion modeling will be conducted.

Relative to the radioactively-contaminated wastes, EPA Region IV, under the authority of the Clean Air Act, has issued NESHAPs approval under 40 CFR Part 61, Subpart H for operation of the TSCA Incinerator. This approval remains in effect and regulates the radionuclide emissions from the TSCA Incinerator. As stated in the approval letter, the maximum allowable ORR annual dose limit to the public is 10 millirem. Although the TSCA Incinerator's allowable dose is 7.5 millirem out of the ORR 10 millirem dose limit, to date, the highest predicted annual yearly dose was 0.53 millirem and occurred in 1992.

⁸ EPA, 1994. *Hazardous Waste Minimization and Combustion Strategy*, EPA/530-R-94-044, USEPA, Washington, D.C.

Waste Experimental Reduction Facility (WERF): Preliminary Screening Risk Assessment Data

A preliminary (pre-trial burn) screening risk assessment for WERF incinerator emissions has been performed consistent with EPA guidance.⁹ It was submitted in January 1997 to the State of Idaho as part of the RCRA permit application for the incinerator.¹⁰

Based on the screening information, the total (sum of indirect and direct exposures) excess lifetime cancer risks estimated by the screening risk assessment for chemical emissions including the 1995 TEQ data were 7.9E-6, 9.2E-8, and 9.6E-8 for the hypothetical subsistence farmer, adult resident, and child resident, respectively, at the point of maximum air concentration. Estimated radiation doses associated with projected WERF incinerator emissions were 0.029 millirem to the maximally exposed offsite individual (DOE 1995).¹¹ Assuming an annual whole-body irradiation of 0.029 mrad and a quality factor of one, the corresponding increased lifetime risk of fatal cancer would be 1.5E-8 (EPA 1994).¹² These calculated risks are lower than EPA's benchmark of acceptability (target level of 1E-5 for the high end individual risk) (61 FR 17371).

The potential for noncarcinogenic effects for each identified receptor through indirect and direct exposure to chemical emissions from the facility was also estimated. Based on EPA exposure assessment guidance, hazard quotient values for chemicals affecting the same target organ were summed to derive a hazard index (HI). The EPA has established a HI benchmark of 0.25, which is designed to be adequately protective of human health considering noncancer effects. The HI estimated for the WERF emissions was substantially less than 0.25 for each target organ, summed for the indirect and direct pathways, for the subsistence farmer, adult resident, and child resident, respectively. The respective HIs summed for all target organs (conservatively assuming that all chemicals affected the same target organ) were 0.105, 0.074, 0.075 for the subsistence farmer, adult resident, and child resident, respectively, all still substantially less than 0.25.

EPA guidance and directives address environmental concentrations of lead (Pb) as a specific area of concern (see, for example OSWER Dir. 9355.4-12). The modeled maximum concentration of lead

⁹ WERF Screening Level Risk Assessment, *INEEL. RCRA Part B Permit Application*, January, 1997.

¹⁰ *INEEL, RCRA Part B Permit Application, Volume 9, January, 1997.*

¹¹ *Technical Support Document for Air Resources; Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs*, DOE/ID-10497, U. S. Department of Energy, Idaho Operations Office, March 1995.

¹² *Guidance for Performing Screening Level Risk Analyses at Combustion Facilities Burning Hazardous Wastes*, Draft, Environmental Protection Agency, December 1994.

in the soil was calculated to be 0.002 mg/kg. This value is well below the EPA benchmark of 100 mg/kg.⁽⁹⁾ In addition, the modeled concentration of lead in air was calculated to be 9.17E-5 g/m³, also well below the EPA benchmark of 0.2 g/m³.⁽⁹⁾

Although the areas within the INEEL boundary, in general, are not open to public access, there are public highways that transect the INEEL. To evaluate the potential impacts to members of the public, the maximum ambient air concentrations to receptors placed along these highways were compared to EPA Region III Risk-Based Ambient Air Concentrations. The results indicate that no risk-based ambient air concentrations would be exceeded at these locations and that the sum of the hazard quotients for these receptors was 0.127, also less than 0.25.

Summary of Risk Assessment Component

The Department believes that the preceding MW incinerator-specific risk assessment information supports the justification for a separate MW incinerator subcategory and deferred MACT standards. More specifically, except for CIF's very conservative subsistence fisher risks, which are duly noted above, the preceding risk assessment data and voluntary protective measures (i.e., use of metal feed rate limits) illustrate that, absent additional MACT controls, the Department's MW incinerators provide a level of protectiveness beyond that used by EPA as the target risk level for high-end individuals (1E-5). It should be noted that the Department believes the request for a separate subcategory, however, does not hinge on this risk assessment information solely. Rather, DOE's request is built on a foundation of reasons outlined in Enclosure 1, supported by practical risk assessment information, and strengthened by a number of additional considerations which are further described in DOE's August 1996 consolidated comment package; the March 10, 1997 DOE/EPA meeting; and Enclosures 1, 2, and 4.

**U.S. DEPARTMENT OF ENERGY FOLLOW-UP COMMENTS RELATED TO THE
MARCH 10, 1997, MEETING WITH EPA ON THE HAZARDOUS WASTE COMBUSTOR
PROPOSED RULE (61 FR 17358; APRIL 19, 1996)**

**ENCLOSURE 4. RADIOACTIVE MIXED WASTE AND LAND DISPOSAL
RESTRICTIONS (LDR) STANDARDS FOR HIGH MERCURY-
INORGANIC SUBCATEGORY SECONDARY WASTESTREAMS**

Fundamental to waste treatment is the concept that the type of treatment technology used (e.g., incineration) and the level of treatment achieved are heavily dependent on the physical and chemical characteristics and composition of the waste. DOE has an inventory of RCRA Subtitle C-regulated, mercury-bearing ‘legacy’ waste which require treatment. Such waste exceeds the toxicity characteristic threshold for mercury, yet is not prohibited from incineration under the LDR dilution prohibition because of the organics present and the material’s composition. Table E4-1 estimates the total volume of DOE mixed waste that is destined for thermal treatment, including incineration, and the percentage of the potentially incinerable mixed waste that is characterized as mercury-bearing (D009¹³) hazardous waste.

Table E4-1. Current volumes of DOE D009 potentially incinerable mixed (low-level and transuranic) waste, relative to total DOE mixed waste and total DOE thermally treatable mixed waste.^a

Waste category	Total, m³	Percent classified as D009
Total DOE mixed LL and TRU waste	165,369	27%
Waste with organic contaminants	111,871	30%
Waste currently planned for thermal treatment	66,439	14%

a. Source of information: DOE Mixed Waste Inventory Report (MWIR) developed in support of the Federal Facilities Compliance Act and supporting Site Treatment Plans.

The Department has conveyed, both in the consolidated comment package submitted in August 1996 and during its briefing to EPA personnel on March 10, 1997, a number of its concerns associated with compliance with the mercury emission standard. [See General Comment 2 (p. 5, third paragraph) and Specific Comment 4.III.A.3.a of the August 1996 comment submittal)]. In addition to the prevalence of mercury in potentially incinerable DOE wastes, additional operational concerns relative to mercury-bearing feedstreams include the following:

¹³ Under 40 CFR 261.24, waste exhibits the characteristic of toxicity and is assigned the D009 waste code when an extract from a representative sample equals or exceeds the EPA-established threshold concentration for mercury of 0.2 mg/l.

- mercury content in DOE legacy waste streams is highly variable, as are the waste matrices, and complete characterization data may not be available.
- DOE has additional organic-bearing wastestreams that demand further characterization, during which additional mercury-bearing wastes may be identified.
- compliance with feed control by DOE on certain previously-containerized legacy mixed wastes would entail manual opening, sampling, and sorting each waste package, which presents significant personnel radiation exposure and personnel/facility safety issues.

One concern that was raised during the DOE/EPA meeting on March 10, 1997, focuses on a mercury-bearing waste stream that appears to be unique to mixed-waste (MW) incinerators, and which the Department foresees will be generated while complying with beyond-the-floor (BTF) standards for dioxin/furans (D/F), as proposed. Specifically, D/F abatement options suggested in the proposed MACT rule include carbon injection [40 CFR 63.1210(j)(7)], carbon beds [40 CFR 63.1210(j)(8)], catalytic oxidizers [40 CFR 63.1210(j)(9)], and dioxin inhibitors [63.1210(j)(10)] (61 FR 17522). For DOE's MW incinerators, neither the catalytic oxidizer nor the dioxin inhibitor options were considered because they are not expected to reduce mercury emissions. In evaluating the carbon injection (CI) and carbon bed (CB) options, the Department determined that its use of either the CI or CB proposed D/F control options will likely result in the generation of a wastestream for which no treatment capacity exists.

Under the LDR program (40 CFR Part 268), EPA sets forth treatment standards that are either concentration-based (mg/l or mg/kg) or technology-based. In either case, treatment standards for each treatability group are derived from the performance of a best demonstrated available technology(ies) (BDAT). EPA initially clarified the BDAT concept in a final rule dated November 7, 1986 (51 FR 40572). In defining the terms "demonstrated" and "available," EPA agreed with comments that treatment standards should not be based on emerging and innovative technologies and stated "To be considered a "demonstrated" treatment technology . . . a full scale facility must be known to be in operation for the waste or similar wastes" (51 FR 40588). The Agency goes on to offer four criteria in determining whether a treatment technology is "available," the second of which requires the technology itself or the services of the technology to be commercially available (51 FR 40589).

EPA has established a number of treatability groups for wastes that exhibit the toxicity characteristic (TC) for mercury. Treatment standards for mercury-bearing wastes are set forth in the 40 CFR 268.40 table "Treatment Standards for Hazardous Wastes." These include a treatment standard for inorganic nonwastewater, including incinerator residues, that exhibit (or are expected to exhibit) the TC for mercury and whose mercury concentration equals or exceeds 260 mg/kg total mercury. EPA categorizes this type of waste as High Mercury-Inorganic Subcategory waste and specifies that such wastes must be treated using the technology-based standard of "RMERC."¹⁴

¹⁴ RMERC, which is a technology-based LDR standard, requires retorting or roasting in a thermal processing unit capable of volatilizing mercury and subsequently condensing the volatilized mercury for recovery. The "retorting or roasting unit (or facility) must be subject to one or more

Relative to DOE MW incinerators, when MW is burned, the combustion process does not destroy the radioactivity associated with waste, only the chemical and physical forms of radionuclides. Carbon injected into dry systems will adsorb radionuclides, along with mercury, D/F, suspended particulate fumes and other products of incomplete combustion. Spent carbon will be captured in exhaust scrubbers and filtration devices.¹⁵ DOE has evaluated inserting a bulk carbon silo with pneumatics and a secondary baghouse to function as the carbon collector after the reheater but before the units' HEPA filters. Spent carbon will be collected on the bags, rapped to a hopper, and then collected. Using a carbon injection rate of 5-20 lbs/hr, in the course of one year, assuming 7200 hours of operation, the amount of additional radioactive mixed waste expected to be generated is estimated to be between 36,000 lbs and 144,000 lbs.

DOE also notes that while baghouses are generally viewed as good particulate collection devices, allowing for particulate emissions of 0.0015 grains/dscf, the use of HEPA filters can provide at least another order of magnitude of particulate removal (0.00078 g/dscf at CIF). Thus, it is expected that some injected carbon will leak through the baghouse to the HEPA filters shortening HEPA life because of the particulate loads reporting from the baghouse. A HEPA bank at CIF consists of nine filters at 40 lbs/filter; typically, two banks are on line to meet minimum equipment requirements. Currently these filters are changed out about once a month. As more particulate reports, however, the differential pressure across the HEPAs will increase necessitating a more frequent changeout. A changeout of all three banks produces about one ton of waste (spent HEPAs). Moreover, DOE anticipates that like the carbon wastes captured in the baghouse, spent HEPA filters will have mercury, dioxin, and radioactive contaminants. Although the level of radioactivity, D/F, and mercury may be low, the HEPA filters would need to be sampled at the point of generation (i.e., upon being removed from service) and analyzed for mercury, radioactivity, and D/F to determine whether they qualify as high mercury-inorganic wastes.

of the following: (1) a National Emissions Standard for Hazardous Air Pollutants (NESHAP) for mercury; (2) a Best Available Control Technology (BACT) or a Lowest Achievable Emission Rate (LAER) standards for mercury imposed pursuant to a Prevention of Significant Deterioration (PSD) permit; or (3) a State permit that establishes emission limitations (within the meaning of section 301 of the Clean Air Act) for mercury. All wastewater and nonwastewater residues derived from this process must then comply with the corresponding treatment standards per waste code with consideration of any applicable subcategories (e.g., High or Low Mercury Subcategories).” See 40 CFR 268.42, Table 1-- Technology Codes and Description of Technology-Based Standards.

¹⁵ As with injected carbon, carbon bed systems also adsorb radionuclides, along with mercury and other off-gas products.

Relative to the use of carbon beds, it is the Department's understanding that carbon bed systems are fairly large structures. MW incinerators could be retrofitted with carbon beds that follow the HEPA filters. A calculated amount of carbon would be removed and new carbon added on a specified frequency (e.g., daily or weekly). This "moving bed" of carbon would need to report to an airtight enclosure for subsequent removal, sampling, and analysis. As with carbon injection, DOE anticipates the carbon beds will adsorb mercury, dioxin, and radionuclides. Although the level of radioactivity should be low, the carbon beds will concentrate the mercury and it is hypothesized that final mercury concentrations will exceed the High Mercury-Inorganic Subcategory threshold. In summary, the Department estimates the potential production of approximately 200,000 pounds per year of incinerator residues including spent carbon, baghouse bags, and additional HEPA filters.

Incinerator residues must either meet all applicable LDR treatment standards at the waste's initial point of generation or be subjected to treatment until the residue meets the assigned standards. If D/F concentrations exceed 1 ppb, then current LDR standards typically necessitate the carbon be reincinerated. Reincineration of the spent residues may be possible; however, the mercury may become more concentrated until it exceeds the LDR high mercury-inorganic subcategory threshold (260 mg/kg total mercury). Wastes within this subcategory must be treated by an EPA-prescribed method of treatment designated as RMERC (i.e., recovery of mercury by retorting or roasting) prior to land disposal. Should the high mercury carbon also possess a radioactive component, however, treatment capacity is currently unavailable. Therefore, if carbon wastestreams with mercury concentrations that exceed high-mercury threshold are also radioactively-contaminated, the waste cannot be land disposed until it is treated to meet the technology-based standard. There is no current solution except to store the waste. Prolonged storage, however, is not an acceptable option per the LDR storage prohibition.

In light of the above discussion, should EPA establish the final D/F standards necessitating the use of carbon injection/carbon beds (as opposed to temperature control to below 400° F at the PM control device), DOE requests EPA establish a new LDR subcategory, Radioactive High Mercury-Inorganic Subcategory, and set forth a new technology-based treatment standard based on immobilization (e.g., stabilization or macroencapsulation). Such a treatment designation would minimize the sampling and analytical process needed to determine if the secondary waste is < 1.0 ppb for D/F and <260 mg/kg for mercury.

It should be noted that under the Federal Facility Compliance Act and its associated Consent Orders which govern the management and treatment of existing and emerging mixed waste streams, a new mixed waste stream must be reported to the regulating community within 48 hours. The follow-up information must contain the plan that must be followed for ultimate treatment and disposal of the waste. If EPA fails to establish a new subcategory treatment standard for this wastestream, DOE sites will need to accommodate the prohibited wastes by designing, constructing, permitting, and operating additional mixed waste storage facilities. In addition, it is highly likely that it may be necessary to initiate treatability studies to ascertain the appropriateness and effectiveness of various treatment technologies. This will divert already scarce resources away from other DOE priorities

(e.g., environmental restoration and waste minimization efforts) to focus on developing retorter/roasters that can accommodate mercury contaminated carbon possessing a radioactive component.

EPA has previously encountered and resolved a situation in which final treatment standards for certain K-listed hazardous wastes resulted in no legal means of disposal for wastes requiring a disposal outlet. Specifically, in the final regulation designated as First Third [August 17, 1988; 53 FR 31138], EPA established a treatment standard of “no land disposal” for a number of K-listed nonwastewaters. This standard was premised on EPA’s determination that: (1) the waste could be totally recycled without generating a residue; (2) the waste was not being land disposed; and (3) the waste was no longer being generated (53 FR 31151, col. 1). Subsequent to issuing the First Third final rule, EPA was informed that although these wastes were no longer being generated by manufacturing processes, they were nonetheless being actively managed as derived-from wastes (e.g., leachate resulting from placement of K-listed wastes into landfills). In the May 2, 1989 Federal Register (54 FR 18836), EPA amended the no land disposal treatment standard for most of the First Third wastes noting that, had the Agency known these wastes were still being actively managed, it would not have issued the no land disposal standard.