DOE/ID/12584–132
GJPO–114

Mixed-Waste Treatment — What About the Residuals?

A Comparative Analysis of MSO and Incineration

June 1993

Approved for public release; distribution is unlimited.

Work performed under DOE Contract No. DE–AC04–86ID12584 for the **U.S. Department of Energy**
Grand Junction Projects Office

RUST Geotech Inc.

DOE/ID/12584-132
GJPO-114

Mixed-Waste Treatment — What About the Residuals?

A Comparative Analysis of MSO and Incineration

June 1993

Prepared for
Office of Environmental Restoration
U.S. Department of Energy
Washington, D.C.

Prepared by
Martin Marietta Energy Systems, Inc.
U.S. Department of Energy
Oak Ridge National Laboratory
and
RUST Geotech Inc.
U.S. Department of Energy
Albuquerque Operations Office
Grand Junction Projects Office
Grand Junction, Colorado
Under DOE Contract No. DE-AC04-86ID12584

Contents

Appendices

Tables

Tables (continued)

Figures

Acronyms and Abbreviations

AEA	Atomic Energy Act
APC	Air pollution control
BDAT	Best demonstrated available technology
C	Celsius
CAI	Controlled Air Incinerator
CFR	Code of Federal Regulations
CIF	Consolidated Incinerator Facility
D&D	Decontamination and decommissioning
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DWPF	Defense Waste Processing Facility
EM	Office of Environmental Restoration and Waste Management
EPA	U.S. Environmental Protection Agency
ER	Environmental restoration
ETEC	Energy Technology Engineering Center
FFCA	Federal Facility Compliance Act
FR	*Federal Register*
FBU/PROD	Fluidized Bed Unit/Production
HEPA	High-efficiency particulate air
HSWA	Hazardous and Solid Waste Amendments
INEL	Idaho National Engineering Laboratory
LANL	Los Alamos National Laboratory
LDRs	Land disposal restrictions
LLW	Low-level waste
MSO	Molten salt oxidation
NCPMW	National Compliance Plan for Mixed Waste
NEPA	National Environmental Policy Act
OR	Oak Ridge Operations Office
PCBs	Polychlorinated biphenyls
PEIS	Programmatic Environmental Impact Statement
PICs	Products of incomplete combustion
RCRA	Resource Conservation and Recovery Act
RF	Rocky Flats Plant
SPC	Sulfur polymer cement
SR	Savannah River Operations Office
SRS	Savannah River Site
TCLP	Toxicity characteristic leaching procedure
TCE	Tricholoethylene
TRU	Transuranic
TSCA	Toxic Substances Control Act
WERF	Waste Experimental Reduction Facility
WWT	Wastewater treatment

Executive Summary

Purpose

This report examines the issues concerning final waste forms, or residuals, that result from the treatment of mixed waste in molten salt oxidation (MSO) and incinerator systems. MSO is a technology with the potential to treat a certain segment of the waste streams at U.S. Department of Energy (DOE) sites. MSO was compared with incineration because incineration is the best demonstrated available technology (BDAT) for the same waste streams. The Grand Junction Projects Office (GJPO) and Oak Ridge National Laboratory (ORNL) prepared this report for the DOE Office of Environmental Restoration (OER).

The goals of this study are to objectively evaluate the anticipated residuals from MSO and incineration, examine regulatory issues for these final waste forms, and determine secondary treatment options. This report, developed to address concerns that MSO residuals present unique disposal difficulties, is part of a larger effort to successfully implement MSO as a treatment technology for mixed and hazardous waste. A Peer Review Panel reviewed the MSO technology in November 1991, and the implementation effort is ongoing under the guidance of the MSO Task Force.

Approach

Several critical areas were examined to determine their impact on residual production and disposal. The major topics discussed are summarized below.

Regulatory Issues Regarding Acceptability of Final Waste Forms—The Resource Conservation and Recovery Act (RCRA) has the most significant impact on the acceptability of final waste forms. Wastes can be deemed hazardous under RCRA if they are either characteristic or listed. Characteristic waste can be considered nonhazardous under RCRA if the characteristic (ignitability, corrosivity, reactivity or toxicity) is removed. In the case of listed waste, the derived-from residual is still considered a hazardous waste even after treatment, and it must be disposed of in a RCRA-permitted hazardous waste disposal unit. A delisting procedure is available to allow a listed hazardous waste to be designated nonhazardous. However, delisting of waste treatment residuals is difficult because it normally requires very explicit knowledge of processes by which waste streams are generated and subsequently treated or it requires that the composition of a waste stream undergoing treatment be well known. Typically, DOE wastes will not be good candidates for delisting. The regulations governing management of treatment residuals are more dependent on the waste feed rather than the type of treatment technology used.

Mixed-Waste Regulations/Policies—Aside from RCRA, the law having the greatest impact on DOE mixed waste is the Federal Facility Compliance Act (FFCA). The FFCA requires that DOE have approved (by the States having jurisdiction over DOE sites) site-specific plans for developing treatment capacities and technologies to treat all mixed wastes to the land disposal restriction (LDR) treatment standards by October 1995. The outcome of the FFCA is to force site personnel to address the mixed-waste issue aggressively and to search for mixed-waste treatment and disposal capacity.

DOE Office of Waste Management (EM-30) Waste Inventories—To determine the number of DOE waste streams that EM-30 has responsibility for and which may be appropriate for treatment by MSO and/or incineration, the entire *Waste Management Information System—Waste Profile Report* was reviewed using "best professional judgment." Although this type of review yields results of limited accuracy (matching treatment technologies to waste streams can only be done on a case-by-case basis after consultation with site personnel), it does provide a general indication of the number of potentially applicable waste streams. MSO may be able to treat approximately 880 DOE EM-30 waste streams; incineration has potential application to a slightly larger number of streams (920) because of its ability to handle soil and other inert material.

DOE Office of Environmental Restoration (EM-40) Waste Inventories—A review of the *Technology Needs Crosswalk* 1993 data base indicated that 198 EM-40 problem units have organic contaminants. Of this amount, 119 problem units or 60 percent are potential candidates for treatment by MSO or incineration. These wastes are typically soil, water, or other media that would first undergo pretreatment to treat the contaminant of concern. Those problem units that would not be appropriate candidates for treatment by MSO are predominantly groundwater problems with very low concentrations of organics. For these problem units, technologies such as hydrogen peroxide/ozone/ultraviolet treatment are more appropriate.

Mass Balance Calculations—Mass balance calculations were completed for 10 specific DOE waste streams that are potential treatment candidates for five existing or planned DOE incinerators and an MSO treatment system. The waste streams were matched with incinerators that would most likely treat the waste (e.g., waste at the Oak Ridge site was assumed to be treated by the Oak Ridge incinerator). The five incinerators considered are the Oak Ridge Reservation rotary-kiln incinerator, Savannah River Site rotary-kiln incinerator, Los Alamos National Laboratory controlled-air incinerator, Idaho National Engineering Laboratory controlled-air combustor, and Rocky Flats Plant fluidized-bed combustor. The 10 waste streams are very diverse but generally consist of waste oil and/or solvents; 1 waste stream includes radioactively contaminated graphite molds and crucibles.

Results of the mass balance calculations indicate that (1) similar mass quantities of residuals are produced by MSO and incineration, and (2) the residuals comprise nearly identical constituents (mostly ash and salts). Overall, ancillary systems for incineration (e.g., acid-gas treatment systems) have a greater impact on the quantities of residuals produced than the primary treatment unit.

Waste Form Treatment—In some cases, the residuals produced from MSO and/or incineration may require further treatment to immobilize contaminants or improve handling characteristics. The treatment options evaluated were glass, hydraulic cement, sulfur polymer cement, ceramics, and organic binders. Many of these treatment options may apply to the residuals from MSO and incineration, although most still require additional testing/demonstration. Because of the variability in the residuals resulting from different waste feeds, treatability studies will be needed to match waste forms to treatment options.

Findings

The major findings of this report are

- Final disposal options are more significantly impacted by the type of waste treated and the existing regulations than by the type of treatment technology.
- Mixed waste with a characteristic hazardous component can be reclassified as radioactive waste if the waste can be treated to remove the characteristic. However, a mixed waste with a listed hazardous component will remain a mixed waste, regardless of the treatment technology used or treatment levels achieved, unless the residuals can be successfully delisted.
- Typical DOE waste streams are not good candidates for delisting because they were generated through diverse processes and commonly contain a varying mixture of contaminants. In addition, limited records are available describing the wastes.
- The FFCA will force DOE to aggressively develop additional mixed-waste treatment capacity using treatment technologies such as MSO.
- MSO may potentially be able to treat most of the EM-30 waste streams (95 percent) that are candidates for treatment by incineration. Sixty percent of the EM-40 problem units with organic contaminants are potential candidates for treatment by MSO or incineration.
- Mass balance results indicate that MSO and incineration generate similar quantities and types of residuals: ash, NaF and/or NaCl, excess caustic, and waste gases. However, the wet off-gas systems employed by incinerators to treat acidic gases also result in excess water in the blowdown residuals (resulting in a slurry waste form).
- If secondary waste treatment is considered an obstacle for MSO, it also exists for every type of thermal treatment technology, including incineration, plasma arc furnace, and supercritical water oxidation.
- Incineration may still be required to treat soil and other inert materials, even if MSO is implemented across the DOE complex.

- Additional work is needed to confirm the mass balance calculations in this report. This work is underway and will include determining actual caustic use in incinerator off-gas scrubber systems and direct one-to-one comparisons of off-gas treatment systems for MSO and incineration.

Actions Being Taken

- As part of the MSO Five-Year Implementation Plan, the Energy Technology Engineering Center (ETEC) and ORNL are performing numerous treatability studies using ion exchange, filtration, chemical separation, and biosorption for spent salt treatment to remove metals and/or radionuclides. These efforts will have benefits for other thermal treatment technologies.

- DOE is providing input to the EPA rule-making committee that is reviewing changes to the hazardous-waste identification regulations. Final adoption of new regulations, as required by Congress, will occur prior to October 1994.

- EPA announced on May 18, 1993, a series of strategies to minimize new hazardous-waste generation and to temporarily freeze the permitting of new incineration units for the next 18 months. This action will allow EPA to develop more stringent requirements for new incinerators.

Section 1.0

Overview

The U.S. Department of Energy (DOE) has a large inventory of mixed waste (radioactive and hazardous components*) that will require treatment prior to final disposal. Incineration is currently the best demonstrated available technology (BDAT) for many of these waste streams; however, an alternative thermal treatment technology, molten salt oxidation (MSO), has significant potential to treat a certain segment of these wastes. The MSO technology is described in Section 5.0.

An important concern for any treatment technology is the amount and disposition of secondary waste that is generated through the treatment process. This report examines the issues concerning the final waste forms, or residuals, that result from the treatment of mixed waste in MSO systems and other thermal treatment units. Final waste form is an important issue for the ultimate implementation of MSO because there has been concern that the MSO residuals present unique disposal difficulties. Development of mass balances and analysis of regulatory and final disposal issues, particularly the feasibility of delisting, address this concern.

Residual waste comparisons are made between MSO and incineration because DOE plans to use incineration to treat many of its mixed wastes, and sufficient information about incineration is available in the literature to perform a mass balance. The intent of this report is ***not*** to rate one technology as better than another. Rating requires far more information on a large number of technical and nontechnical factors and is inherently site and waste specific. Instead, this report attempts to provide a comparison of the two technologies and describe the strengths and weaknesses of each from a technical (e.g., mass balance) and nontechnical (e.g., regulatory) perspective. Other technologies also may be appropriate for mixed-waste treatment but are not evaluated here as process details are not sufficient to perform mass balance calculations comparable to those provided for MSO and incineration. However, from a nontechnical, regulatory perspective, it is anticipated that final waste forms resulting from all mixed-waste treatment technologies will face the same types of regulatory and disposal constraints.

This report focuses on treatment of mixed-waste because it presents the most significant obstacles in terms of final waste disposal for DOE. Issues concerning the treatment of organic hazardous waste (with no radioactive contamination), which is an important and appropriate waste stream for MSO and incineration treatment, are a subset of mixed-waste treatment and, therefore, are addressed to a lesser degree.

This report represents one small part of a larger effort to successfully implement the MSO technology to treat mixed and hazardous waste. A Peer Review Panel reviewed the MSO technology in November 1991 and the implementation effort continues today under the auspices of an MSO Task Force. Individuals wishing to obtain more information on these activities may consult the Evaluation of the MSO Process Technology [1] or the MSO Technology Five-Year Implementation Plan [2].

---

*Mixed waste is defined as waste having a radioactive waste component regulated under the Atomic Energy Act and a hazardous waste component regulated under the Resource Conservation and Recovery Act.

Nine additional sections constitute this report:

- Section 2.0 reviews the regulatory drivers that influence final waste forms.
- Section 3.0 discusses proposed U.S. Environmental Protection Agency (EPA) and DOE mixed-waste regulations/policies.
- Section 4.0 covers mixed-waste inventories that may be appropriately treated by MSO and/or incineration.
- Section 5.0 presents MSO and incineration system flow diagrams for 10 specific DOE waste streams.
- Section 6.0 furnishes mass balances for MSO and incineration that are based on the 10 waste streams identified in Section 5.0.
- Section 7.0 reviews waste form (residual) treatment options.
- Section 8.0 presents conclusions.
- Section 9.0 contains the references.
- Section 10.0 contains the acknowledgments.

To ensure that the conclusions drawn are valid, this report was reviewed by experts in the thermal treatment field and by individuals responsible for existing or proposed incineration facilities at DOE sites.

Section 2.0

Regulatory Issues Regarding Acceptability of Final Waste Forms

DOE Order 5820.2A (*Radioactive Waste Management*, September 26, 1988) provides guidelines for management of DOE's radioactive wastes. However, final disposition of wastes that also contain a ***hazardous*** component (i.e., ***mixed wastes***), must conform with Resource Conservation and Recovery Act (RCRA) requirements. The intent of this section is to provide a clear understanding of RCRA regulatory language (e.g., hazardous wastes, mixed wastes, characteristic wastes, listed wastes, derived-from wastes, and delisting) along with a discussion of RCRA requirements and the implications for mixed waste-treatment and disposal.

Wastes can be deemed hazardous under RCRA if they are either "listed" or "characteristic." ***Listed wastes*** are identified in Subpart D of 40 Code of Federal Regulations (CFR) Part 261 and are designated as P, U, K, or F wastes (see Appendix A for a complete list of these wastes). P and U wastes are commercial chemical products, their residues, or off-specification chemicals that are generically identified using the name of a single listed constituent (e.g., benzene, toluene). Waste streams resulting from specific manufacturing sources are identified as K wastes (e.g., wood-preservation wastewater treatment sludges). Wastes generated by several industries—from nonspecific sources—are designated as F wastes (e.g., spent solvents, electroplating wastes).

Under RCRA, a waste is deemed to be a ***characteristic waste*** if it displays any of the characteristics of ignitability, corrosivity, reactivity, or toxicity. The definition of these characteristics are

- **Ignitability**—waste with a flash point of 60 °C (140 °F) or less.

- **Corrosivity**—waste with a pH less than or equal to 2.0 or greater than or equal to 12.5, or capable of corroding steel at a rate of more than 6.35 millimeters (0.25 inch) per year.

- **Reactivity**—waste that is explosive, reacts violently with water, or generates toxic gases, vapors, or fumes when exposed to water or liquids that are moderately acidic or alkaline.

- **Toxicity**—waste for which the toxicity characteristic leaching procedure (TCLP) test extract contains a concentration of a specified contaminant above its regulatory threshold. Specified contaminants include 32 organics and 8 inorganics (see Appendix A).

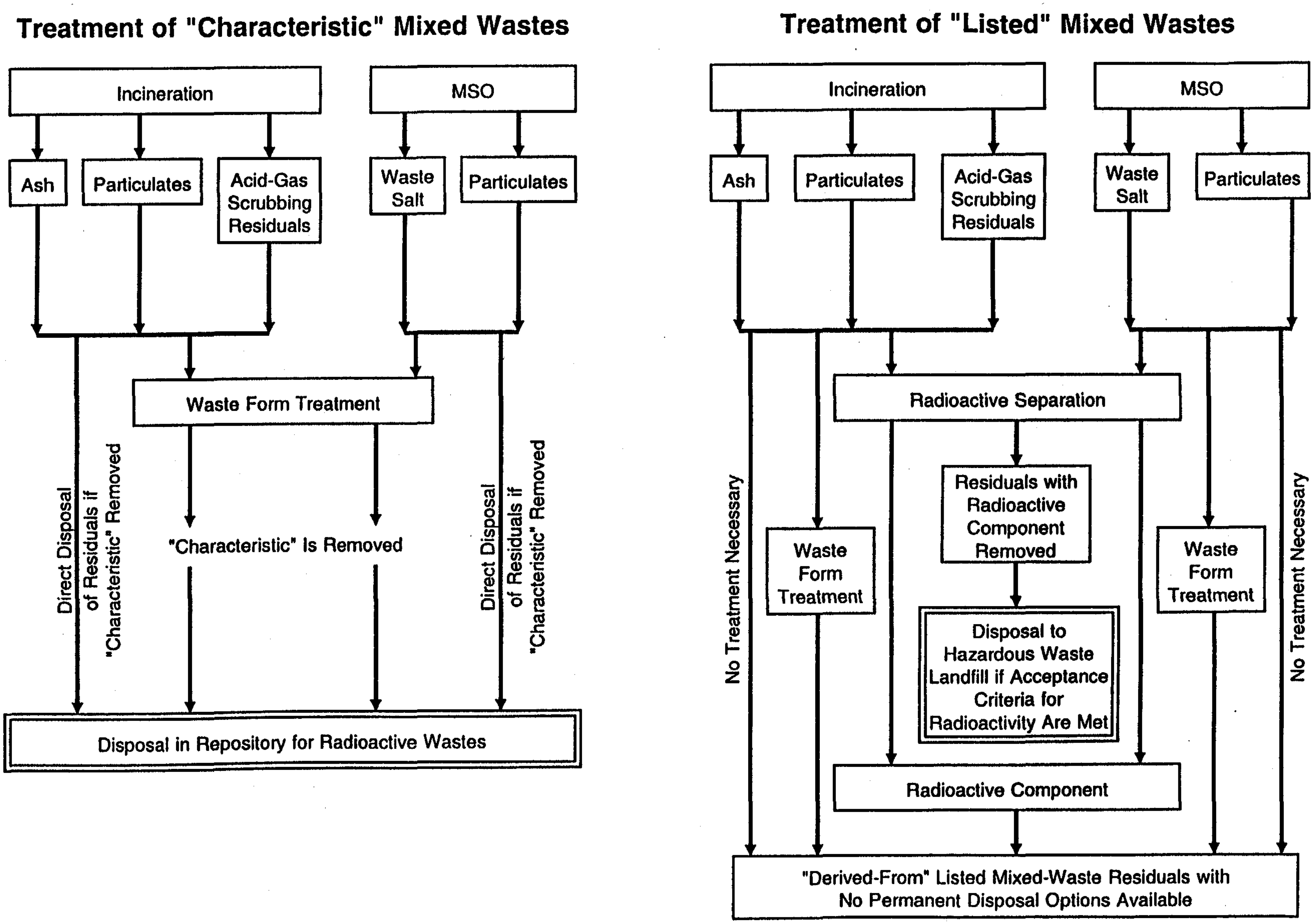
The treatment and disposal requirements associated with characteristic and listed wastes are quite different. Wastes that are hazardous by characteristic can be reclassified as nonhazardous if they can be treated to eliminate the hazardous characteristic (e.g., neutralization of an acid with a caustic solution). Treatment products no longer displaying the hazardous characteristic can then be managed as nonhazardous waste and do ***not*** require disposal in a RCRA-permitted hazardous-waste disposal facility (a double-lined landfill with leachate collection system). No specific treatment methods or levels are stipulated for characteristic wastes. Conversely, before a listed waste can be disposed, it must be treated by use of the BDAT for that waste (or an equivalent or better technology) or be treated to a specified treatment level. However, even after treatment, the ***derived-from*** residual is still considered to be a listed hazardous waste and must be disposed in a RCRA-permitted hazardous waste disposal unit. Additionally, any ***mixture*** of a listed hazardous waste and a solid waste is considered to be a hazardous waste, regardless of the amount of the listed waste that might be present. For example, if one drop of a listed waste were mixed with 1,000 gallons of nonhazardous wastewater, the entire mixture (all 1,000 gallons) is considered to be hazardous. Appendix B presents a guide from the EPA that contains additional information on the derived-from and mixture rules.

RCRA allows for exemptions from using the BDAT and from achieving specified treatment levels for listed wastes. However, residual products from these exempt treatment systems require management as a hazardous waste under the "derived-from" rule. A ***delisting*** procedure is available to allow a listed hazardous waste to be designated nonhazardous (and managed as such). Petitions for delisting a waste are submitted to the EPA for approval on a case-by-case basis. The intent of the delisting process is to avoid overregulation of hazardous materials that do not pose a threat to human health and the environment. In practice, however, delisting is a costly, complicated, and time-consuming process that is not routinely undertaken. Descriptions of wastes that have been delisted as of July 1, 1992, are provided in Appendix C.

Delisting of waste treatment residuals is difficult because it normally requires very explicit knowledge of processes by which waste streams are generated and subsequently treated (wastes derived from specific sources) or it requires that the composition of a waste stream undergoing treatment is well known (wastes from nonspecific sources). An example of the former is retorted wastewater treatment sludge from the mercury cell process in chlorine production. Both the waste generation and treatment processes are well known and highly controlled. In the latter case, kiln residue generated by the treatment of cancelled pesticides containing 2,4,5-T and Silvex is an example of a treated waste stream with a well-known composition. Other points to note with regard to delisting are (1) many delisting petitions were approved as one-time exemptions, (2) approvals for a majority of the other petitions are contingent upon regular sampling and analysis of treatment residuals to ensure contaminants are below specified levels, and (3) each waste stream must be separately petitioned for delisting.

Typical DOE waste streams have been generated through diverse processes and commonly contain a varying mixture of contaminants. In addition, limited records are available describing waste residuals. Therefore, these wastes are not good candidates for delisting. Additionally, residual from a treatment process applied to these wastes (e.g., incinerator ash and blowdown solids) would be considered a **derived-from listed waste** and would be equally difficult to delist because of the heterogeneity of the wastes being treated. Consequently, nearly all listed wastes, mixtures of listed wastes, and residuals derived from listed wastes require management as hazardous wastes. This is the case regardless of how the wastes are treated and what treatment levels are achieved.

DOE's inventory of mixed waste includes radioactive waste mixed with both characteristic and listed hazardous wastes. A mixed waste with a characteristic hazardous component can be reclassified as radioactive waste if the waste can be treated to remove the hazardous characteristic. However, a mixed waste with listed hazardous components will remain a mixed waste, regardless of the treatment technology used or treatment levels achieved, unless the residuals can be successfully delisted. Therefore, from a regulatory perspective, all treatment technologies, including the BDAT for a given listed waste, will result in treatment residuals that are still deemed hazardous. For example, a tetrachloroethylene solvent waste (a U-listed waste) that was treated by either incineration or MSO would yield NaCl as the only residual waste, yet this benign residual would be considered a listed hazardous waste under the "derived-from" rule. Figure 2-1 provides an overview of how the residuals from both incineration (BDAT for organic-contaminated mixed wastes) and MSO would be considered under current RCRA regulations.


Treatment of "Characteristic" Mixed Wastes

Treatment of "Listed" Mixed Wastes

Figure 2-1. Residual Disposal Options for Characteristic and Listed Mixed Wastes

Section 3.0

Mixed-Waste Regulations/Policies

Mixed waste is defined as a waste that has a *radioactive* waste component regulated under the Atomic Energy Act (AEA) and a *hazardous* waste component regulated under RCRA. This combination of wastes that are regulated differently has complicated the development of standard management practices and policies for mixed waste. An additional complication is the necessity to handle mixed waste containing high-level waste (highly radioactive waste generated from the reprocessing of irradiated reactor fuel), transuranic waste (waste consisting of man-made, long-lived radioisotopes heavier than uranium that emits alpha particles), and low-level waste (all radioactive waste not included in either of the previous two categories) differently because of the diverse hazards presented by each of these radioactive components. These requirements strongly influence the current and proposed mixed-waste regulations and policies.

3.1 Current Mixed-Waste Regulations/Policies

RCRA has the greatest impact on DOE's current mixed-waste regulations and policies. From RCRA's passage in 1976 through the mid 1980s, it was not clear if RCRA applied to DOE's mixed waste. This issue was partially resolved on July 3, 1986, when EPA published a notice in the *Federal Register* (51 FR 24505) stating that mixed waste was subject to RCRA and that States were required to petition EPA for authorization to regulate mixed waste. Nevertheless, there still was confusion as to what constituted mixed waste. DOE clarified the definition of mixed waste in 1987 with the "Byproduct Material" rule. This rule specifies that all DOE radioactive waste that is hazardous under RCRA is subject to regulation under both RCRA and AEA (52 FR 15937).

The delay in determining the applicability of RCRA to mixed waste limited DOE's participation in the process that led to the development of the 1984 Hazardous and Solid Waste Amendments (HSWA) and to the regulations promulgated in the first 10 years after RCRA was passed. As a result, mixed-waste issues were not addressed adequately by EPA in many RCRA and HSWA regulations, which frequently has made regulatory interpretation difficult.

The land disposal restrictions (LDRs), which are part of HSWA, probably have the greatest impact on DOE of any rules or regulations that were developed under RCRA. LDRs prohibit the land disposal of regulated hazardous waste unless the waste meets the regulated treatment standards. Mixed waste is subject to these restrictions because capability to treat most DOE wastes is still unavailable using RCRA-approved or -equivalent treatment technologies.

HSWA has made it difficult to store mixed waste. LDRs prohibit the storage of hazardous waste except where storage is necessary to accumulate sufficient quantities to allow proper treatment, recovery, or disposal. This restriction does not allow storage for the purpose of developing treatment technologies. Therefore, although DOE submits applications and obtains permits for its mixed-waste storage areas, the LDR storage prohibition still applies to the waste.

EPA can grant temporary relief from the storage prohibition via the National Capacity Variance when EPA determines that treatment capacity is not sufficient for a particular waste. Most of these variances are short-lived and capacity variances have expired for many of DOE's mixed wastes (e.g., early regulated solvents, dioxin, and State of California list LDRs). However, EPA did grant a National Capacity Variance for "Thirds" mixed-waste streams, which are approximately 30 percent of DOE's mixed waste. This variance expired in May 1992 but potentially could be extended through mid-1994 with an extension. By mid-1994, DOE will be storing essentially all of its waste contrary to the LDRs.

Another law that impacts mixed wastes is the Federal Facility Compliance Act (FFCA) that was signed into law in October 1992. This law specifically requires that within 180 days (by April 1993) the Secretary of Energy will provide the Governor of each State in which DOE stores or generates mixed waste the following reports:

- A national inventory of all mixed waste.
- A national inventory of mixed-waste treatment capacities and technologies.

The FFCA also requires DOE to provide site-specific plans for developing treatment capacities and technologies to treat all mixed wastes to the LDR treatment standards. These plans must be approved by individual States having jurisdiction over DOE sites within 3 years of enactment of the Act (October 1995).

Through the National Governors' Association (see Appendix D), the Governors who have responsibility for approval of these plans are taking the exceptionally strong position that they will impose "*...fines and penalties for violations of RCRA Section 3004(J) involving all mixed waste not covered by an approved plan* [underlining added for emphasis]." After 3 years from the date FFCA was enacted, the Act stipulates that the waiver of sovereign immunity shall not apply to DOE sites for violations of the RCRA LDR storage prohibition for mixed wastes if the DOE site is not in compliance with (1) an approved site-specific mixed-waste treatment plan and (2) an order requiring compliance with the site-specific plan.

The net effect of the FFCA is to force the issues of mixed-waste generation, storage, and treatment at DOE installations. This compels site personnel to address the mixed-waste issue aggressively and to search for mixed-waste treatment capacity.

3.2 Proposed Mixed-Waste Regulations/Policies

DOE's National Compliance Plan for Mixed Waste (NCPMW) is expected to have a significant impact on the way DOE handles its waste in the future. The primary purpose of the NCPMW is to integrate the Department's mixed-waste management activities into a coordinated national plan to ensure development of adequate mixed-waste treatment capacity. The NCPMW also will establish schedules for DOE to use and upgrade existing mixed-waste treatment capacity, develop new mixed-waste treatment technologies, submit new permit applications, and construct and use new waste treatment facilities.

Although the focus of the NCPMW is on treatment technology and capacity for mixed waste, it also will address several other issues. These include a comprehensive management approach for mixed waste (from point of generation to disposal); minimization, characterization, storage, and transportation of mixed waste; use of commercial capacity; and integration of environmental restoration and decontamination and decommissioning (D&D) activities with the development of appropriate mixed-waste treatment, storage, and disposal capacity.

DOE will implement this Plan using a two-step process: (1) develop the National Compliance Plan and (2) develop site-specific plans. This approach will rely heavily on input from the EPA, the States, and the public, and it will meet the requirements of the FFCA. The development of the Plan will be coordinated with efforts by the DOE Office of Environmental Restoration and Waste Management (EM) to prepare a programmatic environmental impact statement (PEIS) under the auspices of the National Environmental Policy Act (NEPA).

DOE will develop the National Compliance Plan during a 3-year period. By October 1995, DOE will (1) publish the EM PEIS Record of Decision, (2) submit the final National Compliance Plan to the EPA and the States for comment, and (3) complete site-specific plans and receive approval of them by the EPA and the States.

Although DOE is attempting to develop these three distinct sets of plans concurrently, the National Governors' Association has taken the position (see Appendix D) that "*...we believe it is critical that the Department [of Energy] begin immediately to develop site-specific plans. The Department has no obligation to develop or submit a national plan for mixed waste. While we recognize that the Department may wish to develop a national management strategy for its own purposes, we must emphasize that such a strategy will have no binding effect upon state regulators and will not under any circumstance* [underling added for emphasis] *constitute an acceptable submission to states under the terms of the Federal Facilities Compliance Act.*"

3.3 Implications of the Mixed-Waste Regulations/Policies

While many of DOE's mixed wastes do not have associated treatment processes to meet the requirements of RCRA regulations, MSO and incineration are technically capable of treating most of the organically contaminated mixed wastes. The main issue with these systems is not the treatment capability of these technologies but rather the available treatment capacities and the options for disposal of the residuals from the treatment of RCRA listed wastes. As noted previously, these residuals remain as "listed" wastes because of the derived-from rule (see Section 2.0), and DOE has no approved repository for their disposal. Currently, EPA is charged by Congress to develop new hazardous waste identification regulations that will affect the delisting of derived-from residuals. DOE, through the Office of Domestic and International Energy Policy (EP-63), is providing input to the EPA rule-making committee that must have proposed changes available for public comment after October 1993 with final regulations adopted by October 1994.

3.4 EPA's Recent Restriction on Incineration

On May 18, 1993, EPA Administrator Carol M. Browner announced a series of strategies to minimize new hazardous waste generation and to temporarily freeze the permitting of new incineration units (see Appendix E). This action by EPA to review the permits issued to currently operating hazardous-waste incinerators and industrial furnaces effectively puts a moratorium on new incinerator units for 18 months. EPA also is taking the following series of immediate actions

- Conducting a major overhaul of Federal rules governing waste combustion;
- Requiring full risk assessments, including those for indirect exposure, in all new permits to ensure that they are based on the best scientific evidence;
- Requiring new permits to include an appropriate dioxin emission standard;
- Requiring new permits to include an appropriate, more stringent control for metals;
- Calling for hazardous-waste producers to commit to waste reduction programs;
- Calling for a national review of the relative roles of waste combustion and waste reduction in hazardous-waste management; and
- Calling for greater public involvement opportunities.

In addition, the *Draft Strategy for Combustion of Hazardous Waste* (see Appendix E) states "EPA will continue and enhance its efforts to foster the development of innovative technologies for the safe and effective treatment of hazardous waste. Such actions are essential to our national waste management system and to our global competitiveness."

These actions emphasize the importance of considering other technologies, such as MSO, for the treatment of mixed wastes.

Section 4.0

Waste Inventories and Annual Generation Rates of DOE Wastes

4.1 Approach to DOE EM-30 Wastes

A major question concerning the MSO technology is "How much waste does DOE have in inventory or is generated annually that would be appropriate for treatment by MSO?" To answer this question, the entire data base (approximately 4,500 pages) of the *Waste Management Information System — Waste Profile Report* [3] was reviewed to identify those EM-30 wastes that are or could potentially be appropriate for MSO treatment. This data base, compiled by DOE, also was reviewed to determine the number of wastes that would be appropriate for treatment by incineration. On the basis of the information contained in the *Waste Profile Report*, which was sketchy in many cases, a judgment on the acceptability for treatment was formed. Responses were "yes," "no," or "potentially." Appendix F contains the list of waste streams that received a "yes" or "potentially" response for treatment by MSO and/or incineration. This information is summarized in Table 4-1.

To link specific waste streams to potential treatment by MSO and/or incineration, it was assumed that additional requirements such as pretreatment (e.g., size reduction), addition of glove-box enclosures, and/or other ancillary systems could be provided to make a complete and feasible system. In addition, this determination was based strictly on technical applicability and did not consider potentially significant factors such as regulator and/or public acceptance.

The appropriateness of waste streams for treatment by MSO or incineration was assigned on the basis of "best professional judgment." Because the waste stream lists provided in the *Waste Profile Report* were often missing information or contained conflicting data, the information presented in Appendix F is of limited accuracy. Moreover, the information on these waste streams did not contain all the site-specific factors that are necessary to accurately determine the appropriate treatment technology; this must be done on a case-by-case basis. Despite the uncertainty involved in evaluating these wastes, the results of this process are useful in making some generalizations and comparisons between MSO and incineration.

The general guidelines used to link waste streams to potential treatment by MSO and/or incineration are summarized in Table 4-2. These guidelines were followed except for cases when additional contradictory or explanatory information was provided to make a more accurate determination on the appropriate treatment. Note that wastes containing transuranic (TRU) materials were excluded from consideration except in cases where the TRU concentration is insignificant.

Overall, the process used to link waste streams with potential treatment by MSO and/or incineration is only intended to provide an overview and show potential trends; accurate linkages can only be done on a site-specific, case-by-case basis.

Table 4-1. Summary of the Number of DOE Waste Streams Appropriate for Treatment by MSO and/or Incineration Technologies

	MSO		Incineration	
	Yes	Potentially	Yes	Potentially
	360	520	540	380
Total	880		920	

Table 4-2. Guidelines Used To Link Waste Streams with Potential Treatment by MSO or Incineration

Waste Stream or Waste Stream Attribute	Type of Treatment Considered				
	MSO		Incineration		MSO and Incineration Are Inappropriate
	Yes	Potential	Yes	Potential	
High-Activity Wastes					✓
TRU Wastes (some are included on a case-by-case basis)					✓
Noncombustible Wastes (without additional conflicting information)					✓
Mixtures of Combustible and Noncombustible Material		✓		✓	
Site Lists Incineration as Anticipated Treatment (exact determination was based on other available information)			✓	✓	
Combustible Material Mixed with Soil				✓	
Wood, Rags, Plastic, and/or Paper		✓	✓		
Sludges with Organics		✓	✓		
Waste Streams with up to 90% Water (waste streams with higher water contents were excluded)		✓		✓	
Solvent Streams	✓		✓		
Graphite Materials	✓			✓	
Solvent Streams with High Fluorine	✓			✓	
Reactive Materials (e.g., pyrophoric)					✓

4.2 Findings — EM-30 Wastes

Of all wastes identified by the DOE Office of Waste Management, 920 waste streams exist that could potentially be treated by incineration. The MSO technology could potentially treat approximately 880 of these same waste streams or 95 percent. Of the waste streams having the highest probability of treatment (i.e., identified as being appropriate for treatment by MSO and/or incineration), 540 and 360 waste streams were identified for incineration and MSO treatment, respectively. This implies that MSO could treat, with a high probability, 67 percent of the waste streams that are appropriate for incineration.

The total number of waste streams reviewed in the *Waste Profile Report* was 2,004. In other words, of the total number of potential DOE waste streams listed in the *Waste Profile Report*, approximately half could potentially be treated by either MSO or incineration.

Waste volumes identified in the *Waste Profile Report* range from a few gallons to several thousand cubic meters. As stated earlier, accurate linkages can only be done on a site-specific, case-by-case basis. It is also important to note that this analysis was limited to DOE EM-30 wastes. Other organizations (e.g., U.S. Department of Defense) have large volumes of waste that MSO and incineration could treat.

4.3 Approach to DOE EM-40 Wastes

The problem unit records in the *Technology Needs Crosswalk* [4] data base were evaluated to determine the potential applicability of the MSO technology to these EM-40 waste streams. Initially, a list was compiled of all problem units assigned the keyword "organics". Other characteristics of each of the problem units were then evaluated and the list further refined. Problem units were eliminated from the list on the basis of the following criteria:

- A remedial solution is already being implemented for the problem;
- Contaminant concentration levels in groundwater or surface water are less than 1 percent; or
- Insufficient information is available to make even a preliminary assessment.

It was assumed that for treatment of contaminated soils, some type of contaminant removal system would be required. Information for a number of different soil treatment systems was surveyed to gain a basic understanding of options for addressing contaminated soils. Through this exercise the observation was made that application of many of these treatment processes would result in the generation of a secondary waste stream consisting of organics in the form of gases or liquids. These secondary waste streams require further treatment and

MSO is a potential candidate. Process flow diagrams for some of these systems are shown in Figures 4-1 through 4-4.

It was recognized that the applicability of MSO to contaminated soils would depend on the type of contaminant removal system used, not on characteristics of the soils. Therefore, most of the soil problem units were retained on the basis of the rationale that MSO could be applied as part of the treatment chain of technologies that will likely be necessary to treat these complex wastes. Appendix G contains the list of problem units that are potential candidates for treatment by MSO and the data (if known) for a Record of Decision under various compliance agreements.

The assumption that some type of contaminant removal system would be required for soils also holds true for the decontamination and decommissioning of buildings, equipment, piping, etc. The most common decontamination techniques that could use MSO for treatment of secondary generated wastes are complexing agents, strippable coatings, Freon cleaning, chemical extraction, and solvent cleaning.

4.4 Findings — EM-40 Wastes

Of the total number of EM-40 problem units identified in the *Technology Needs Crosswalk* data base, 198 have organic contamination. Of this amount, 119 problem units, or 60 percent, are potential candidates for treatment by MSO. These wastes are typically soil, water, or other media that would first undergo pretreatment steps to extract the contaminants of concern. The extracted residuals would then be treated by MSO. Those problem units that would not be appropriate candidates for treatment by MSO are predominantly groundwater problems with very low concentrations of organics (less than 1 percent). For these problem units, technologies such as hydrogen peroxide/ozone/ultraviolet treatment are more suitable.

Of the problem units that could potentially use MSO as part of the treatment process, all have compliance dates for Records of Decision (RODs) between 1994 and 1998. However, this number only represents 30 percent of those problem units potentially appropriate for MSO treatment. The remaining 70 percent either have no defined compliance date or information is not available to identify ROD dates.

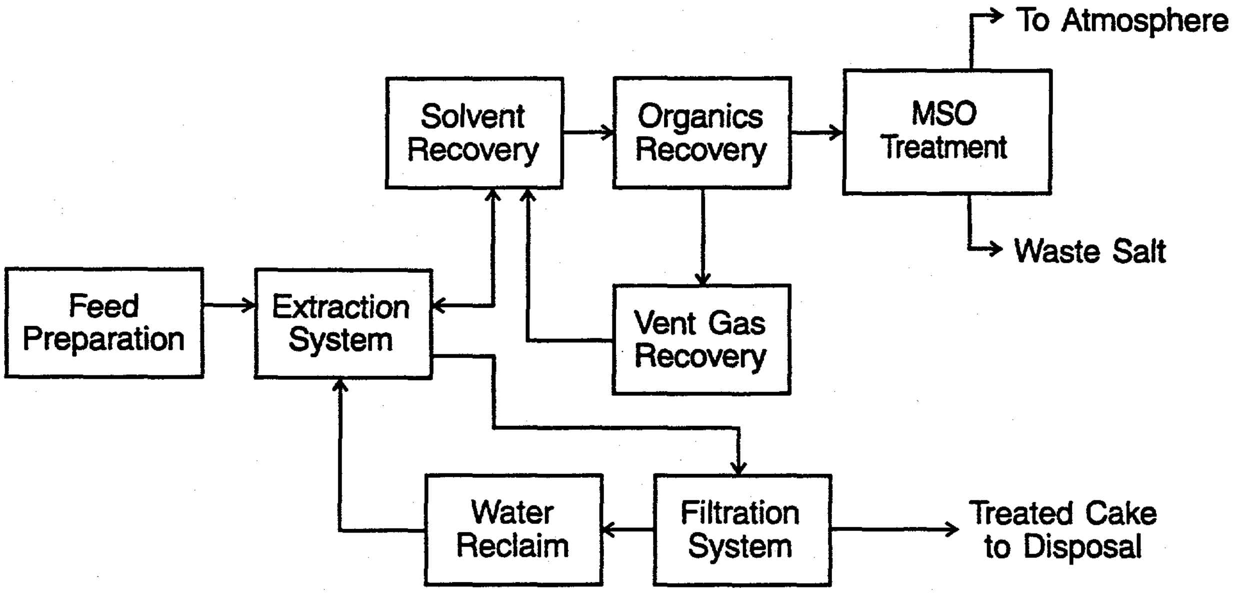


Figure 4–1. Solvent Extraction Remediation Process

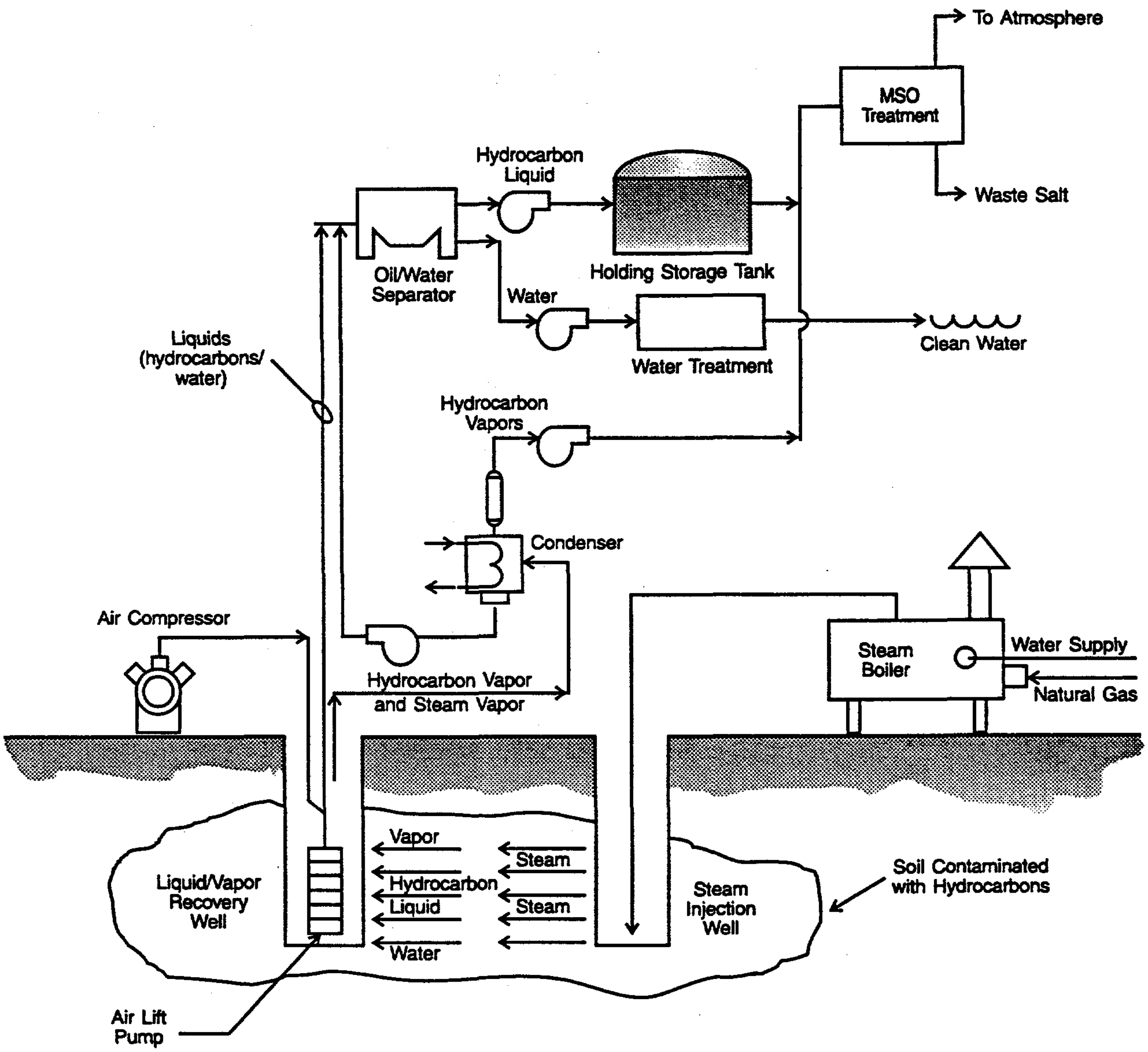


Figure 4–2. Steam Injection and Vapor Extraction Process

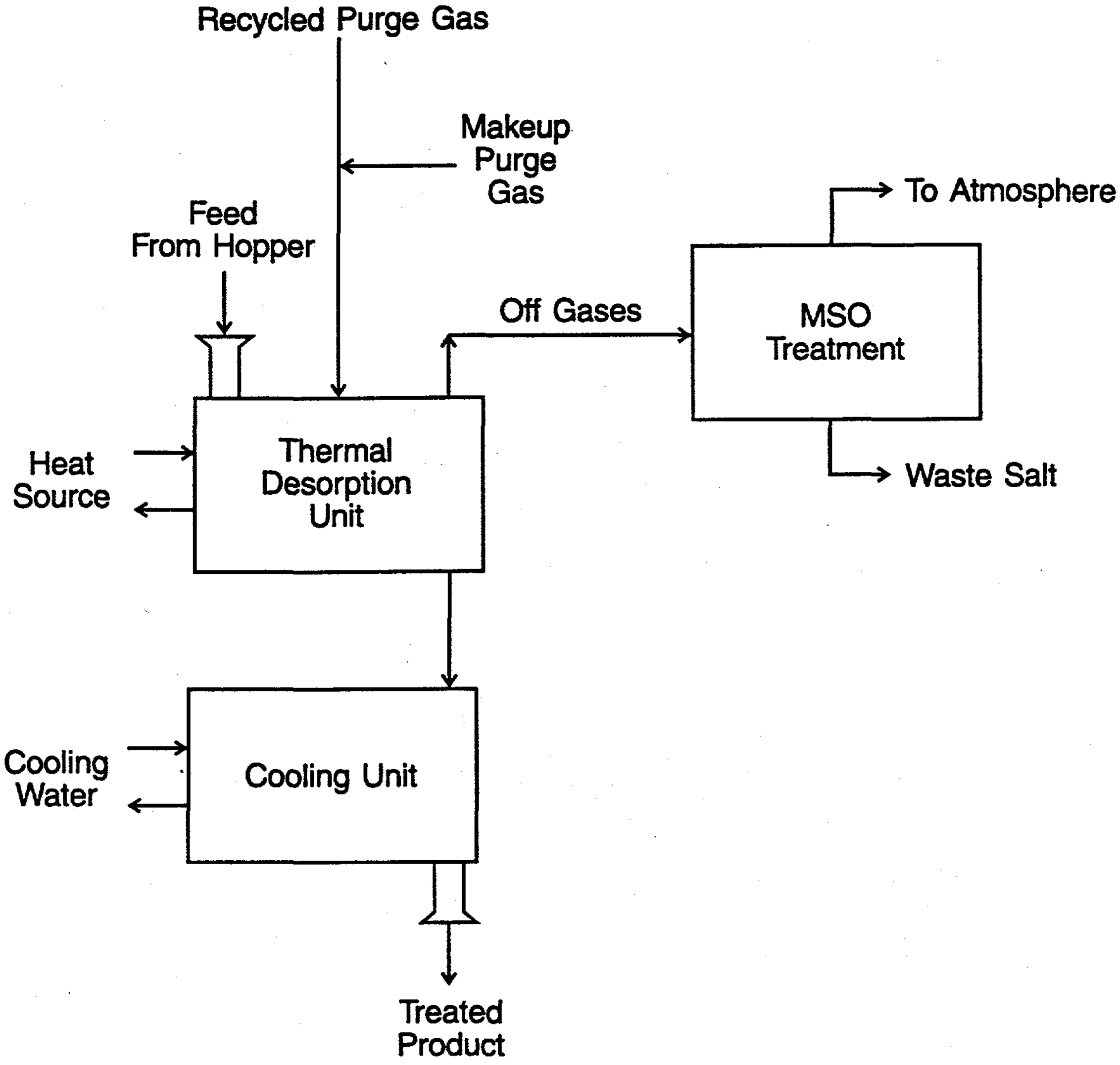


Figure 4–3. Soils Treatment by Thermal Desorption

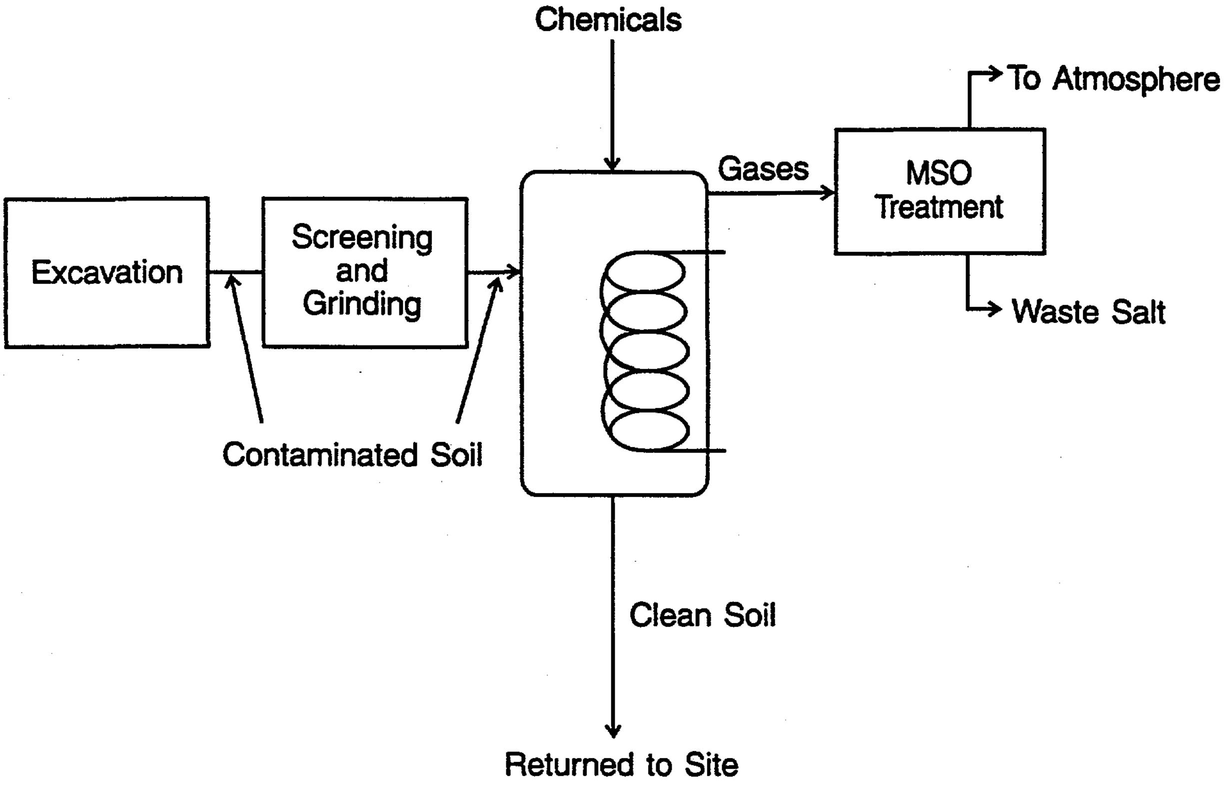


Figure 4–4. Base-Catalyzed Dechlorination Process

Section 5.0

Process Flow Diagrams for Incineration and MSO

This section presents descriptions of the thermal treatment systems that are planned for use at DOE sites to treat 10 individual waste streams subsequently identified in Section 6.0. To accurately compare the residual components of incineration and MSO, the assumption was made that either the currently operating or the proposed system at each DOE site would be used for treatment of the selected wastes. Personnel responsible for the operation of these systems supplied information on the DOE site-specific units. Characteristics of each of these thermal treatment units and MSO technology are described in Table 5-1.

5.1 Incinerators

Incinerators are designed to treat moderate to highly combustible wastes by destroying the organic fraction of the waste stream. This is accomplished by burning the waste in a combustion chamber in the presence of excess oxygen. The hydrogen and carbon fractions of the waste are converted to H_2O and CO_2 (and some carbon ash), and any fluorine or chlorine fractions are converted to acidic gases. The acidic gases are then exposed to caustics (e.g., NaOH, Na_2CO_3) that react to form simple salts. Typically, more than 99.99 percent of the nonacidic organic waste is destroyed, and more than 99.6 percent of the acids (e.g., HCl) are neutralized [5, 6]. Metals, radionuclides, and other noncombustible material are recovered as a largely inert residual ash.

The five DOE incinerators addressed in this study are (1) the Fluidized Bed Unit/Production (FBU/PROD) at the Rocky Flats Plant, (2) the Controlled Air Incinerator (CAI) at Los Alamos National Laboratory, (3) the Toxic Substances Control Act (TSCA) incinerator at Oak Ridge, (4) the Consolidated Incineration Facility (CIF) at the Savannah River Site (SRS), and (5) the Waste Experimental Reduction Facility (WERF) at Idaho National Engineering Laboratory. Several discrete components perform the same operations in all five DOE incinerators of interest, although the particular design and setup will vary. The key components are

1. A feed preparation system to process the raw waste stream to a suitable composition for feeding into the combustor.

2. The primary combustion chamber, where the bulk of the organic waste is oxidized and most of the residual ash is collected.

3. The secondary combustion chamber or afterburner, where the gas off stream from the primary chamber is burned again to ensure complete oxidation. Some nonsolid waste streams may be directly injected at this point.

4. The off-gas treatment, or air pollution control (APC), system that treats the off gas from the combustion chambers. This gas must be filtered to remove particulates and, in most cases, scrubbed with caustic material to remove acidic gases.

Table 5-1. Site-Specific Thermal Treatment Units

Unit Descriptions	Thermal Treatment Units–Characteristics					
Location	Oak Ridge (OR)	Los Alamos National Lab (LANL)	Idaho National Engineering Lab (INEL)	Savannah River (SR)	Rocky Flats (RF)	
Thermal Unit Location	OR TSCA	LANL CAI	INEL WERF	SR CIF	RF FBU/PROD	
Type of Unit	Rotary-Kiln Incineration	Controlled-Air Incineration	Controlled-Air Incineration	Rotary Kiln Incineration	Fluidized-Bed Combustion Unit	MSO
Combustion Capacity (kW)	2,900	450	600	3,000	440	—
Waste for Comparison; Number from Table 6-1	6,7,8,9,10	4	2,5	3	1	All
Comments or Status	In Operation	Standby	Standby	Planned 1993 Construction	Standby	Undergoing Demonstration
Off-Gas Treatments for Acids	Packed-Bed Scrubber	Packed-Bed Scrubber	Proposed: Spray Cooler Using Caustic	Steam-Jet Scrubber	Na_2CO_3 Solids	Molten Na_2CO_3
Off-Gas Treatments for Solids	Venturi Scrubber, Ionizing Wet Scrubber	Venturi Scrubber, HEPA, Carbon Absorption	Cooler Bag Filters, HEPA	Cyclone, HEPA	Cyclones, Sintered Metal Filters, HEPA	Pre-Cool Bag Filters, HEPA
Caustic Used To Neutralize Acids	NaOH	NaOH	NaOH (proposed)	NaOH	Na_2CO_3	Na_2CO_3
Saturation Efficiency of Caustic (%)	95	90	90[a]	90	30	90
Weight of H_2O to Weight of Caustic in Scrubber Solution	20:1[a]	30:1[a]	20:1[b]	20:1[b]	-0-	-0-
Water Removed (%)	95	95	95	85	-0-	-0-
Residual Waste						
Ash/Metals/Rads	Ash Slurry, Caustic Solutions	Dry Ash and Scrubber Solutions	Dry Ash, Bag Filter Solids, and Caustic Solutions (proposed)	Dry Ash, Cyclone Solids, and Scrubber Solutions	Dry Ash, Filter Solids, and Na Salts	Waste Salt Melt and Bag Filter Solids
Chlorine/Fluorine/Sulfur	Caustic Scrubber Solutions	Caustic Scrubber Solutions	Caustic Scrubber Solutions (proposed)	Caustic Scrubber Solutions	Dry Na Salts with Ash	Waste Salt Melt and Bag Filter Solids

[a] Estimated values based on other waste streams.

[b] Assumed values based on OR TSCA experience.

In comparing the weight or volume of the residual ash with that of the original waste stream, significant reduction of the amount of waste seems apparent: weight reduction ratios of 10 to 1 or better are common [7, 8]. However, if caustic scrubber systems are employed to neutralize acidic gases in the off-gas stream, substantial amounts of secondary aqueous waste—up to 30 times the weight of the original waste stream—can be generated [9].

Two of the DOE incinerators examined in this report do not use caustic scrubbers. The INEL WERF facility has no system to treat acidic gases and cannot be used for any waste stream containing significant amounts of halogenated organics [10]. The FBU/PROD neutralizes the acidic gases by reaction with Na_2CO_3 in the primary combustion chamber; thus, the off-gas treatment system does not have to control acidic gases [7].

5.1.1 Incinerator Designs

Combustion Chamber—Three basic types of combustion chambers are used at the five DOE incinerators being considered in this study [10].

1. **Controlled-Air Combustor** (Figure 5-1): Both the primary and secondary combustion chambers are illustrated. Proper temperatures in the chambers are usually maintained by an auxiliary fuel burner or by electric heat. The flow rate of the underfire air is controlled to minimize particulate concentrations in the off gas; gas residence times in each chamber range from 0.3 second to 2.0 seconds. The unit is run under negative pressure to minimize fugitive emissions.

   This system is not suited to treatment of wastes that require turbulence for effective combustion, such as powdered carbon, pulp, some sludges, and viscous materials. LANL CAI and INEL WERF use this type of system.

2. **Rotary-Kiln Combustor** (Figure 5-2): The primary chamber is rotated to enable the burning of wastes that require agitation. This design accepts the widest waste variety of any incinerator. Large noncombustible objects, including intact boxes and drums can be accepted by a rotary kiln. Temperature and pressure control are similar to the controlled-air combustor; gas residence times are 1 second to 3 seconds.

   The turbulence in the combustion chamber may result in a higher particulate loading in the off gas than in other incinerators and, therefore, may cause more strain on the APC system. The Oak Ridge TSCA and Savannah River CIF units use rotary kiln designs.

3. **Fluidized-Bed Combustor** (Figure 5-3): This system is unique because the primary combustion chamber contains a bed of granular material, such as Na_2CO_3 and a catalyst in the Rocky Flats Plant FBU/PROD. Air introduced at the bottom of a distributer plate (sieve) produces vigorous agitation (fluidization) of the solid Na_2CO_3. Combustion temperature is maintained by firing fuel directly into the bed.

ORNL-DWG 93M-5119

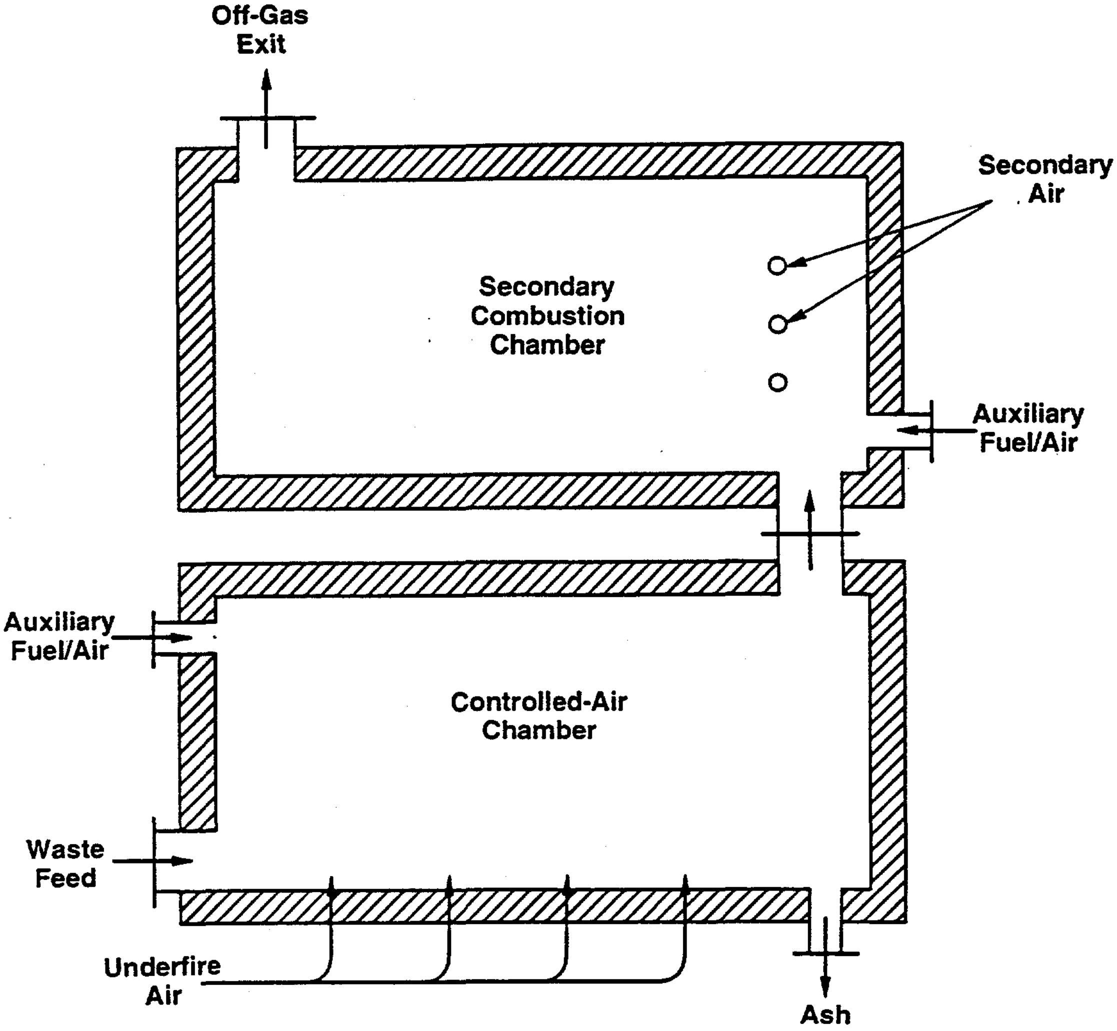


Figure 5-1. Controlled-Air Combustor

ORNL-DWG 93M-5118

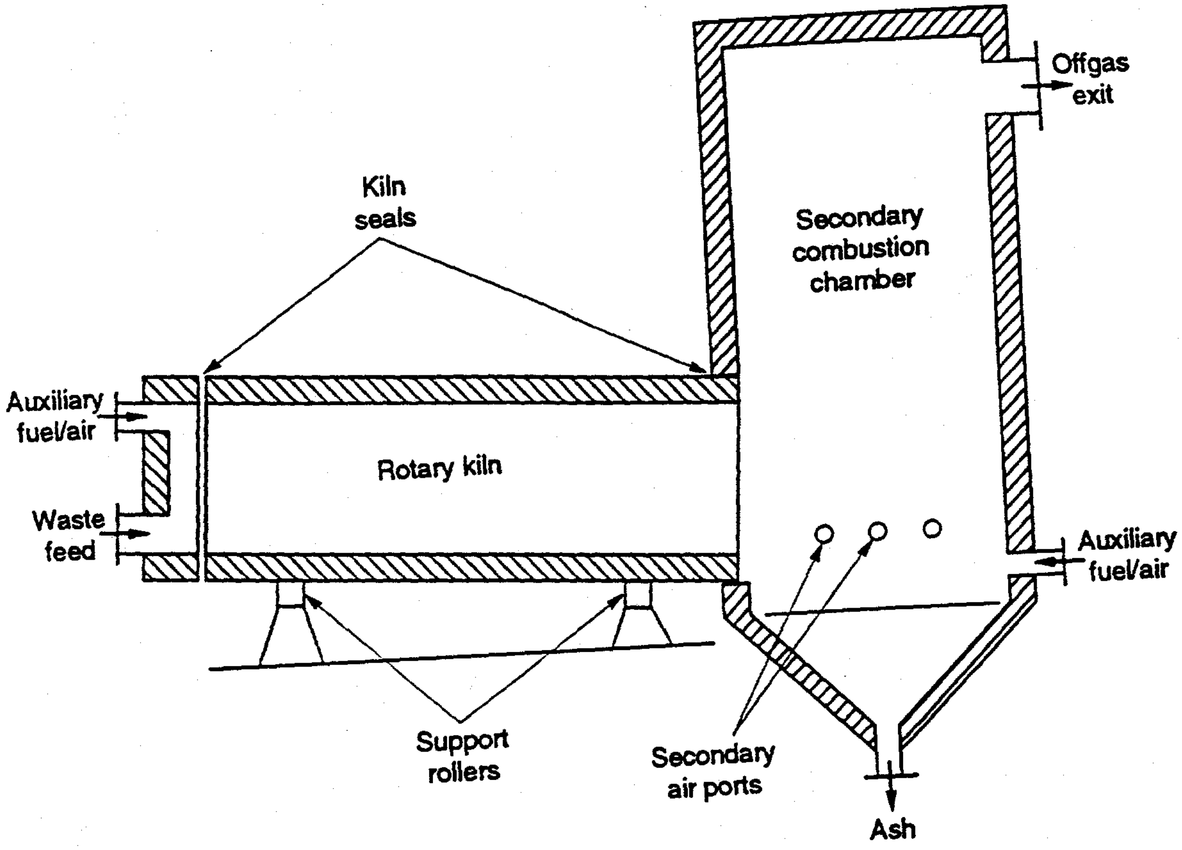


Figure 5–2. Rotary-Kiln Combustor

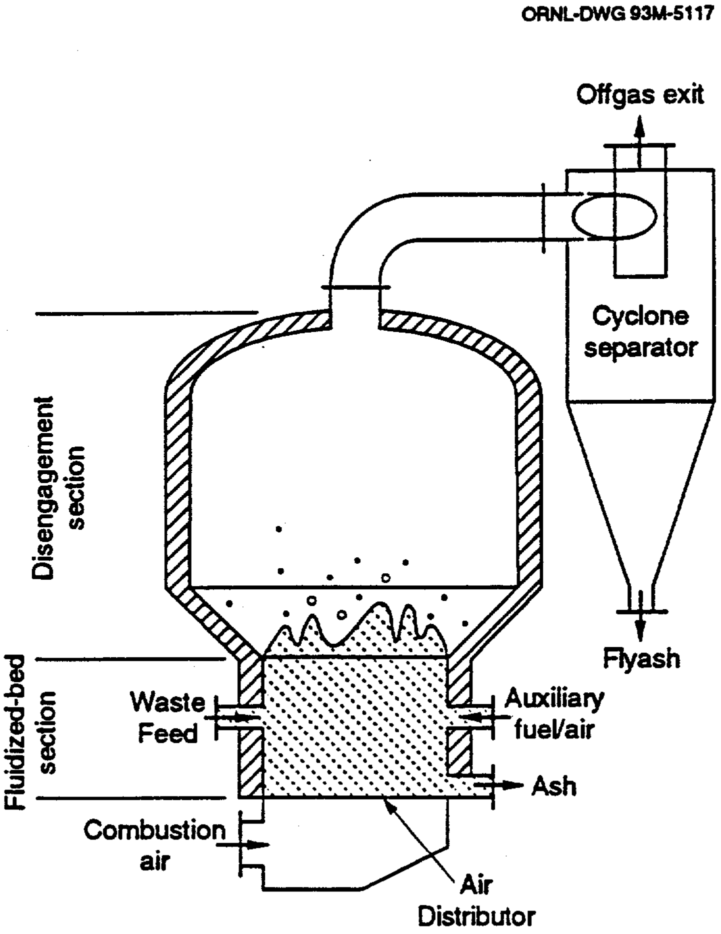


Figure 5–3. Fluidized-Bed Combustor

Fluidized beds produce excellent agitation and provide a mechanism for stable heat transfer from the bed material to the waste being treated, while maintaining mechanical simplicity. The addition of a catalyst enables this design to operate at lower temperatures than other incinerators, reducing the volatilization of metals. Acidic gas neutralization occurs in the bed, and the resulting solid salts are collected in the ash. Although more dry ash is collected than with other incinerator designs, caustic scrubber systems for off-gas treatment are not required.

Ash is continuously withdrawn from the gas/solid mixture, and complete combustion may not occur in some fraction of the waste in the primary chamber; gas residence times can be as little as 0.2 to 0.4 second. A catalyst-rich secondary combustion is then used after the cyclone separator to complete the combustion of organics. Solid wastes and incombustible material must be shredded (reduced in size) prior to introduction.

Off-Gas Treatment—Complex systems are needed to treat the contaminated off gas from the combustion chambers before release to the environment. All of the off-gas systems for the five incinerators consist of about a half-dozen main components that directly treat the off gas. If caustic scrubbing is used, the system must be designed to maintain caustic flow as well as to recycle, replenish, and collect waste caustic (blowdown).

Those components acting directly on the off gas can be classified as parts of a "dry" or "wet" off-gas treatment program. Of the five DOE incinerators of interest, the three that treat acidic gases in the off gas use wet systems; the FBU/PROD and WERF units use dry systems. Wet systems produce large volumes of secondary waste. Dry and wet systems are briefly described below [8, 10, 11].

Dry Components: A dry system often consists of components for coarse particle removal, followed by filters designed to remove the remaining fine particulates. These components work most efficiently under different temperatures with devices to cool or heat the off gas. Description of six types of dry off-gas treatment components follow:

1. **Cyclone** (Figure 5-4): In a cyclone, the off gas is imparted with a rotational motion upon entering the device, resulting in centrifugal accelerations of 10 to more than 1,000 times that of gravity. The larger particles continue in their original direction because of their inertia and their greater density over the surrounding gas. These particles then impact the wall and are collected as dust at the bottom. Small (<5 microns) particles tend to follow the spiraling gas and escape capture. Cyclones can operate at high temperatures and are often the initial treatment for the off gas.

2. **Air Dilution Coolers and Heat Exchangers** (Figure 5-5): Air dilution coolers are used to lower the temperature of the off gas by injection of cooler air into the off-gas flow. This is a reliable method for gas cooling but has the disadvantage of

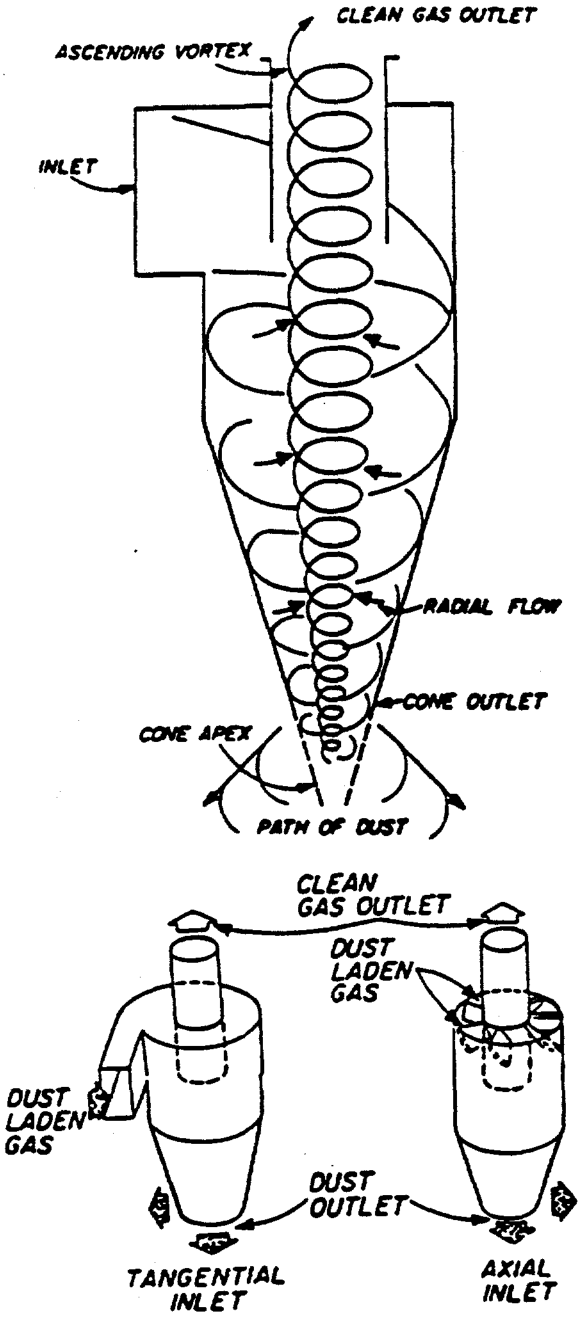
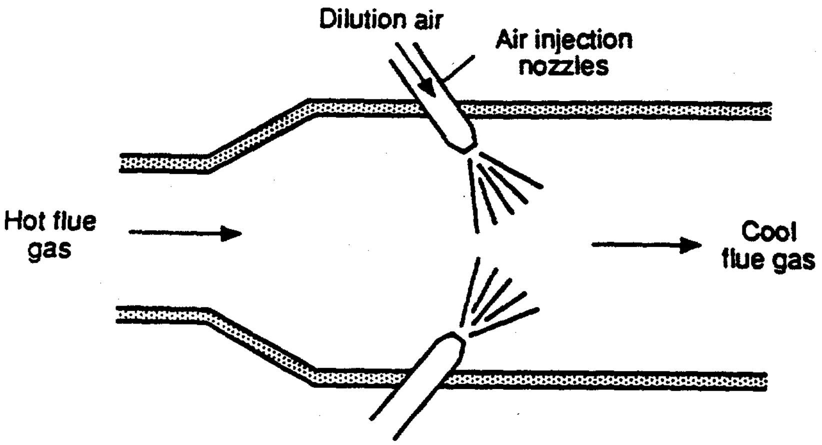
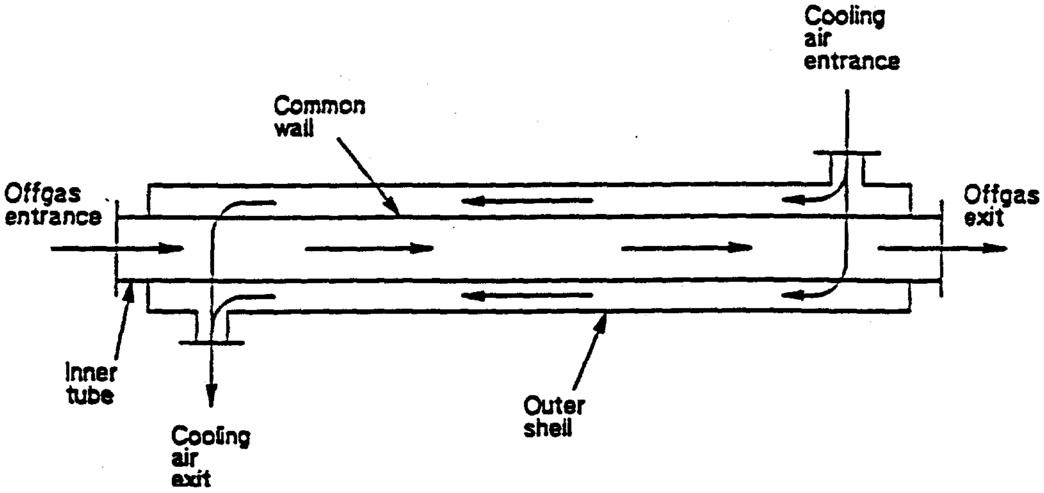


Figure 5–4. Cyclone Air Filter



Air Dilution Cooler



Heat Exchanger

Figure 5-5. Air Dilution Cooler (above) and Heat Exchanger (below) increasing the amount of off gas to be treated. Conversely, heat exchangers pump cooled gas or water along the off-gas piping and cool the flow by removing off-gas heat though the common wall. This does not increase the volume of off gas, unlike the adiabatic mixing used in air dilution coolers.

3. **Bag Filters** (Figure 5-6): "Baghouse" filters capture particulates present in the off gas on the fabric of filter bags. A wire-mesh cage in each bag prevents bag collapse under flow. A cake of dust forms on the bags and is removed by flexing the fabric though mechanical shakers, reverses of flow, or an air pulse. Baghouse filters must be maintained at a proper temperature range to avoid both burning and liquid condensation. A spark arrestor is usually placed upstream to prevent sparks from burning holes in the fabric.

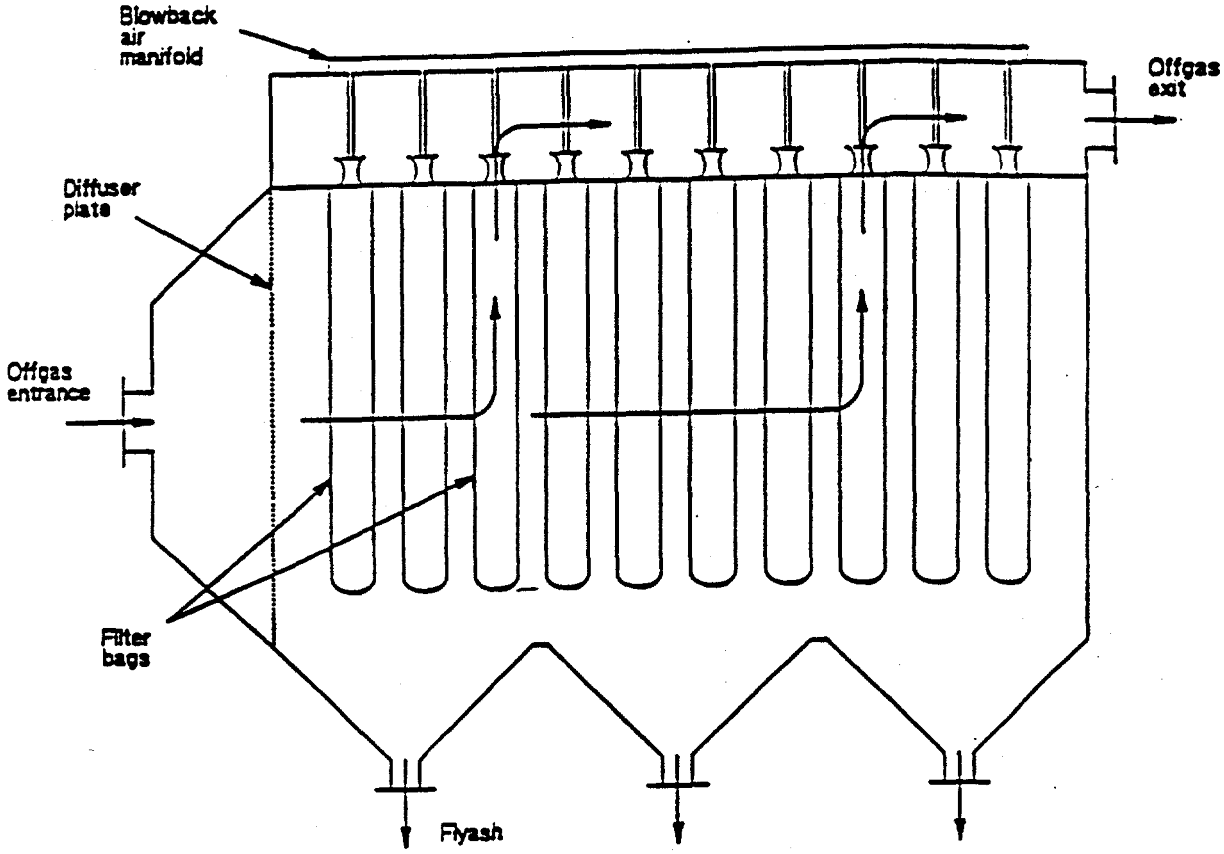
4. **Sintered Metal Filters:** A sintered metal is formed from metallic powder that has been heated to near its melting temperature, resulting in a metallic material that is both porous and strong. These filter systems are similar in shape to the bag filters described above. Because of the rigidity of the metallic filter material, pulse-jet cleaning usually is used. Sintered metal filters can operate at higher temperatures and are resistant to spark damage.

5. **HEPA Filters:** These high-efficiency particulate air (HEPA) filters are usually the last step in a multicomponent APC treatment system before off gas is released to the atmosphere. These filters are specially made for capture of very small particulates, and several of them are often placed in series to form HEPA "banks" to increase efficiency of particle removal. HEPA filters are expensive, cannot be cleaned, and are added to the secondary waste at the end of service.

6. **Carbon Bed Adsorber:** LANL CAI employs this device as the last step in the APC system. Beds of activated carbon are very effective at trapping toxic metals and products of incomplete combustion (PICs) resulting from the unlikely event of a system failure. The bed is not effective at the low PIC levels present during normal operation.

Wet Components: A wet system typically uses a "quench" cooler to saturate the off gas, followed by a scrubber for initial particle removal. An absorber column then is used for removal of acidic gases. The three incinerators discussed in this report that use wet APC systems (CAI, TSCA, and CIF) use a NaOH solution for all the wet components to neutralize acidic gases. In addition, these three incinerators use a common caustic treatment/recycling/replenishing subsystem for the entire APC system. Following treatment with the caustic wet scrubber, the off gas is heated and/or dried before fine-particle removal by HEPA filters.

1. **Quench Tower** (Figure 5-7): A "quench" tower cools and saturates the off gas by spraying caustic into the stream. This design component functions primarily as the



EPA 68-CO-0094

Figure 5-6. Bag Filter "Baghouse"

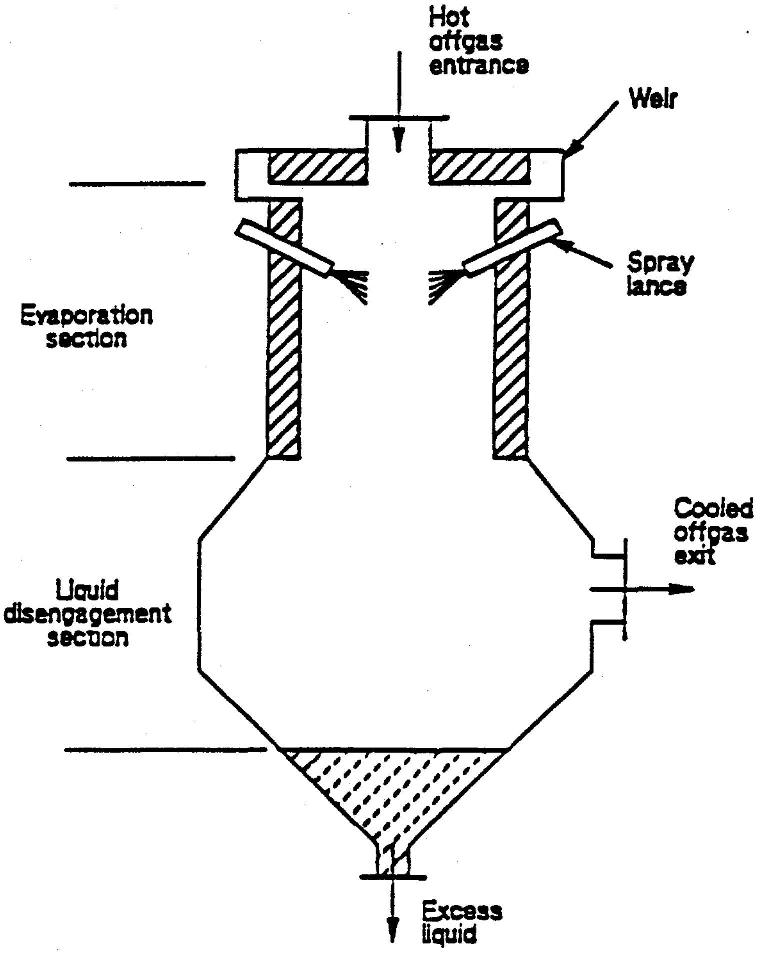


Figure 5-7. Quench Tower

first of a multicomponent off-gas treatment system in which the off gas is cooled before additional treatment. In addition, the quench tower neutralizes some of the acidic gas and retains some large particles. The excess caustic is collected at the bottom of the quench tower for recycling or disposal.

2. **Venturi Scrubber** (Figure 5-8): This device is designed to remove particles from the off gas. The off gas is accelerated by converging the ductwork into a constricted throat section that increases the velocity of the off gas to as much as 100 meters per second. At this point the caustic solution is injected, dispersed into droplets, and accelerated by the off-gas stream. The much smaller off-gas particles are then captured by impacting the larger caustic droplets in the diverging section of the scrubber. Efficiency of the venturi scrubber is enhanced under conditions where (a) the off-gas stream is saturated with water, and (b) the caustic liquid has been cooled to a temperature that is lower than that of the off-gas stream. Venturi scrubbers are simple, self-cleaning, and, under proper conditions, effective at removing many types of off-gas particles.

3. **Demisters:** This device uses a fine mesh to collect droplets from the venturi or packed-bed scrubbers and serves to collect the particles imparted in the liquid. They also are used for removal of mist or condensation from the off-gas stream.

4. **Packed-Bed Scrubber** (Figure 5-9): Packed-bed scrubbers are used to remove acidic gases from the off gas. The bed is composed of material with a very large surface area and is designed to spread the caustic as a thin film over the entire surface, maximizing transfer of acid in the off gas to the caustic as the off gas flows though the packed bed. The scrubber liquid is continuously percolated through the packed bed with the scrubber operated in either a "countercurrent" (off-gas flow upward counter to the scrubber solution flow as in Figure 5-9) or "crosscurrent" (horizontal flow of the off gas perpendicular to the downward flow of the caustic solution) configuration.

5. **Steam-Atomized Free Jet Scrubber** (Figure 5-10): This scrubber system is used at the SRS CIF for particle capture and acidic-gas neutralization; caustic solution is used in place of water as illustrated in the figure. The steam is discharged from the ejector at nearly 1,000 meters per second, roughly the same velocity as a modern high-power rifle. The subsequent setup is designed to provide maximum turbulence to facilitate particle capture and acid-gas treatment by the formation of tiny droplets of caustic solution. In the agglomeration tube, the caustic droplets combine into a size of about 100 microns, making for easy removal by a demister. This system is very efficient at both particle removal and acid-gas neutralization.

6. **Ionizing Wet Scrubber** (Figure 5-11): An ionizing wet scrubber is used at the Oak Ridge TSCA incinerator subsequent to the venturi packed-bed system, negating the need for HEPA filters. The off gas is passed though a high-voltage ionizing

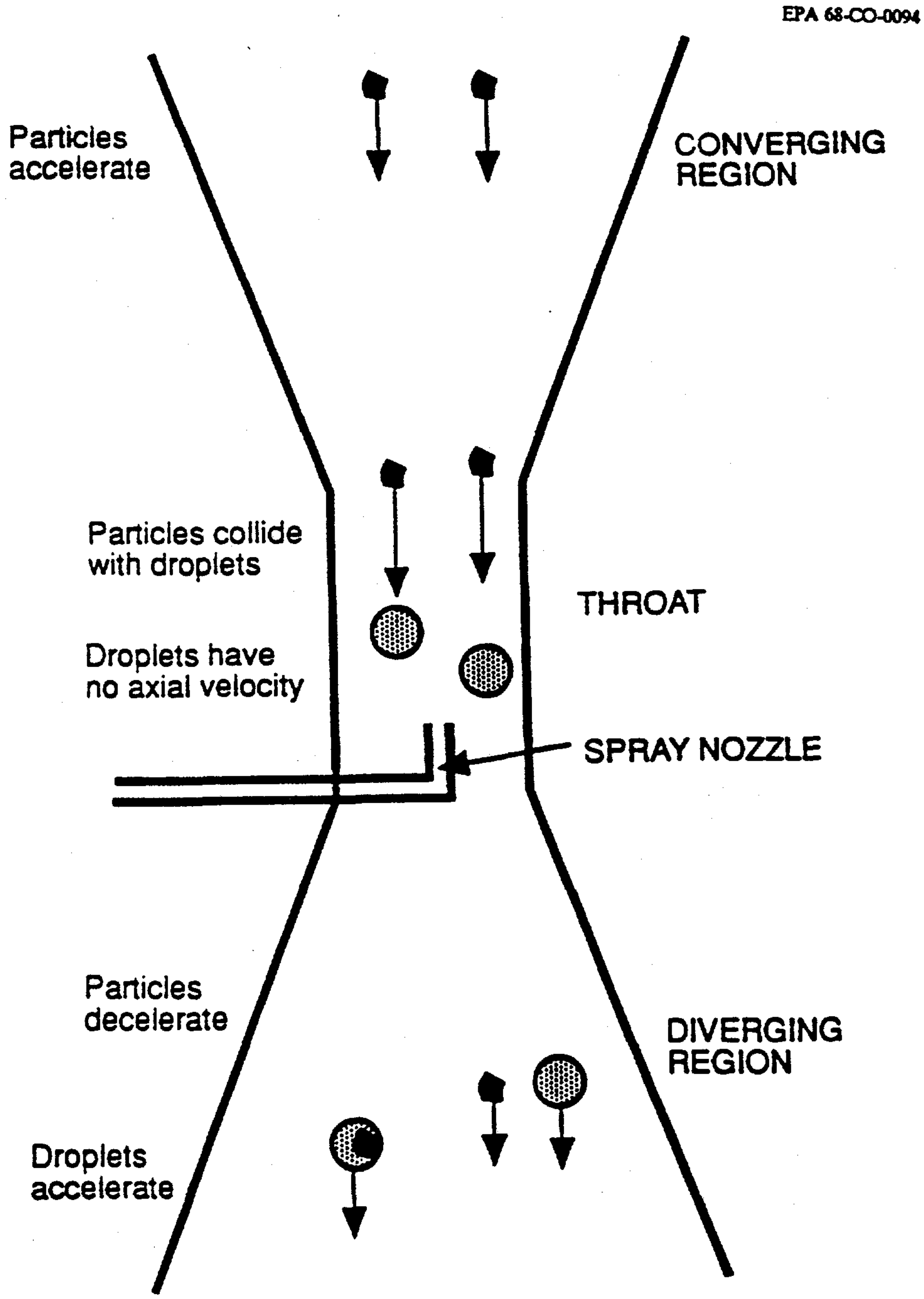


Figure 5-8. Venturi Scrubber

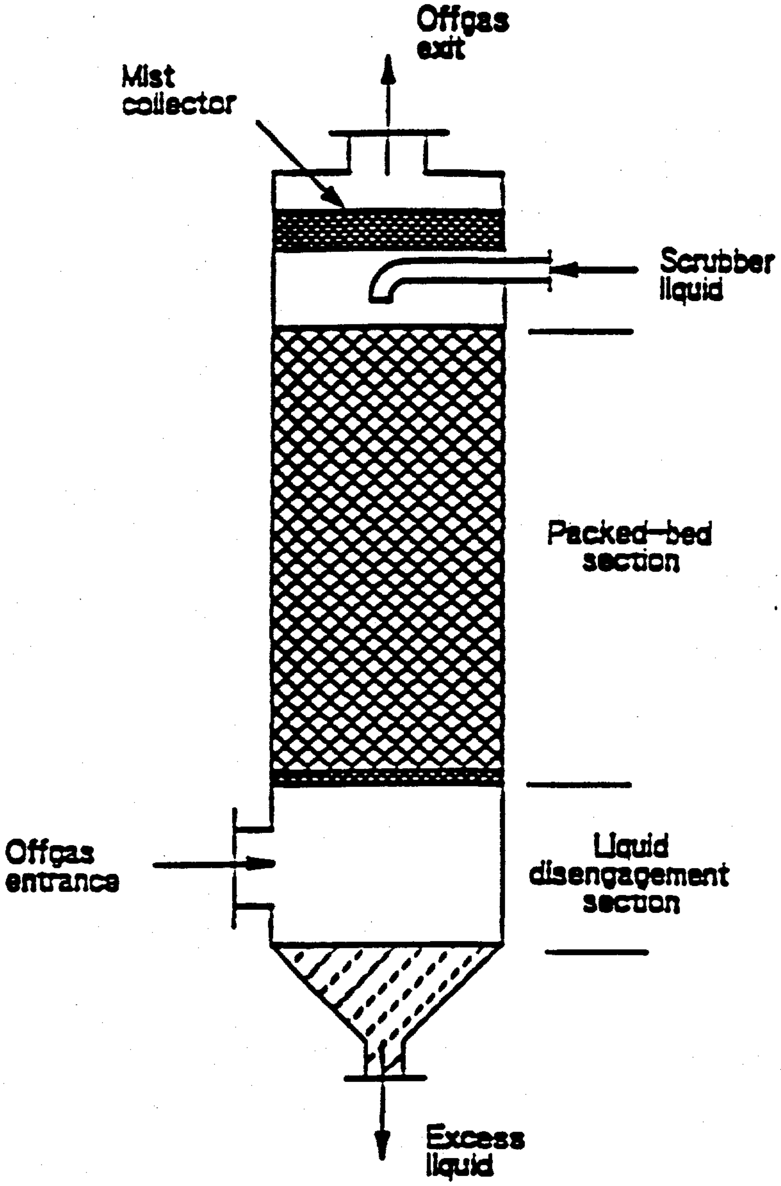


Figure 5–9. Packed-Bed Scrubber

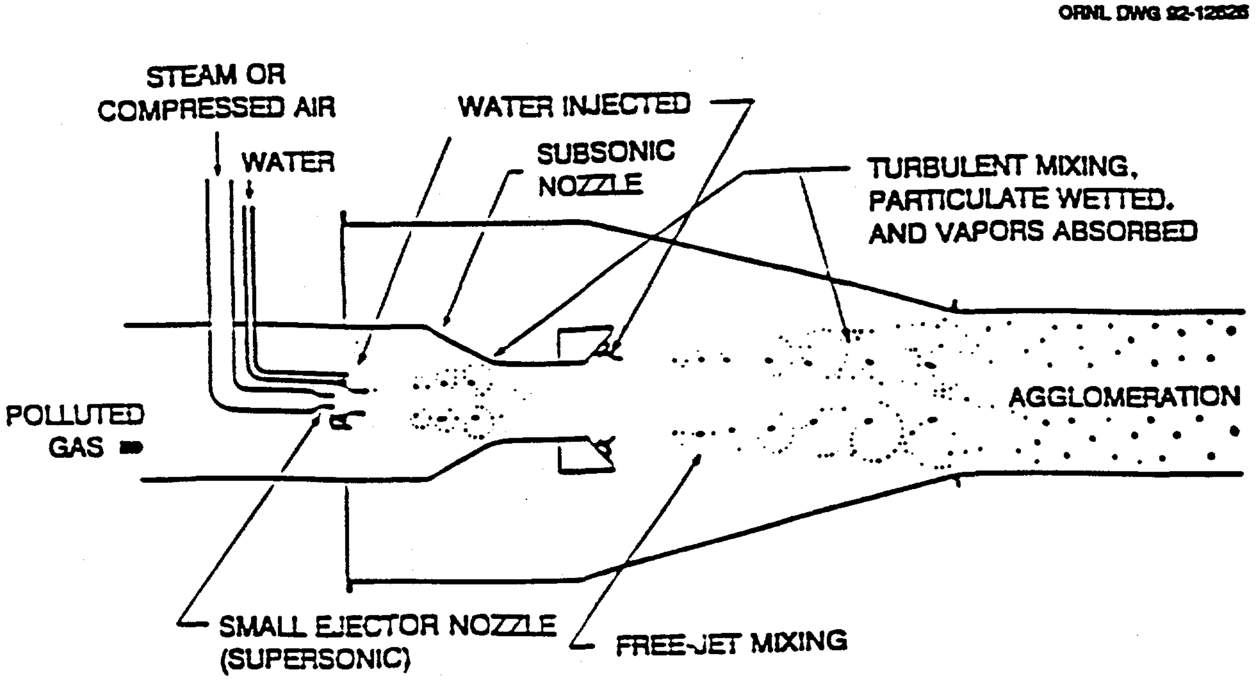


Figure 5–10. Steam-Atomized Free Jet Scrubber

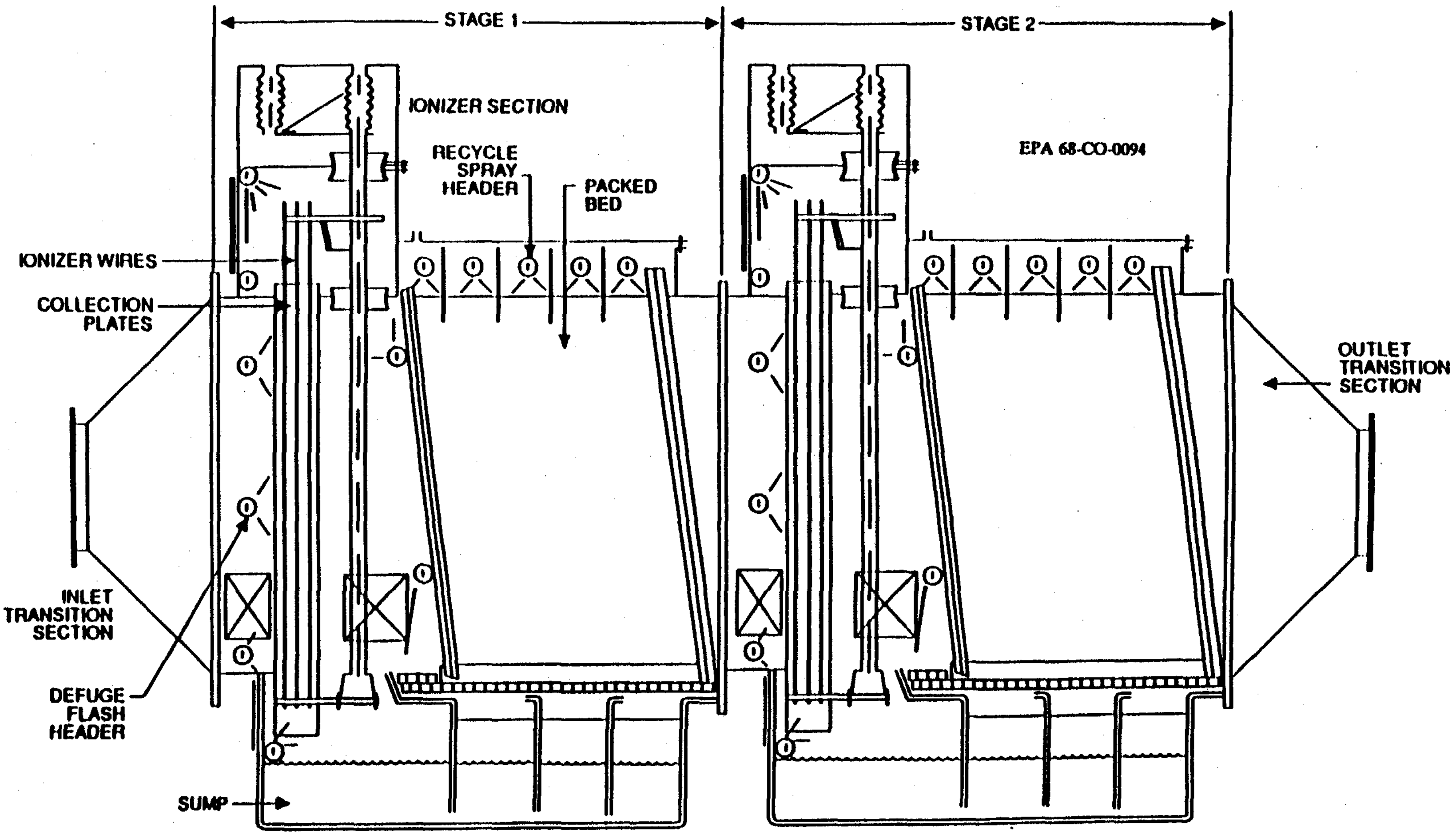


Figure 5-11. Ionizing Wet Scrubber

chamber to electrostatically charge the particulates in the off-gas stream. The negative electrodes are used to charge the particulates and the positive electrodes are used primarily to complete the circuit, although they collect some of the particulates. The off gas then enters a packed-bed scrubbing section where final particulate removal and acid-gas neutralization occur. Particulate removal occurs either by direct impaction with the bed and associated caustic droplets, or by an electrical effect known as image-force attraction. This occurs when a charged particle induces an opposite charge on a neutral surface (the bedding and caustic) and is drawn to it.

Note that the raw blowdown from wet systems is usually dewatered before it is treated further (Section 7.0 presents information on residual treatments). Dewatering the raw blowdown can be done either through evaporation or waste-water treatment (WWT). The residue after WWT consists of ash, insoluble metals, and additives; while for evaporation the residuals are ash, soluble metals, and sodium chloride salts. WWT is usually preferred because the soluble metals and salts left in the evaporation residue are more likely to leach, and the chloride salts can cause swelling in the final waste form [17]. However, WWT may not be able to reduce radioactive contaminants to acceptable levels, in which case evaporation is used for dewatering.

5.1.2 The Five DOE Incinerators

Five DOE incinerators are considered in this report. A process flow diagram is included for each incinerator showing complete flow of all waste forms processed and generated. The general operation of each incinerator, including off-gas treatment, can be determined by referencing the flow diagrams with the descriptions of the main components in the previous section. This information was obtained from references 8, 10, and 12 unless otherwise stated.

1. **OR TSCA**: K-25 Plant, Oak Ridge, TN (Figure 5-12). This is a rotary-kiln incinerator with a combustion capacity of 2,900 kilowatts (kW) followed by a wet off-gas treatment system. This off-gas system is the only one of the five incinerators that does not use HEPA filters and, thus, has no dry off-gas components. The OR TSCA incinerator is designed to treat low-level, TSCA polychlorinated biphenyls (PCBs), and RCRA wastes and can handle the wide variety of waste forms typically treated in a rotary kiln. Waste oils and solvents (high-heat content liquids) are injected into the secondary combustor. The kiln operates at 900 °C, and the secondary combustor operates at 1,200 °C [13]; the temperature is maintained by inflows of methane. Off-gas treatment by this system includes quench tower, venturi scrubber, demister, packed-bed wet scrubber, and ionizing wet scrubber. The raw blowdown is sent to holding tanks where the slurry is settled out and collected. The liquid is then sent to a WWT facility for treatment. Operating under a TSCA permit, the Oak Ridge incinerator is currently treating approximately 2.5 million pounds of waste per year.

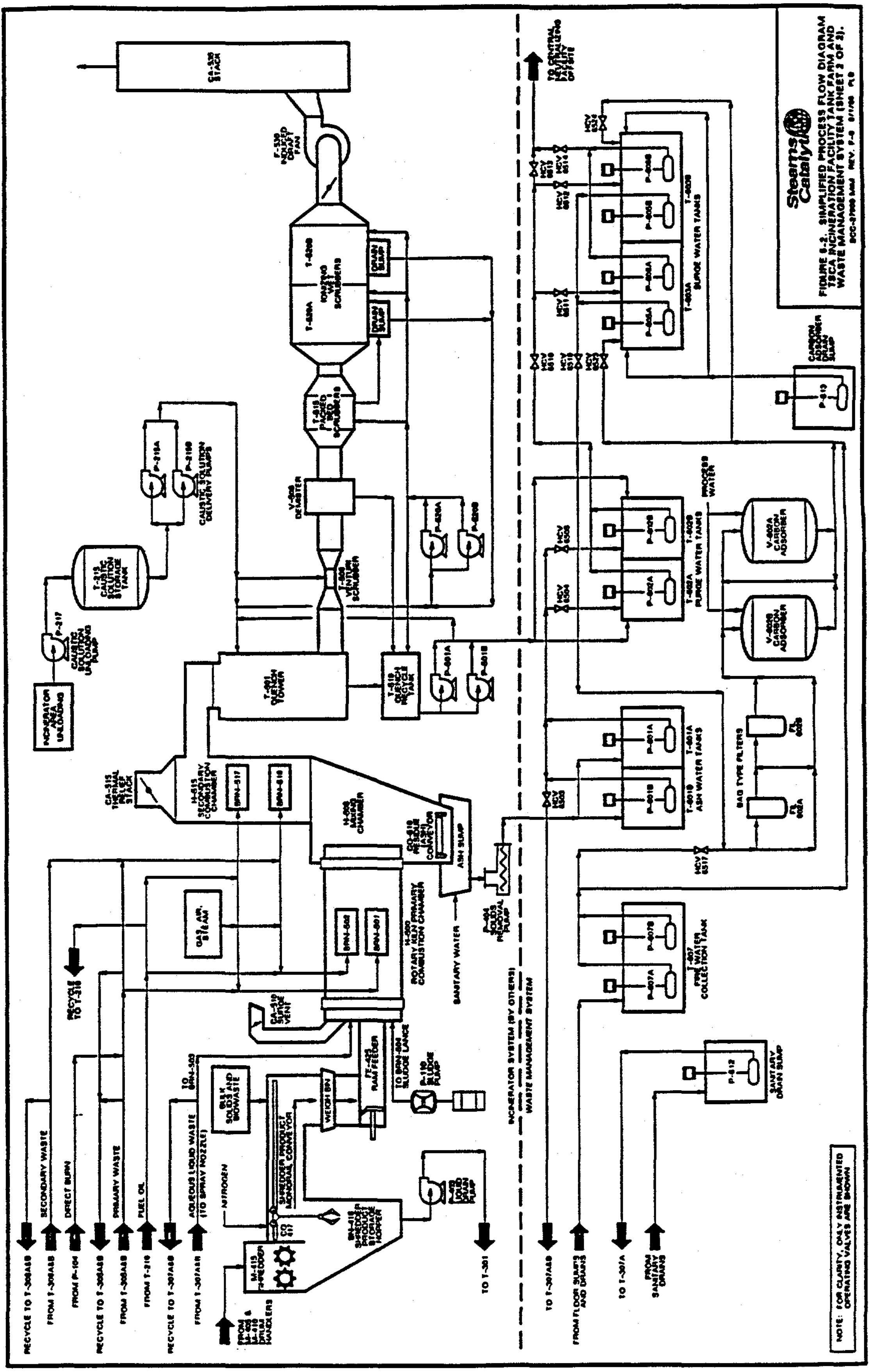


Figure 5-12. OR TSCA Incinerator

2. **SRS CIF**: Savannah River, SC (Figure 5-13). The CIF is another rotary kiln/wet APC system design. It has a combustion capacity of 3,000 kW and is designed to handle low-level, RCRA, and mixed wastes at 919 kilograms per hour (kg/hr). Similarities to the OR TSCA are apparent in terms of combustion design, size, wastes to be treated, and general operation. However, as TSCA waste must be burned at temperatures that are greater than those required for RCRA waste, the SRS CIF should be able to operate at lower temperatures than those used at the TSCA incinerator [13]. Off-gas treatment will be accomplished by use of quench tower, steam-atomized fine jet scrubber, cyclone separator, demister, reheater, and HEPA filters. The SRS CIF will use evaporation to treat the raw blowdown. This system has recently been approved by DOE and construction is planned to start in 1993.

3. **LANL CAI**: Los Alamos, NM (Figure 5-14). The controlled air incinerator at LANL has a combustion capacity of 450 kW; the primary and secondary chambers operate at 870 °C and 1,150 °C, respectively. The operating temperature is maintained by natural gas with diesel fuel as a backup. It was originally installed in 1976 and has treated radioactively contaminated PCBs and RCRA wastes on a production scale. The system is currently in a standby mode. Large glass or metal objects must be removed from the liquid waste before incineration [14]. A wet off-gas treatment system is used consisting of a quench tower, venturi scrubber, packed-bed scrubber, demister, superheater, HEPA filters, and activated-carbon absorption beds. The LANL CAI filters out the ash from the blowdown (the wet ash is fed back into the incinerator) and sends the remaining liquid to the laboratory's general WWT facility.

4. **INEL WERF**: Idaho Falls, ID (Figure 5-15). The WERF is a controlled-air combustor and differs from the LANL CAI because it uses a dry off-gas system. The WERF has a combustion capacity of 600 kW and maintains a temperature of 980 °C in the combustion chambers by using fuel-oil burners. The combustor has been fitted with a high-energy vortex burner to allow treatment of liquid wastes and was almost continuously operated for several years in treating low-level radioactive wastes, mixed wastes, and RCRA solids and liquids at 180 kg/hr. Because the WERF has no ability to treat acidic gases, halogenated organics cannot be treated. Proposed modifications to this system (spray cooler with caustic solution) would allow halogenated organic treatment. Existing off-gas treatment consists of air-dilution cooler, heat exchanger, second air-dilution cooler, baghouse filters, and HEPA filters. This system is on standby pending approval of an Environmental Impact Statement.

5. **RFP FBU/PROD**: Rocky Flats, CO (Figure 5-16). The Rocky Flats unit is a fluidized-bed combustor (FBU) with a capacity of 440 kW operating at a temperature of 550 to 600 °C. This incinerator was built in 1978 as a production (PROD) model of a 9-kg/hr pilot unit. An updated version of this system is in the

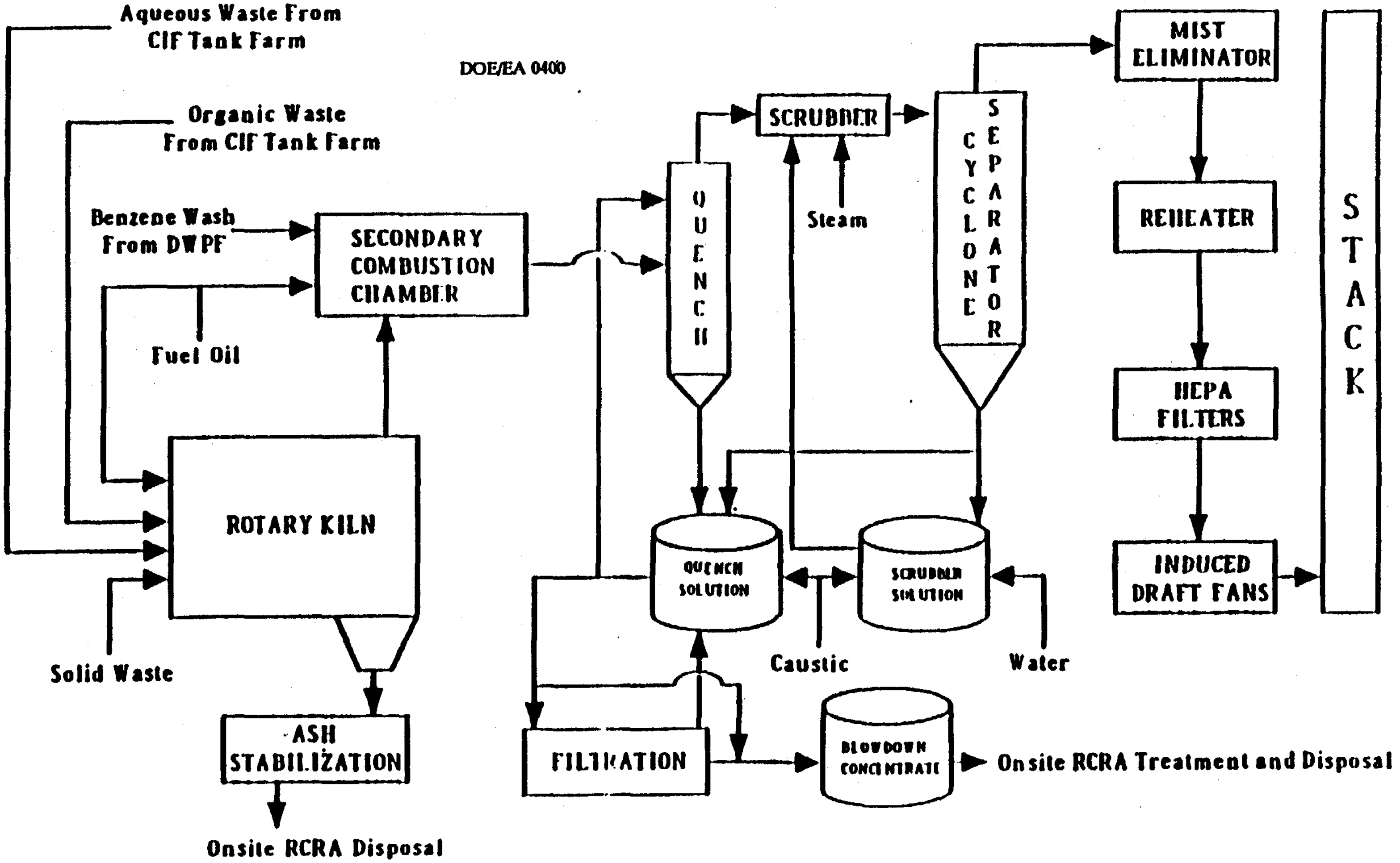


Figure 5–13. SRS CIF Incinerator

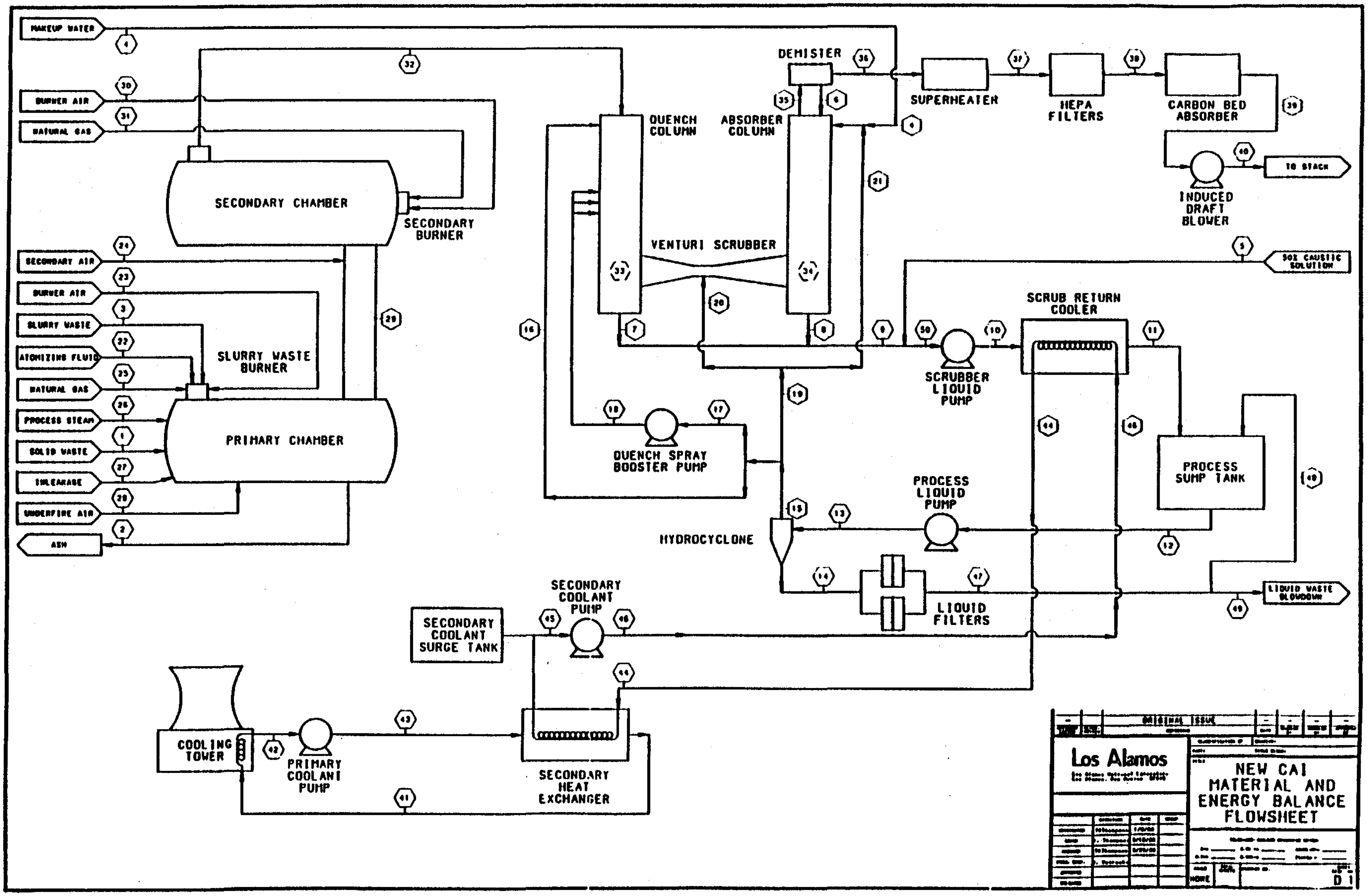


Figure 5-14. LANL CAI Incinerator

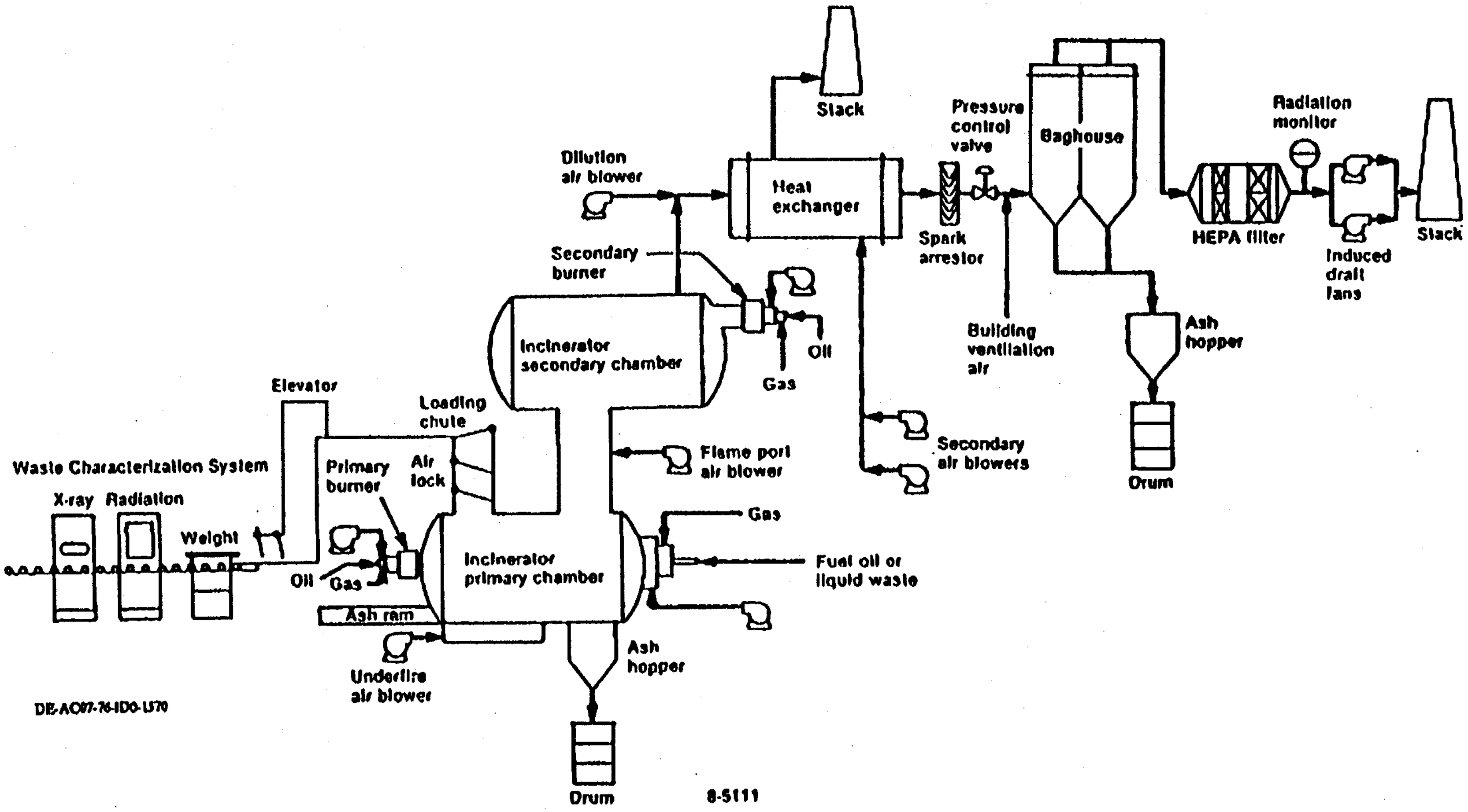


Figure 5–15. INEL WERF Incinerator

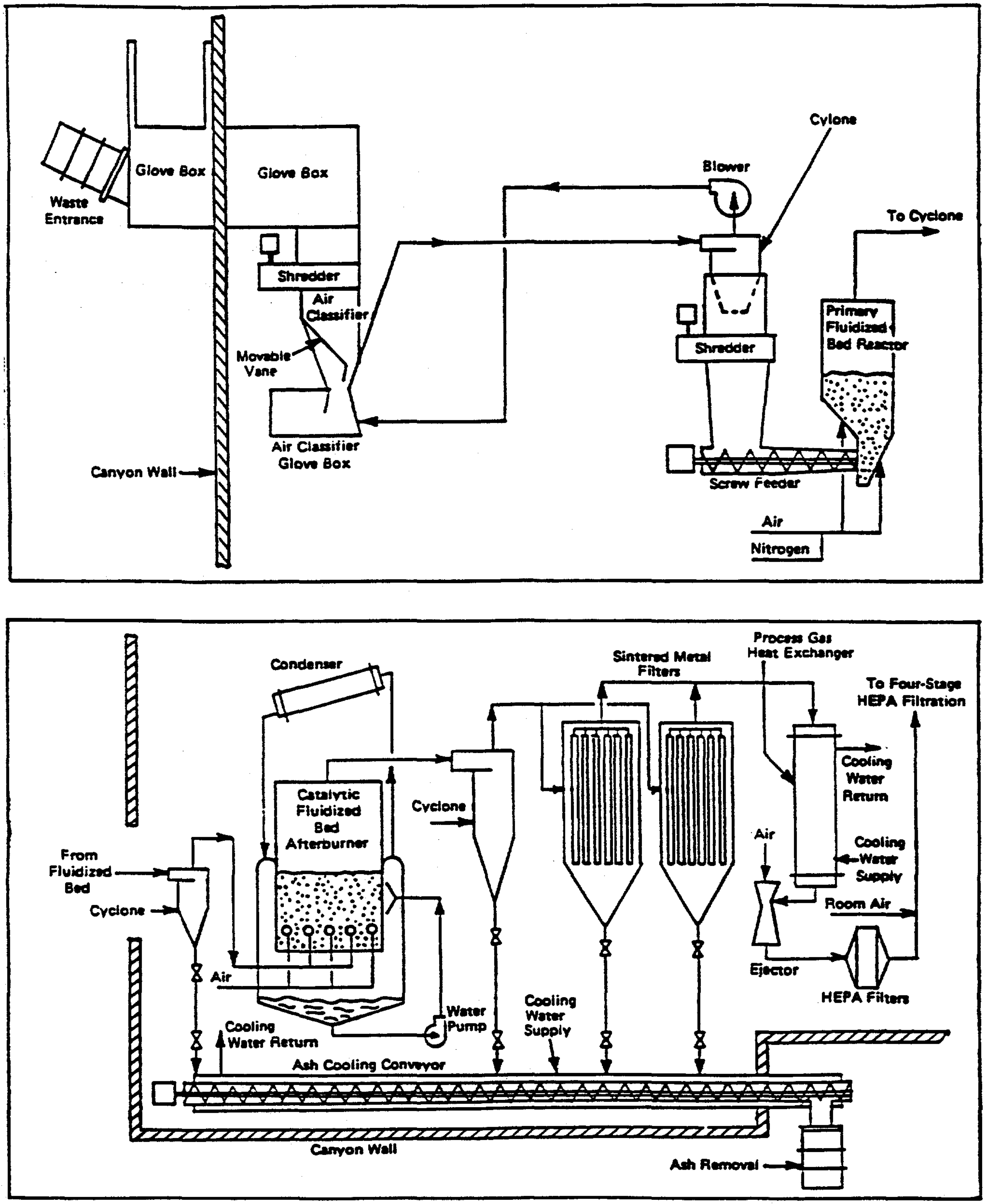


Figure 5–16. RFP FBU/PROD Incinerator

planning stages. The RFP FBU/PROD uses a 50/50 Na_2CO_3/catalyst mix in the primary chamber and a 100-percent catalytic afterburner to complete the oxidation of organics and residual carbon monoxide, although collection of unburned carbon in the cyclone ash has been a problem (this will be addressed in the new design). Catalytic combustion is needed because of the lower operating temperature as compared with other incinerators. This incinerator needs auxiliary fuel on start-up only; waste combustion provides enough heat for normal operation. The system is designed to treat 82 kg/hr of low-level and transuranic waste. A dry off-gas treatment system (cyclone, sintered metal filters, heat exchanger, and HEPA filters) is used to take advantage of the ability of the combustor to neutralize acidic gases. This is the only incinerator addressed in this study that can treat acidic gases without the need for a wet off-gas acid-gas scrubbing system [7]. The RFP FBU/PROD currently is on standby.

5.2 Molten Salt Oxidation

The AEC funded research and development of molten salt processes in the early 1950s. During the 1960s, the AEC (and later, the DOE) provided funding to Rockwell International (Rockwell), operator of DOE's Energy Technology Engineering Center (ETEC), to conduct experimental and theoretical studies on MSO. Rockwell's activities initially focused on the properties and chemistry of molten salts, but the company also examined the use of molten salts as a catalyst for gasifying coal. During these tests, the idea emerged to use MSO technology to treat hazardous wastes. Through numerous small contracts, Rockwell evaluated the feasibility of treating specific wastes (perchloroethylene bottoms, hexachlorobenzene, chlordane, PCBs, and simulated radioactive wastes) using the MSO process. Data from these bench- and pilot-scale tests indicate excellent destruction and removal efficiencies.

5.2.1 Process Description

As a primary treatment technology, MSO is a noncombustion process* combining chemical neutralization and thermal treatment for the treatment of organically contaminated mixed wastes (Figure 5–17). The molten salt, usually sodium carbonate or a blend of other salts,

---

*Molten salt oxidation is not a combustion process in the conventional sense. Combustion usually refers to an oxidation process in which fuel and air are burned at a flame front. The flame front is located at the interface between a fuel-rich region and an oxygen, or oxidizer-rich, region. The flame supports combustion at a flame velocity that is characteristic of each fuel-oxidizer combination. Continued oxidation usually requires a sustained flame. If the flame is extinguished, oxidation of the fuel, even in the presence of the oxidizer, will not continue.

Molten salt oxidation is a combined thermal and chemical treatment process in which the fuel-oxidizer reactions occur in contact with a liquid salt. Because the salt heats the reactants and catalyzes oxidation, the process does not require a flame to initiate or continue the reaction. In the MSO process, the fuel and the oxidizer (usually air) are not separated but are mixed with liquid salt in a turbulent salt bed. Thus, molten salt treatment does not depend on a flame to continue the oxidation process. Moreover, the heat of neutralization is released in the bed. The total heat of reaction is often sufficient to maintain the operating temperature of the molten salt bed without the need for auxiliary fuels.

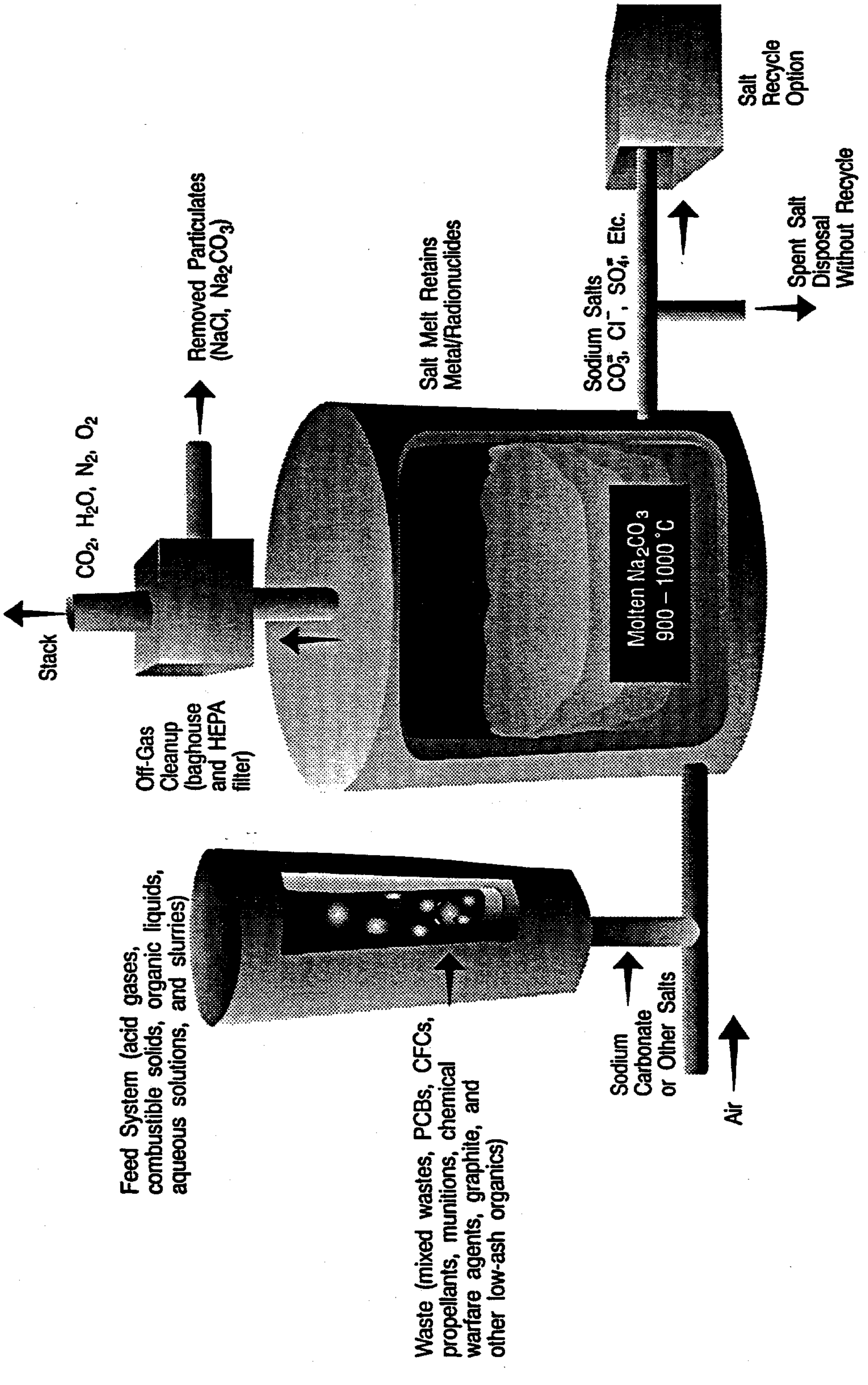


Figure 5-17. MSO Process

(1) acts as a dispersing medium for both the waste being processed and the air used in the processing; (2) enhances the oxidation reactions and accelerates the destruction of organic material; (3) enhances completeness of the chemical reactions by providing better contact over a relatively long time period and provides a stable heat-transfer medium that resists thermal surges; (4) neutralizes and retains acid gases and, thus, requires no wet off-gas scrubbing system; (5) helps retain soot and chars in the melt for more complete reaction; and (6) retains the ash and other noncombustible material associated with the waste. These characteristics potentially enable (1) superior organic destruction because of enhanced oxidation effects of the salt, a longer residence time, and more intimate contact with caustic molten salt; (2) potential for excellent capture of heavy metals and radionuclides because of wetting, encapsulation, and chemical reaction with the salt melt; (3) reaction and neutralization and acidic products such as HCl, HF, SO_2, and P_2O_5; (4) reduced off-gas flow; and (5) solid, stable, homogeneous residuals [1,2].

Wastes that have been identified as the most appropriate for primary treatment by MSO include high-heating-value organic liquids (e.g., solvents, waste oils), low-heating-value liquids (e.g., chlorinated organic liquids), low-ash combustible solids, chlorofluorocarbons, (e.g., Freon, Halon), organic sludges, explosives, propellants, and chemical warfare agents. These same wastes mixed with radioactive materials would also be appropriate. Particle size reduction may be required for some of these wastes to get feed size down to one-eighth inch or less. Waste such as soils, asbestos, concrete, grout, and D&D rubble are not practical for MSO treatment because of their high inert content.

Off-gas treatment systems used with an MSO unit would consist of dry off-gas unit processes consisting of a baghouse filter and HEPA filter. In addition, the MSO design potentially could be used in the treatment of secondary wastes, where it could operate as the first stage in an off-gas system for an incinerator. The utility of such a "hybrid" system is currently under investigation.

Although MSO appears to hold significant promise as a treatment system for organically contaminated mixed and hazardous wastes, it does not have the maturity level of incineration. Therefore, numerous applied and basic research issues, as well as other technical issues, currently are being addressed or planned:

- Chemical reactions occurring in the salt melt.
- Formation of PICs.
- Control of NO_x and CO emissions.
- Salt carryover to off-gas systems.
- Volatilities, solubilities, and activities of actinides, metals, and metal halides for differing salt chemistry.
- Waste-salt handling, treatment (stabilization chemistry), recycling, and final waste form.

- Melt freeze conditions.
- Steam explosion potential.
- Corrosion resistance of materials in contact with the salt melt.
- Analysis of failure modes, risk to workers, public, and the environment.
- Assessment of risks from emissions.
- Comparison of MSO risks with other technologies.
- Cost benefit analysis.
- Monitoring required to ensure compliance.
- Emergency procedures.
- Socioeconomic effects.
- Reduction of waste toxicity, mobility, and volume provided by MSO versus other treatment systems.

Issues that have a high potential to negatively impact the implementation of MSO are being addressed most aggressively. For example, the disposition of residual wastes (the topic of this report), which is perceived by some potentially affected interests as MSO's Achilles' heel, is being addressed early in the development stages.

Section 6.0

Mass Balances

To understand the nature of the residual products from the treatment of wastes it is important to perform mass balances of all the chemical compounds that are used (reactants) in the specific process. These calculations include all the gases, liquids, and solids. This section examines what the residual products are from the treatment of 10 specific wastes by incineration and MSO.

6.1 Description of Wastes

Ten specific wastes were identified from information contained in Section 4.0 of this report as being appropriate for treatment by MSO and incineration. They include wastes that are typical to DOE sites, large-volume wastes, easily treated wastes, halogenated wastes, and/or difficult-to-treat wastes. The 10 wastes selected are chemically described in Table 6-1 (at the end of this section) and are briefly described below.

Waste 1: This waste at Rocky Flats consists of approximately 29,000 gallons of low-level waste oil with a low percentage of halogenated solvents (1,1,1-trichloroethane, carbon tetrachloride, toluene, ethylbenzene). This waste contains low levels of uranium, plutonium, lead, beryllium, and zinc and could be treated by the RF FBU/PROD facility.

Waste 2: Twenty-one 55-gallon drums of waste oil at INEL contain approximately 6-percent solvents in the form of trichloroethylene (TCE). Radioactive constituents include cesium-137, americium-241/plutonium-238, cobalt-60, and strontium-90. Heavy metals include lead, mercury, silver, and chromium, each being under 15 parts per million (ppm). The WERF incinerator is assumed to be modified with acid-gas scrubbing equipment to handle this waste.

Waste 3: This is a waste stream that is expected to be generated in the future. Approximately 50,000 gallons per year of benzene is expected to be generated from the Defense Waste Processing Facility (DWPF) at the Savannah River Site. No radioactive or other contaminant values are known for this future waste. Ash content is assumed to be zero. This waste was selected to represent an essentially pure product, nonhalogenated organic. Current plans for treating this waste will be at the future SRS CIF.

Waste 4: This waste is composed of LLW scintillation fluids that are common throughout DOE. Although these wastes are from the Lawrence Berkeley Laboratory, LANL CAI was identified for treatment because the sample analysis was more complete than similar wastes at LANL. The tritium component of this waste would require a condensation loop for both the incinerator or MSO treatment systems if concentrations exceed air emission discharge standards.

Waste 5: Waste 5 comprises graphite molds and crucibles stored at the Idaho National Engineering Laboratory. This is certified TRU graphite waste. The planned action for this waste is thermal treatment.

Waste 6: This is a waste lubricating and hydraulic oil that is stored at the BETTIS Atomic Power Laboratory in Pennsylvania. The radioactive category for this waste oil is low-level waste (LLW). It will likely be shipped from Pennsylvania to Oak Ridge for treatment at the OR TSCA facility.

Wastes 7, 8, 9, and 10: All four of these wastes are located at the Oak Ridge facility, and all are assumed to be treated at the OR TSCA facility. Waste 7 is perfluorodimethylcyclohexane (C_8F_{16}), and Waste 8 is trichloroheptafluorobutane ($C_4Cl_3F_7$). Waste 9 is waste oil mixed with low-level radioactive components and hazardous constituents such as thorium and beryllium. Waste 10 is two-thirds waste oil and one-fifth tretrachloroethane contaminated with beryllium and uranium. It also includes Freon and 1,1,1-trichloroethane.

6.2 Assumptions

In the performance of the mass balances for the 10 specified wastes, the following assumptions were made:

1. If appropriate, the existing or proposed thermal treatment system at each of the sites was used for the corresponding wastes(s) stored at that site. The exceptions to this are the BETTIS oil (Waste 6) that is assumed to be treated at the OR TSCA facility and the TRU graphite (Waste 5) that was assumed to be treated in a rotary kiln incinerator (the WERF controlled-air incinerator is inappropriate to treat graphite).

2. Graphite, especially ultrapure nuclear-grade graphite, is exceptionally difficult to oxidize by any means and would require special modifications to a rotary kiln system to ensure complete oxidation. For MSO, the sodium carbonate salt melt would be augmented with 10-percent sodium sulfate to catalyze the reaction. For the purposes of this report, both of these modifications are assumed.

3. For incineration systems, the common feed rate upper limit for fluorine is typically less than 2 percent by weight because of the extreme corrosive nature of the off gas, HF. Thus, for incineration systems it is assumed that Wastes 7 and 8, which contain 76 and 46 percent-weight, respectively, of fluorine, would be blended with other waste oils to meet the acceptance criteria of the incinerator. At Oak Ridge, a range of 1 to 2 percent fluorine feed to the TSCA incinerator is used.

4. For MSO, fluorine also can cause corrosion of refractory lining in the MSO vessel in the range of 25 percent-weight NaF. When operating an MSO system with high fluorine wastes such as Wastes 7 and 8, the NaF concentration in the MSO vessel is conservatively maintained at 10 percent and is run in a constant salt overflow mode. The overflow salt, containing 10-percent NaF, is dissolved in water and mixed with calcium hydroxide to form insoluble CaF_2. The remaining Na_2CO_3 is then recycled back to the MSO vessel after drying. In this manner, the saturation efficiency of Na_2CO_3 can be maintained at a high level of weight-percent (see Assumption 13).

Calcium-based salts also may be an acceptable approach, but at this time insufficient studies have been performed to verify this approach.

5. For all treatment systems, wastes are completely oxidized to carbon dioxide and water with excess oxygen. The percentage of excess oxygen was estimated on the basis of operator input and oxygen demand of the waste.

6. Excess air from auxiliary fuel burners in the primary and secondary chambers of the incineration systems was not calculated, nor were the off-gas products.

7. For acid-gas scrubbing systems, it was assumed that 95 percent of the water in the caustic solution was removed by mechanical dewatering equipment except for the SRS CIF which will use evaporation to remove 85 percent of the water.

8. All products are reacted to equilibrium with excesses of caustic (NaOH, Na_2CO_3) as molten salts, solids, or solutions. The acidic gases that are present (not including CO_2), at some intermediate stage, are converted into the corresponding sodium salts and do not appear in the overall mass balance results.

9. The materials that do not react do not affect the calculations for chemical reactions and pass through the systems unchanged. These unchanged materials include

    - excess oxygen,
    - nitrogen in air,
    - excess caustic, and
    - water in the off-gas treatment solutions or the waste feeds.

    The compositions of the waste residuals show these unreacted materials as appropriate.

10. The principal reactions of the waste elements with oxygen and caustic are so favorable and so complete that the equilibrium concentrations of reactants or intermediates are not significant from a mass balance viewpoint. Any significant residues from a hazard viewpoint are determined by kinetics and cannot be calculated from the available data. These low concentrations of CO, NO_x, organic residues, etc., can only be determined experimentally for each system but are assumed to meet air-quality emission limitations.

11. The behavior of the toxic or radioactive metals in the waste feed are best considered separately from the primary mass balances. These metals may change physical or chemical form, but they will remain toxic or radioactive in the residuals. The mass amounts are too small to have significant effects on the amounts of oxygen or caustic reacted and commonly have no or small effects on the masses of the residual wastes. The behavior and the final locations of the metals will depend on the temperatures, the amounts of solid entrainment, etc., and cannot be determined from the assumptions listed above. Most of the radionuclides will divide between the ash or solid products and the

off gas as either volatile forms or entrained solids. Subsequent treatment of the salt and scrubber residuals may be necessary to limit the leachability of metals below EPA standards.

12. The saturation efficiency of caustic solutions (NaOH or Na_2CO_3) was assumed to be

    - 95 percent by weight for OR TSCA;
    - 90 percent by weight for INEL WERF, SRS CIF, and LANL CAI; and
    - 30 percent by weight for RF FBU/PROD.

    These values were based on the operators' experience and understanding of their systems. "Saturation efficiency" is defined as the point at which the caustic consumed by weight is nearing the level at which acidic gases may not be fully treated.

13. For MSO, the saturation efficiency of the Na_2CO_3 was assumed to be 90 percent by weight unless the ash content (undissolved impurities) exceeded 20 percent by weight, and, thus, ash content became the controlling factor for salt-melt wasting. Extensive testing by Rockwell has shown that the 98 percent saturation level can be achieved prior to HCl breakthrough. For operating purposes, however, the more conservative 90-percent saturation efficiency is used. Ash content affects the viscosity of the molten salt; above 25 percent, the melt becomes too viscous for operating purposes. The 20-percent value is used as a threshold to represent a conservative operating approach.

6.3 Primary Reactions

The primary reactions of the waste feeds are simple when the compositions are considered by the ultimate analysis of elements. The primary overall reactions with oxygen and the caustic along with the relative mass amounts are

$$\underset{1.000}{C} + \underset{2.667}{O_2} \rightarrow \underset{3.667}{CO_2} \qquad (6\text{-}1)$$

$$\underset{1.000}{H} + \underset{8.000}{1/4O_2} \rightarrow \underset{9.000}{1/2H_2O} \qquad (6\text{-}2)$$

For chlorine and the two different caustics used at DOE facilities

$$\begin{array}{ccccccccc} Cl & + & NaOH & \rightarrow & NaCl & + & 1/2H_2O & + & 1/4O_2 \\ 1.000 & & 1.128 & & 1.648 & & 0.254 & & 0.226 \end{array} \tag{6-3}$$

$$\begin{array}{ccccccccc} Cl & + & 1/2Na_2CO_3 & \rightarrow & NaCl & + & 1/2CO_2 & + & 1/4O_2 \\ 1.000 & & 1.495 & & 1.648 & & 0.621 & & 0.226 \end{array} \tag{6-4}$$

For fluorine and two different caustics

$$\begin{array}{ccccccccc} F & + & NaOH & \rightarrow & NaF & + & 1/2H_2O & + & 1/4O_2 \\ 1.000 & & 2.105 & & 2.210 & & 0.474 & & 0.421 \end{array} \tag{6-5}$$

$$\begin{array}{ccccccccc} F & + & 1/2Na_2CO_3 & \rightarrow & NaF & + & 1/2CO_2 & + & 1/4O_2 \\ 1.000 & & 2.790 & & 2.210 & & 1.158 & & 0.421 \end{array} \tag{6-6}$$

For phosphorus (Waste 9), the following reactions apply

$$\begin{array}{ccccc} P & + & 5/4O_2 & \rightarrow & 1/2P_2O_5 \\ 1.000 & & 1.292 & & 2.292 \end{array} \tag{6-7}$$

$$\begin{array}{ccccccc} P_2O_5 & + & 6NaOH & \rightarrow & 2Na_3PO_4 & + & 3H_2O \\ 1.000 & & 1.691 & & 2.310 & & 0.380 \end{array} \tag{6-8}$$

$$\begin{array}{ccccccc} P_2O_5 & + & 3Na_2CO_3 & \rightarrow & 2Na_3PO_4 & + & 3CO_2 \\ 1.000 & & 2.240 & & 2.310 & & 0.930 \end{array} \tag{6-9}$$

Any oxygen in the waste feed replaces an equal mass of oxygen feed as air. The amounts of metals are not significant from a mass balance viewpoint (see assumption in Section 6.2), and the behavior or reactions of the metals are considered separately. When the caustic feed is NaOH, the sodium hydroxide will react with CO_2 to form Na_2CO_3, and the final form of excess caustic is Na_2CO_3 instead of NaOH. Normally, the amount of CO_2 reacted in this way is not significant when compared with the total amount of CO_2 formed. For the purposes of this report, this reaction was assumed to be equal to zero because, in practice, the caustic solution is recycled, and both the sodium hydroxide and the sodium carbonate are consumed in acid-gas scrubbing. However, in reality the total amounts of waste gas for most incinerators will be much different than those listed here. The temperature control for a typical incinerator is achieved through additions of auxiliary fuel and excess air, which can add significantly to the waste-gas volume.

6.4 Mass Balances

The mass balances for the 10 wastes identified in Table 6-1 are presented in Table 6-2 for each site-specific thermal treatment system and are based on 1.0 kg of waste being treated. Table 6-3 presents the same information except treatment is by MSO. Comparisons of the waste gases for the site-specific thermal systems and MSO are developed in Tables 6-4 and 6-5, respectively. Table 6-6 summarizes the residual products for each waste by both the site-specific thermal system and MSO. Figure 6-1 presents a graphical representation of the principal off-gas products (CO_2 and H_2O); Figures 6-2 and 6-3 show the solid and liquid residuals for the two types of treatment. Note that the ash, metals, NaCl, and NaF in Figures 6-2 and 6-3 are representative of the entire system (i.e., the main treatment unit and all ancillary components). Appendix H presents an example mass balance calculation.

6.5 Discussion of Mass Balance Results

The mass balance results by themselves do not provide any clear differences between the different types of incinerators. The oxidations using air give the same chemical reactions and the same overall products for all systems.

The differences in final waste forms result mainly from differences in off-gas treatments. Most of the off-gas treatments are interchangeable for the different types of incinerators. There are many different combinations of dry and aqueous treatments to cool the off-gases, remove acidic products of oxidation, remove entrained solids, and remove aqueous droplets or water vapor.

On the other hand, the MSO process is unique in that it allows an efficient utilization of the Na_2CO_3 caustic and produces a very low concentration of acidic gases in the off gas without use of aqueous caustic solutions. The incinerator systems use one of the following off-gas treatments:

- Aqueous scrubbers that produce caustic solution/slurries as waste forms;
- Dry caustic treatments that result in low (25 to 50 percent) utilizations of caustic; or
- No caustic treatments that restrict the allowable waste to those with low concentrations of Cl and F.

High ash/metal/solid concentrations require large discharges of unreacted Na_2CO_3 to limit undissolved concentrations to 20 percent by weight. The mass balance results confirm quantitatively that MSO treatment is best for wastes with low ash, metal, or solid concentrations. High halogen (Cl, F) concentrations in the waste feed also result in large consumptions of Na_2CO_3 to give sodium salts, but the same waste feeds to incinerators also give equal caustic consumptions and amounts of sodium salts from their off-gas treatments. However, incinerators using wet acid-gas scrubbing systems have large quantities of excess water in their residual wastes.

The primary mass balances do not directly identify the final waste form problems and differences. The toxic or radioactive metals may change physical or chemical forms, but they remain toxic or radioactive in the products. The concentrations of organic compounds are too low to be significant. The final compositions and locations of toxic or hazardous residues are determined by reaction kinetics and/or physical transfer effects and cannot be calculated as simple mass balance results from chemical reactions. Experimental results for specific incinerator systems are necessary to make this determination.

Table 6-1. Composition of Selected Waste Streams

Description	Waste Characteristics				
Waste Number	1	2	3	4	5
Associated Thermal Treatment Unit Location	RF	INEL	SRS	LANL	INEL
Waste Name or Description	Oil/Solvent	Decontamination Solvent	DWPF Benzene	LBL Scintillation Fluid	TRU Graphite
Amount	3681 ft^3	21 Units; 55-Gal Drums	189 m^3/yr (Future)	3.4 m^3/yr	248,000 kg; 2027 Drums
Ultimate Compositions (Weight Fractions)					
C	0.84	0.80	0.92	0.83	0.97
H	0.15	0.14	0.08	0.15	Small
Cl	0.00224	0.05		0.01[a]	≤0.01
F	<0.001				≤0.01
O					≤0.01
Ash/Metals[a]	≤0.01	≤0.01		≤0.01	≤0.03
Physical Properties					
Density (g/ml)	0.887	0.90	0.88	0.9	N/A
Volume (L/kg)	1.127	1.1	1.14	1.1	N/A
Radionuclide Concentration (pCi/kg)					
H-3 (tritium)				1.2×10^{10}	
C-14				3.0×10^{7}	
I-125				2.0×10^{7}	
Sr-90/Y-90		5.0×10^{6}			
Cs-137/Ba-137		3.2×10^{7}			
Co-60		2.5×10^{7}			
Total Beta					
U alpha	4.96				
Pu alpha	10.71	5.9×10^{6}			
Total Alpha	27.06				
Metal Concentrations (ppm)					
Pb	92	≤15			
Hg		≤15			
Ag		≤15			
Cr		≤15			
Be	6.2				
Na+K	1000				

[a] Assumed for mass balance calculations.

Table 6-1 (continued). Composition of Selected Waste Streams

Description	Waste Characteristics				
Waste Number	6	7	8	9	10
Associated Thermal Treatment Unit Location	OR	OR	OR	OR	OR
Waste Name or Description	BETTIS Oil/MSF-008,010	Perfluorodimethyl-cyclohexane (C_8F_{16})	Trichlorohepta-fluorobutane ($C_4Cl_3F_7$)	ORNL Waste Oil[a]	2/3 oil/1/6 tetra-chloroethane ($C_2H_2Cl_4$)[b]
Amount	1.7 m^3/yr, 8 Drums (55 gal[a])	N/A	N/A	15,000 gal	25,000 gal
Ultimate Composition (weight fraction)					
C	0.84	0.240	0.167	0.795	0.612
H	0.15			0.141	0.104
Cl			0.370	0.050	0.242
F		0.760	0.463	<0.001	0.006
Ash/Metals	≤0.01				0.036[c]
Physical Properties					
Density (g/ml)	0.9	1.86	1.76	0.90	1.083
Volume (L/kg)	1.1	0.537	0.569	1.114	0.923
Radionuclide Concentration (pCi/L)					
Sr-90/Y-90	4 x 10^6				
Cs-137/Ba-137	4 x 10^6				
Eu-152/Eu-154	2 x 10^6				
Uranium Alpha				1.0 x 10^4	
Total Alpha				1.0 x 10^5	
Total Beta				1.4 x 10^5	
Total Radioactivity					2,500
Metal Concentration (ppm)					
P				15,000	
U					5,900
Hg	1				
Ag	10				
Th				35	
Cr	14				440
Cd					53
Be				0.05	250
Pb				9.	

[a] *Analyses of 9/30/91 as reported by K.G. Edgemon for ORNL waste oil.*

[b] Large solvent wastes at Y-12, personal communication with T.J. Abraham, 9/28/92.

[c] Not included in primary reactions and listed as a product without change.

Table 6-2. Mass Balance Results for Treatment of 1.000 kg of Selected Waste by Site-Specific Thermal Systems

Description	Mass Balance Results for Treatment by Site-Specific Thermal Treatment Systems Basis: 1.000 kg of Waste Feed (See Table 4-2 for compositions); All Amounts in kg Unless Otherwise Stated									
Waste Number	1	2	3	4	5	6	7	8	9	10
Waste Name or Description	Oil/Solvent	Decontamination Solvent	DWPF Benzene	LBL Scintillation Fluid	TRU Graphite	BETTIS Oil/MSF-008,010	Perfluoro-dimethylcyclohexane (C_8F_{16})	Trichloro-heptafluoro-butane ($C_4Cl_3F_7$)	ORNL Waste Oil	1/3 oil/1/5 tetra-chloroethane ($C_2H_2Cl_4$)
Thermal Treatment Systems	RF FBU/ PROD	INEL WERF	SRS CIF	LANL CAI	INEL WERF	OR TSCA	OR TSCA	OR TSCA	OR TSCA	OR TSCA
Caustic	Na_2CO_3	NaOH	NaOH	NaOH	NaOH	NaOH	NaOH	NaOH	NaOH	NaOH
Stoichiometric Reactants										
O_2 Reacted	3.440	3.254	3.078	3.414	2.587	3.440	0.320	0.166	3.251	2.406
Na_2CO_3 or NaOH for Cl	0.0033	0.056		0.011	<0.015		-0-	0.417	0.055	0.273
Na_2CO_3 or NaOH for F	0.003				0.028		1.600	0.975	≤0.002	0.013
Na_2CO_3 or NaOH for P_2O_5									0.058	
Total Reactants	4.446	4.310	4.078	4.425	5.630	4.440	2.920	2.558	4.366	3.692
Stoichiometric Products										
CO_2	3.081	2.934	3.385	3.044	3.557	3.080	0.880	0.612	2.912	2.244
H_2O from H	1.350	1.260	0.692	1.350	Small	1.350	-0-	-0-	1.268	0.936
H_2O from NaOH	-0-	0.013	-0-	0.002	<0.007	-0-	0.360	0.313	0.026	0.064
NaCl	0.0037	0.082		0.016	≤0.016		-0-	0.610	0.083	0.399
NaF	<0.002	-0-			≤0.020		1.680	1.023	-0-	0.013
Na_3PO_4									0.079	
Other (feed amounts)	≤0.010	≤0.010	-0-	≤0.010	≤0.030	≤0.010	-0-	-0-	-0-	0.036
Total Stoichiometric Products	4.447	4.311	4.077	4.422	3.630	4.440	2.920	2.558	4.368	3.692
Excess Reactants Required to Maintain Treatment Efficiency										
Saturation Efficiency of Caustic	30%	90%	90%	90%	90%	95%	95%	95%	95%	95%
Excess NaOH or Na_2CO_3	0.0133	0.009	-0-	0.0018	0.004	-0-	0.088	0.086	0.009	0.022
Total Dry Product	0.029	0.10	-0-	0.028	0.070	0.010	1.768	1.719	0.171	0.470
Water in Residual Wastes[a]	-0-	0.091	-0-	0.018	0.040	-0-	1.768	1.719	0.171	0.434

[a] To represent this waste in a slurry form the salts and excess caustic collected in the blowdown are assumed to contain an equal amount of water by mass.

Table 6-3. *Mass Balance Results for Treatment of 1.000 kg of Selected Waste by MSO*

Description	Mass Balance Results for Treatment by MSO Basis: 1.000 kg of Waste Feed (See Table 4-2 for compositions); All Amounts in kg Unless Otherwise Stated									
Waste Number	1	2	3	4	5	6	7	8	9	10
Waste Name or Description	Oil/Solvent	Decon. Solvent	DWPF Benzene	LBL Scintillation Fluid	TRU Graphite	BETTIS Oil/MSF-008,010	Perfluoro-dimethylcyclo-hexane (C_8F_{16})	Trichloro-heptafluorobutane ($C_4Cl_3F_7$)	ORNL Waste Oil	2/3 oil/1/6 tetra-chloroethane ($C_2H_2Cl_4$)
Stoichiometric Reactants										
O_2 Reacted	3.440	3.254	3.078	3.414	2.587	3.440	0.320	0.166	3.251	2.406
Na_2CO_3 for Cl	0.0033	0.075		0.015	<0.015		0	0.553	0.075	0.362
Na_2CO_3 for F	0.003				0.028		2.120	1.292	0	0.017
Na_2CO_3 for P_2O_5									0.077	
Total Reactants	4.446	4.329	4.078	4.429	3.630	4.440	3.440	3.011	4.403	3.785
Stoichiometric Products										
CO_2	3.081	2.965	3.385	3.050	3.563	3.080	1.760	1.376	2.975	2.410
H_2O from H	1.350	1.260	0.692	1.350	Small	1.350	0	0	1.268	0.936
NaCl	0.0037	0.082		0.016	≤0.016		0	0.610	0.083	0.399
NaF	<0.002				≤0.020		1.680	1.023	0	0.013
Na_3PO_4									0.074	
Other (feed amounts-ash)	≤0.01	≤0.01	-0-	≤0.01	≤0.03	≤0.01	0	0	0	0.036
Total Stoichiometric Products	4.448	4.328	4.077	4.428	3.631	4.440	3.440	3.009	4.400	3.785
Excess Reactants Required to Maintain Treatment Efficiency										
Saturation Efficiency of Caustic	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
Excess Na_2CO_3	0.0006	0.009	0	0.0018	0.004	0	0.187	0.181	0.017	0.046
Saturation Efficiency of Ash	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Excess Salts for Ash	0.04	0.04	-0-	0.04	0.12	0.04	-0-	-0-	-0-	0.144
Melt Chemistry Controlling Discharge of Waste Melt	Ash	NaCl		Ash	Ash	Ash	NaF	NaCl + NaF	NaCl + Na_3PO_4	NaCl + NaF
Total Waste Melt (as discharged)	0.05	0.101	-0-	0.05	0.15	0.05	1.867	1.814	0.174	0.494

Table 6-4. Waste Gases From Treatment of 1.000 kg of Selected Waste by Site-Specific Thermal Systems

Description	Waste Treatment Characteristics Basis: 1.000 kg of Waste Feed (See Table 4-2 for compositions); All Amounts in kg Unless Otherwise Stated									
Waste Number	1	2	3	4	5	6	7	8	9	10
Waste Name or Description	Oil/Solvent	Decon. Solvent	DWPF Benzene	LBL Scintillation Fluid	TRU Graphite	BETTIS Oil/MSF-008,010	Perfluoro-dimethylcyclo-hexane (C_8F_{16})	Trichloro-heptafluoro-butane ($C_4Cl_3F_7$)	ORNL Waste Oil	2/3 oil/1/6 tetra-chloroethane ($C_2H_2Cl_4$)
Thermal Treatment Systems	RF FBU/ PROD	INEL WERF	SRS CIF	LANL CAI	INEL WERF	OR TSCA	OR TSCA	OR TSCA	OR-TSCA	OR-TSCA
Oxygen Feed[c]										
Excess O_2 (%)	100[a]	50[a]	70[a]	50[a]	50[a]	70[a]	50[a]	50[a]	50[a]	50[a]
Excess O_2 (kg)	3.440	1.627	2.155	1.707	1.294	2.408	0.160	0.083	1.625	1.203
Total O_2 (kg)	6.880	4.881	5.233	5.121	3.881	5.848	0.480	0.249	4.875	3.609
Waste Gases to Vent Stack										
O_2 (gram moles)	107.5	50.8	67.3	53.3	40.4	75.3	5.0	2.6	50.8	37.6
N_2+Ar (gram moles)	808.8	575.9	615.2	604.2	457.9	690.0	56.4	29.3	573.1	425.6
CO_2 (gram moles)	70.0	67.4	76.9	69.3	81.1	70.0	20.0	13.9	66.9	54.6
H_2O (gram moles)	75.0[b]	70.0[b]	33.[b]	32.[b]	Small	37.[b]	-0-	-0-	31.[b]	52.0[b]
TOTAL GRAM MOLES	1061.3	764.1	792.4	758.8	579.4	872.3	81.4	45.8	721.8	569.8
O_2 (MOL %)	10.1	6.7	8.5	7.0	7.0	8.6	6.1	5.7	7.0	6.6
N_2+Ar (MOL %)	76.2	75.3	77.6	79.6	79.0	79.1	69.3	64.0	79.4	74.7
CO_2 (MOL %)	6.6	8.8	9.7	9.1	14.0	8.0	24.6	30.3	9.3	9.6
H_2O (MOL %)	7.1	9.2	4.2	4.2	-0-	4.2	-0-	-0-	4.3	9.1

[a] Estimated values of excess O_2.

[b] Quenched to saturation at 30 °C.

[c] Assumed mixture of air as 21% O_2 and 79% of N_2+Ar. CO_2 and H_2O were assumed to be zero.

Table 6-5. *Waste Gases From Treatment of 1.000 kg of Selected Waste by MSO*

Description	Waste Treatment Characteristics Basis: 1.000 kg of Waste Feed (See Table 4-2 for compositions); All Amounts in kg Unless Otherwise Stated									
Waste Number	1	2	3	4	5	6	7	8	9	10
Waste Name or Description	Oil/Solvent	Decon. Solvent	DWPF Benzene	LBL Scintillation Fluid	TRU Graphite	BETTIS Oil/MSF-008,010	Perfluoro-dimethylcyclo-hexane (C_8F_{16})	Trichloro-heptafluoro-butane ($C_4Cl_3F_7$)	ORNL Waste Oil	2/3 oil/1/5 tetra-chloroethane ($C_2H_2Cl_4$)
Thermal Treatment Systems	MSO	MSO	MSO	MSO	MSO	MSO	MSO	MSO	MSO	MSO
Oxygen Feed[c]										
Excess O_2 (%)	33.3[a]	33.3[a]	33.3[a]	33.3[a]	33.3[a]	33.3[a]	33.3[a]	33.3[a]	33.3[a]	33.3[a]
Excess O_2 (kg)	1.15	1.08	1.03	1.14	0.86	1.15	0.107	0.055	1.084	0.802
Total O_2 (kg)	4.59	4.34	4.10	4.55	3.45	4.59	0.427	0.221	4.335	3.208
Waste Gases to Vent Stack										
O_2 (gram moles)	35.9	33.8	32.1	35.6	26.9	35.9	3.3	1.7	33.9	25.1
N_2+Ar (gram moles)	541.6	512.1	482.6	536.9	407.1	541.6	50.4	26.0	509.6	378.5
CO_2 (gram moles)	70.0	67.4	76.93	69.3	81.1	70.0	20.0	13.9	67.6	54.6
H_2O (gram moles)	75.0[b]	70.0[b]	40.0[b]	75.0[b]	Small	75.0[b]	0	0	70.4[b]	52.0[b]
TOTAL GRAM MOLES	722.5	683.3	631.7	716.8	515.0	722.5	73.7	41.6	682.6	510.2
O_2 (MOL %)	5.0	4.9	5.1	5.0	5.2	5.0	4.5	4.1	5.0	4.9
N_2+Ar (MOL %)	74.9	75.0	76.4	74.8	79.1	74.9	68.4	62.5	74.7	74.2
CO_2 (MOL %)	9.7	9.9	12.2	9.7	15.7	9.7	27.1	33.4	9.9	10.7
H_2O (MOL %)	10.4	10.2	6.3	10.5	Small	10.4	0	0	10.5	10.2

[a] Estimated values of excess O_2.

[b] Quenched to saturation at 30 °C.

[c] Assumed mixture of air as 21% O_2 and 79% of N_2+Ar. CO_2 and H_2O were assumed to be zero.

Table 6-6. *Residual Waste Summary From Treatment of 1,000 kg of Selected Waste by Site-Specific Thermal Systems and MSO*

Residual Waste Summary Basis: 1.000 kg of Waste Feed (See Table 4-2 for compositions)										
Waste Number	1	2	3	4	5	6	7	8	9	10
Waste Name or Description	Oil/Solvent	Decon. Solvent	DWPF Benzene	LBL Scintillation Fluid	TRU Graphite	BETTIS Oil/MSF-008,010	Perfluoro-dimethylcyclohexane (C_8F_{16})	Trichloro-heptafluorobutane ($C_4Cl_3F_7$)	ORNL Waste Oil	2/3 oil/1/6 tetra-chloroethane ($C_2H_2Cl_4$)
Thermal Treatment Systems	RF FBU/ PROD	INEL WERF	SRS CIF	LANL CAI	INEL WERF	OR TSCA	OR TSCA	OR TSCA	OR TSCA	OR TSCA
Residual Products From Treatment of 1.000 kg of Waste by Site-Specific Thermal Treatment Systems										
Solids (kg)	0.029	0.10	-0-	0.028	0.070	0.010	1.768	1.719	0.171	0.470
Liquids - H_2O From Acid Scrubbers (kg)	-0-	0.091	-0-	0.018	0.040	-0-	1.768	1.719	0.171	0.434
Gases (gram moles)	1061.3	764.1	792.4	758.8	579.4	872.3	81.4	45.8	721.8	569.8
Residual Products From Treatment of 1.000 kg of Waste by MSO										
Solids (kg)	0.050	0.101	-0-	0.05	0.15	0.05	1.867	1.814	0.174	0.494
Liquids - H_2O (kg)	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-	-0-
Gases (gram moles)	722.5	683.3	631.7	716.8	515.0	722.5	73.7	41.6	682.6	510.2

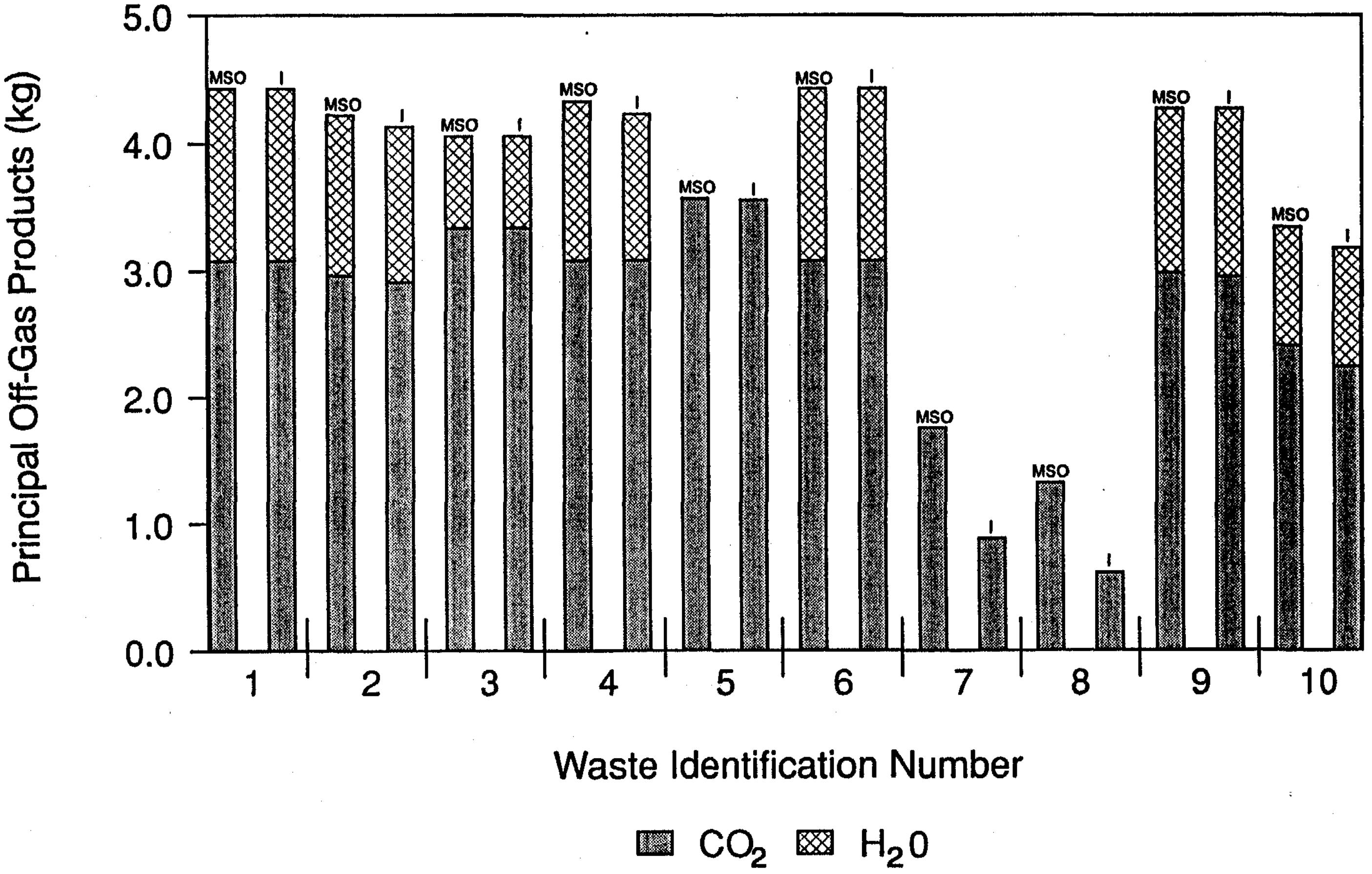


Figure 6-1. Principal Off-Gas Products (CO_2 and H_2O) From Treatment of 1.0 kg of Waste by MSO and Site-Specific Thermal Treatment Units

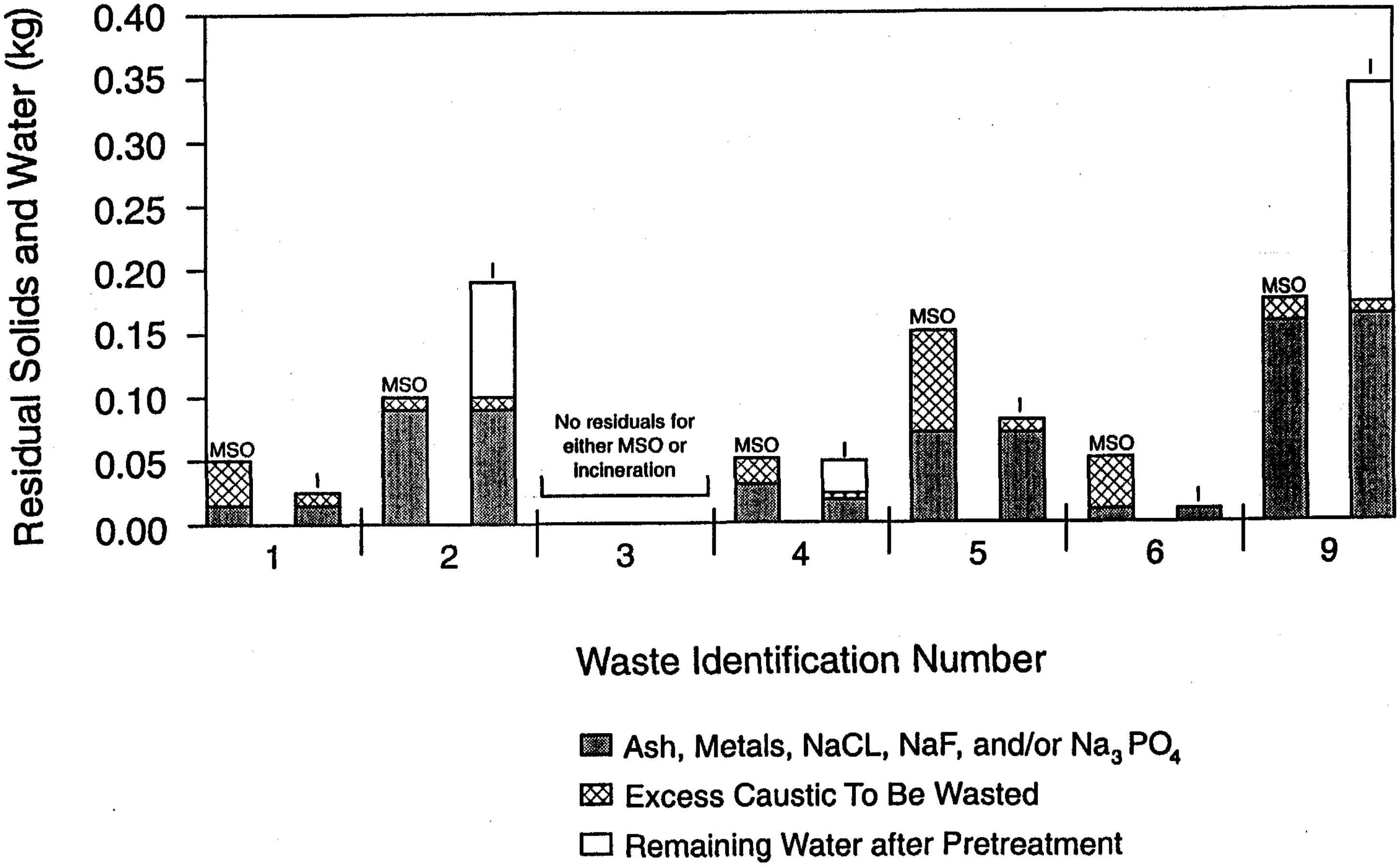


Figure 6-2. Residual Solids and Water From Treatment of 1.0 kg of Waste by MSO and Site-Specific Thermal Treatment Units

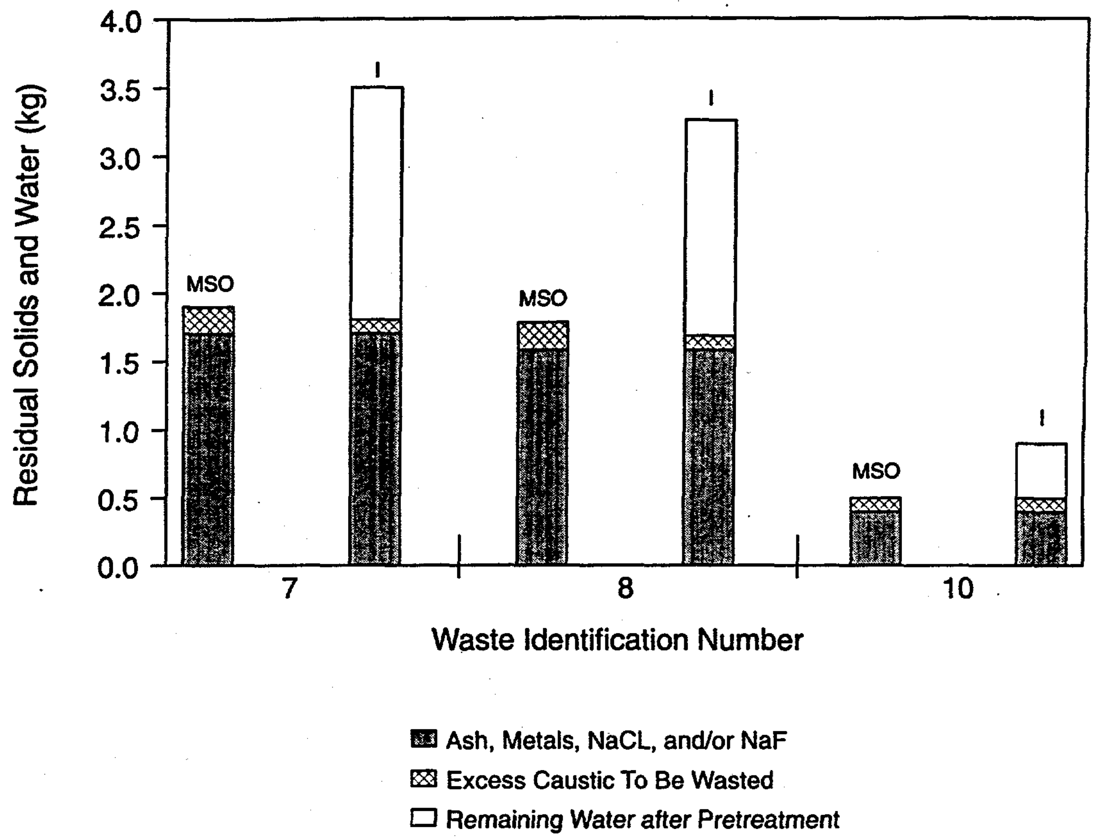


Figure 6-3. Residual Solids and Water From Treatment of 1.0 kg of Halogenated Wastes by MSO and Site-Specific Thermal Treatment Units

Section 7.0

Waste Form Treatment

MSO and incineration (and all other potential mixed-waste treatment technologies) generate residual products that may require further treatment. The need for additional treatment is due to regulatory requirements rather than the character of the residual produced from a particular technology.

The handling of waste from a mixed-waste treatment technology is dictated, in large part, on whether the original waste feed was a characteristic or listed mixed waste under RCRA. For a ***characteristic*** mixed waste, if the characteristic (e.g., flammability, corrosivity, reactivity, and toxicity) is removed from the original material, then the final residual may be disposed of in a landfill that accepts radioactive wastes, assuming all of the waste acceptance criteria are met. If a residual is hazardous because it is a ***listed*** waste, however, the final waste form must always be disposed of in a hazardous waste landfill. Furthermore, if the residual is regulated by LDRs, it must be treated to a certain concentration level or by a specified treatment process before disposal in a hazardous-waste landfill.

The final disposal options are further restricted for RCRA wastes mixed with radioactive wastes, particularly RCRA listed waste. Listed mixed wastes that are treated so that the RCRA component meets the strict requirements of a hazardous-waste landfill will generally not be accepted because of the radioactive contamination. In this case, it may eventually be possible to dispose of these wastes in a DOE disposal unit that is permitted under RCRA (no approved DOE mixed-waste disposal facilities currently exist), or it may be possible to further treat the waste form to separate the radioactive component. Both components will still require disposal in a hazardous-waste landfill, but separation may reduce the volume of radioactively contaminated waste. Disposal options for listed mixed wastes will depend on the constituents and their concentrations in the original waste; all residual products will be considered listed and will require disposal in a RCRA-approved mixed-waste landfill.

Another potential option is to "delist" the residuals. However, delisting is a difficult process that likely will not be possible or practical for most of DOE's mixed-waste inventory (detailed process information is required to apply for delisting; this is not available for many wastes or the waste-generating process may be classified). The net effect is that *the existing regulations governing mixed waste and the type of mixed waste treated have a much greater impact on the acceptability of a final waste form than the treatment technology used.* In other words, all thermal treatment technologies that neutralize acid off gases (e.g., MSO, incineration, plasma arc furnace, supercritical water oxidation) will have the same type of obstacles (if they exist) concerning the acceptability and treatment of secondary wastes.

7.1 Waste Form Categories

The waste type and the anticipated waste handling information for the five DOE incinerators and an MSO unit is summarized in Table 7-1. Although site personnel anticipate waste treatment/handling options, these options may change depending on what is being treated and what other, possibly enhanced, options are available. Table 7-2 summarizes these final

Table 7-1. Waste Type and Waste Handling Information for Five DOE Incinerators and an MSO Unit

Waste Type/Waste Handling Information	Treatment Unit[a]					
	OR TSCA	LANL CAI	INEL WERF	SR CIF	RF FBU/PROD	MSO
Primary Type of Waste Solid Produced	Ash Slurry	Dry Ash	Dry Ash	Grout	Dry Ash	Solid Salt
Secondary Type of Waste Solid Produced	None	HEPA Filters/ Activated Carbon	HEPA Filters	HEPA Filters	HEPA Filters	HEPA Filters
Anticipated Final Waste Form of the Ash	None[b]	Cement; Glassification by 1998	Cement	Portland II Concrete	Microwave/ Vitrification	[c]
Anticipated Final Waste Form of the Dewatered Slurry	None[d]	Feedback into Incinerator	None	Immobilized in Bitumen	None	None

[a] More information on the treatment units is provided in Table 5-1.

[b] Currently under assessment.

[c] This will depend on the type of waste being treated. If additional treatment is required, it may involve dissolving the salt, precipitation, filtration, or ion exchange.

[d] Microwave melting is currently being investigated.

Table 7-2. Waste Form Treatment Options

Waste Form Category	Subcategory	Options
Glass	Melter Plasma Arc Furnace	
Hydraulic Cement		Portland Cement Gypsum Cement Grout Slag Cement Polymer-Modified Cement Other
Sulfur Polymer Cement		
Ceramics	Crystalline	Silicate-Based Ceramics Aluminate-Based Ceramics Phosphate-Based Ceramics Titanate-Based Ceramics
	Chemically Bonded	
Organic Binders	Thermoplastic Systems	Polyethylene Bitumen
	Thermosetting Systems	Polyesters Epoxy

waste-form treatment options; the summary is based on the DOE draft report *Technical Area Status Report for Low-Level Mixed Waste Final Waste Forms* [16]. These waste form options are described below.

Glass—Glass is generated by mixing hazardous compounds with glass-forming materials and melting these materials during a vitrification process. The glass-forming materials may be commercially available glass frit, added chemicals, or components of the waste streams. EPA has determined that vitrification is the BDAT for high-level nuclear waste.

Generating a final glass waste form via thermal vitrification can be accomplished by using fossil fuel combustion, electric joule heating, plasma arc melting, graphite arc melting, in situ vitrification, and induction and microwave heating. This wide variety of technologies provides specific advantages and disadvantages for certain waste streams; however, for the purposes of this report, they are organized into the categories of melter and plasma arc furnaces.

Hydraulic Cement—Hydraulic cements may exhibit physical encapsulation and/or chemical bonding characteristics that are dependent on the cementing agent, water content, and waste stream involved. Hydraulic cement is the most commonly referenced treatment technique in the LLW solidification literature. The major hydraulic-cement base agents are

> *Portland Cement*: This material is generally composed of calcium silicate species that are inherently pH basic and may be used to at least partially neutralize acidic wastes.
>
> *Gypsum Cement*: Gypsum is a calcium sulfate mineral; an example of gypsum is plaster of Paris. Gypsum cements are generally a neutral pH (when mixed with water). They typically set faster than Portland cement but produce lower strength products.
>
> *Grout*: Grout is a pumpable mixture with a cement, clay, or fly-ash base that typically solidifies more slowly and has lower mechanical strength than Portland cement.
>
> *Slag Cement*: Blast-furnace slag cement, which is a by-product of the steel industry, generally exhibits better waste retention properties and leach performance than Portland cement but exhibits lower strength characteristics.
>
> *Polymer-Modified Cements*: Polymer modification is a technique to enhance the characteristics of the previously listed hydraulic cements by improving leach performance, waste retention properties, and physical strengths.
>
> *Other*: Other hydraulic cements include pozzolan and alumina cements. Pozzolan materials exhibit higher compressive strengths and better waste retention than some other cements. Alumina cements have different material capabilities, generally have lower waste loadings, usually are more expensive, and are not commonly available when compared with pozzolan materials.

Sulfur Polymer Cement—These are cements that consist of 95-weight-percent sulfur, 2.5-weight-percent dicyclopentadiene, and 2.5-weight-percent oligomers of cyclopentadiene. Sulfur polymer cement (SPC) is a commercially available, thermoplastic, low-temperature ceramic that does not tolerate water in the mix; water forms steam vents that weaken the cement. SPC is a durable, high-strength concrete that resists abrasion and degradation.

Ceramics—Ceramics consists of crystalline materials (a long-range ordered structure formed using high temperatures) and chemically bonded materials (manufactured at lower temperatures but with similar structure). The four main classes of crystalline ceramics are silicate based, aluminate based, phosphate based, and titanate based. These materials are not all commercially available and offer different advantages depending on the material being treated. The most significant chemically bonded ceramics are phosphate-bonded ceramics, which are commercially available and have been used on heavy metal contaminated waste.

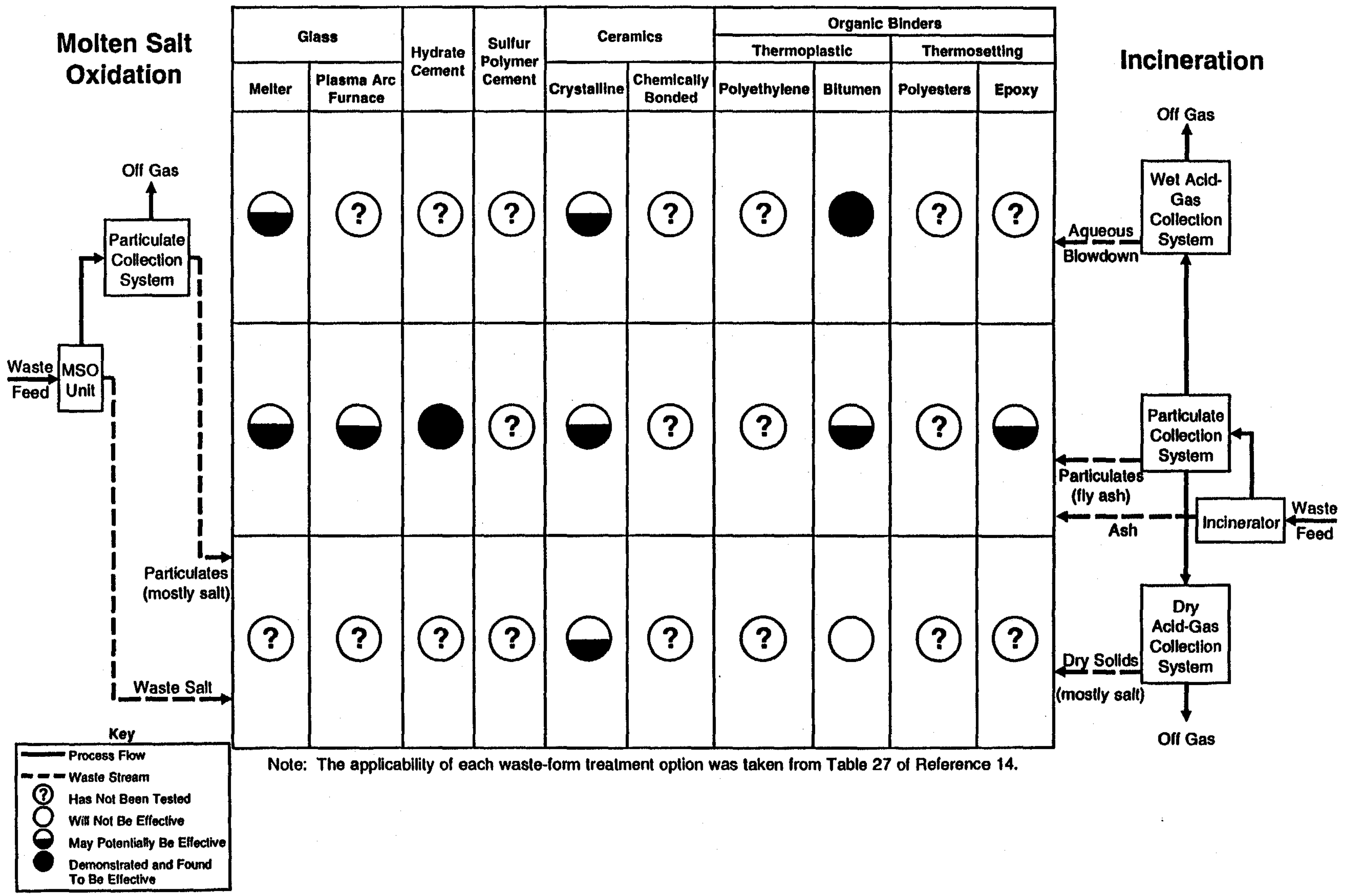
Organic Binders—Organic binders are mostly polymeric materials consisting of long polymer chains or chains that are branched or cross-linked to form three-dimensional network structures. Both types of structures provide encapsulation of the wastes and structural stability. Organics may either be thermoplastics or thermosetting polymers. Thermoplastics have been studied extensively during the past 50 years; solidification processes are simple and adaptable. On the other hand, thermosets form rigid solids that do not flow and require additives for polymerization. Typical thermoplastics are polyethylene and bitumen; common thermosets are polyesters and epoxy. Compressive strengths of organic binders are lower than those of glass and cement waste forms.

7.2 Treatment Options

The way that a residual is treated, either from MSO or incineration, will depend on the original waste feed. Nevertheless, some generic conclusions can be developed from the appropriate waste-form treatment options. Figure 7-1 presents an overview of the appropriateness of treatment options for residuals generated by MSO or incineration. This figure also shows that some waste forms are common to both MSO and incineration (waste salt and particulates from MSO and dry ash, which has a high salt content, from the incinerator acid-collection system). Although numerous treatment options are available, most have not been adequately tested to determine if they are appropriate for any of the residual wastes, even on a generic basis. Because of the variability in the residuals resulting from different waste feeds, it is clear that treatability studies will be needed to match waste forms to treatment options.

7.3 MSO Spent Salt Treatment

Several separate activities at ETEC and ORNL to treat spent salt for the removal of metals and/or radionuclides are currently ongoing or planned as part of the MSO Five-Year



Glass		Hydrate Cement	Sulfur Polymer Cement	Ceramics		Organic Binders			
						Thermoplastic		Thermosetting	
Melter	Plasma Arc Furnace			Crystalline	Chemically Bonded	Polyethylene	Bitumen	Polyesters	Epoxy
◒	?	?	?	◒	?	?	●	?	?
◒	◒	●	?	◒	?	?	◒	?	◒
?	?	?	?	◒	?	?	○	?	?

Note: The applicability of each waste-form treatment option was taken from Table 27 of Reference 14.

Figure 7-1. Final Waste Form Treatment Options

Implementation Plan. Treatability studies using ion exchange, filtration, chemical separation, and biosorption techniques are being performed. This work is coupled with well-established aqueous chemistry technology for salt processing. The intent of this work is to make the spent salt a listed hazardous "derived-from" residual rather than a mixed waste and thereby reduce the volume of mixed wastes requiring disposal.

Section 8.0

Conclusions

The primary purpose of this report is to provide an understanding of the residual products of treatment by incineration and MSO. This includes the regulatory arena that controls the disposal of residual products and the quantity and chemical composition of the residuals. Conclusions that can be drawn from this evaluation are

- The existing regulations governing mixed waste and the type of mixed waste treated have a much greater impact on the acceptability of the final waste form than the treatment technology used.

  - The process for delisting a "derived-from" RCRA waste is not suitable for the bulk of DOE's mixed wastes; therefore, the "derived-from" residuals will remain as mixed waste even if all traces of the hazardous contaminants are removed.

- DOE currently plans to incinerate a significant amount of its combustible waste, even though permitting and approvals for operation are questionable for some incineration systems. This is especially true in light of EPA's recent (May 18, 1993) actions that effectively place an 18-month moratorium on new incinerators. MSO is a noncombustion alternative to incineration that could treat a significant volume of DOE's waste.

  - Review of the *Waste Profile Report* [3] indicates that 880 EM-30 waste streams would be appropriate or potentially appropriate for treatment by MSO. This equals 95 percent of all EM-30 waste streams that could be or potentially could be treated by incineration. Typically, wastes that could not be treated by MSO are soils, inert solids, and debris. Information on each waste requires a case-by-case assessment if treatment by MSO or incineration is contemplated.

  - Review of the *Technology Needs Crosswalk* [4] data base of EM-40 problem units shows that approximately 60 percent of the problem units with organically contaminated materials could potentially be treated by MSO or incineration. These wastes are typically soil, water, or other media that would first undergo pretreatment steps to extract the contaminant(s) of concern. The remaining 40 percent is typically groundwater with dilute concentrations of organics that is more appropriate for other treatment technologies.

- The mass balance calculations conducted for MSO and incineration indicate that both systems generate nearly equal volumes of secondary waste (when treating equal volumes of the same waste and assuming an efficient dewatering of the incinerator raw blowdown waste stream). The same restrictions/regulations apply to the management of secondary waste streams generated by both systems.

  - MSO and incineration generate similar wastes consisting of ash, NaCl and/or NaF, excess caustic, and waste gases (see Figures 6-1, 6-2, and 6-3).

  - If secondary waste treatment obstacles exist for MSO, they also exist for every type of thermal treatment technology, including incineration, plasma arc furnace, and supercritical water oxidation.

  - With roughly equal volumes and types of secondary waste generated by incineration and MSO, the critical issue may be how the toxic and radioactive metals are dispersed in these waste streams and which systems result in the easiest isolation and containment of these compounds. The mass balance calculations do not address this issue.

  - Additional work is still needed to confirm the mass balance calculations, particularly for ancillary systems.

- The FFCA dictates that DOE must have approved site-specific mixed-waste plans for each site by October 1995. Therefore, decisions will be required in the near future regarding strategies for treating and managing mixed-waste streams.

  - This will place an emphasis on implementing existing or new technologies (such as MSO) to provide more mixed-waste treatment capacity.

Currently, several separate actions are occurring that affect the MSO program

- As part of the applied research activities of the MSO Five-Year Implementation Plan, ETEC and ORNL are performing numerous treatability studies using ion exchange, filtration, chemical separation, and biosorption techniques to remove metals and/or radionuclides. This work is coupled with well-established aqueous chemistry technology for salt processing. These efforts will have benefits for other thermal treatment technologies.

- DOE is providing input to the EPA rule-making committee that is reviewing changes to the hazardous-waste identification regulations. Final adoption of new regulations, as required by Congress, will occur prior to October 1994.

- EPA has effectively placed an 18-month moratorium on new incinerator permits while it reviews existing permits and makes a major overhaul of Federal rules governing incineration.

Section 9.0

References

1. Chem-Nuclear Geotech, Inc., 1992. *Technology Needs Assessment: Evaluation of the Molten Salt Oxidation Process Technology*, DOE/ID/12584-97, U.S. Department of Energy, Grand Junction Projects Office, Grand Junction, Colorado, January 1992.

2. Chem-Nuclear Geotech, Inc., 1992. *Molten Salt Oxidation Technology Five-Year Implementation Plan*, P-GJPO-650, U.S. Department of Energy, Grand Junction Projects Office, Grand Junction, Colorado, May 1992.

3. Waste Management Informaton System. *Waste Profile Report.*

4. Chem-Nuclear Geotech, Inc., 1993. *Technology Needs Crosswalk*, First Edition, DOE/ID/12584-117, U.S. Department of Energy, Grand Junction Projects Office, Grand Junction, Colorado, January 1993.

5. *RCRA Trial Burn Final Report for the Los Alamos Controlled Air Incinerator, Volume 1*, March 1987.

6. Rogers, T.O., R. Heller, and D. Blind, 1992. *TSCA Incinerator Testing and Operational Experience*, K/TSCA-029 (IT Corp.), March 1992.

7. Merle, L.J., F.G. Meyer, A.J. Johnson, and D.L. Ziegler, 1992. *Rocky Flats Plant Fluidized Bed Incinerator*, RFP-3249, March, 1982.

8. Energy and Environmental Research Co., 1992. *State of the Art Assessment of APC Systems and Monitoring Technologies for the Rocky Flats Fluidized Bed Unit*, Draft, EPA 68-CO-0094, November 1992.

9. Calculated from T.K. Thompsom, 1989. *New CAI Incinerator Material and Energy Balence Steady State*, Max CI, Los Alamos National Laboratory, Los Alamos, New Mexico, May 1989.

10. Koenig, R.A., 1992. *Summary of Radiactive and Mixed Waste Thermal Treatment Technologies within the Department of Energy Nuclear Weapons Complex*, 01-92EW30054.000, Merlin Co./Boulder, Inc., November 1992.

11. Dalton, J.D., R.L. Gillins, T.L. Harris, and A.L. Wollermann, 1992. *An Assessment of Off-Gas Treatment Technologies for Application to Thermal Treatment of Department of Energy Wastes*, DOE/MWIP-1 (SAIC Corp.), September 1992.

12. Crosley, S., 1992. *DOE Incineration Study, Table 1*, November 1992.

13. Bostick, W.D., D.H. Bunch, L.V. Gibson, D.P. Hoffmann, and J.L. Shoemaker, U.S. Department of Energy, Oak Ridge, Tennessee, 1990. *Effluent Testing for the Oak Ridge Mixed Waste Incinerator: Emissions Test for August 27, 1990*, K/QT-389, December 1990.

14. Neuls, A.S., W.E. Draper, R.A. Koenig, J.M. Newmyer, and C.L. Warner, 1982. *The Los Alamos Controlled Air Incinerator for Radioactive Waste, Volume 1*, LA-9427, August 1982.

15. Chem-Nuclear Geotech, Inc., 1992. *Molten Salt Oxidation Technology Progress Report*, DOE/ID/12584-119, U.S. Department of Energy, Grand Junction Projects Office, Grand Junction, Colorado, November 1992.

16. *Technical Area Status Report for Low-Level Mixed Waste Final Waste Forms*, Draft, DOE/MWIP-3, November 1992.

17. Burns, H.H., 1992. *Waste Treatment Evaluation for Aqueous Mixed Waste from Incineration*, Westinghouse Savannah River Company, WSRC-MS-92-143, Presented at the 11th Annual Incineration Conference, May 1992.

Section 10.0

Acknowledgments

This report is the result of a concerted team effort among personnel from the Grand Junction Projects Office (GJPO) and Oak Ridge National Laboratory (ORNL). At the GJPO, the project was managed by Tim Carlson; Clay Carpenter and Laura Cummins provided technical input and wrote several sections of this report. Jill Frantz did an excellent job of word processing and organizing the entire report while Publications provided editing, graphics, and reproduction support. The ORNL effort was lead by Jean MacInnis and coordinated through Sladjana Crosley. Technical input was provided by Christopher Maxwell, Paul Haas, and Lisa Nanstad. In addition, the following site contacts provided valuable information on the incinerators evaluated in this report: William Hermes, Fidel Perez, Luther Gibson (Oak Ridge National Laboratory); Dave Dalton (Idaho National Engineering Laboratory); Paul Williams (Rocky Flats Plant); Stan Zygmund (Los Alamos National Laboratory); Heather Holmes Burnes (Savannah River Site); and Ralph Koenig (Merlin Company, he provided flow diagrams for incinerators across the DOE complex). The Program Manager for this project was John Duray of GJPO.

Appendix A

RCRA Characteristic and Listed Wastes

(40 CFR 261.24 to 261.33; July 1, 1992)

Contents of Appendix A

sidered to be the extract for the purpose of this section.

(b) A solid waste that exhibits the characteristic of toxicity has the EPA Hazardous Waste Number specified in Table I which corresponds to the toxic contaminant causing it to be hazardous.

TABLE 1—MAXIMUM CONCENTRATION OF CONTAMINANTS FOR THE TOXICITY CHARACTERISTIC

EPA HW No.[1]	Contaminant	CAS No.[2]	Regulatory Level (mg/L)
D004	Arsenic	7440–38–2	5.0
D005	Barium	7440–39–3	100.0
D018	Benzene	71–43–2	0.5
D006	Cadmium	7440–43–9	1.0
D019	Carbon tetrachloride	56–23–5	0.5
D020	Chlordane	57–74–9	0.03
D021	Chlorobenzene	108–90–7	100.0
D022	Chloroform	67–66–3	6.0
D007	Chromium	7440–47–3	5.0.
D023	o-Cresol	95–48–7	[4] 200.0
D024	m-Cresol	108–39–4	[4] 200.0
D025	p-Cresol	106–44–5	[4] 200.0
D026	Cresol		[4] 200.0
D016	2,4-D	94–75–7	10.0
D027	1,4-Dichlorobenzene	106–46–7	7.5
D028	1,2-Dichloroethane	107–06–2	0.5
D029	1,1-Dichloroethylene	75–35–4	0.7
D030	2,4-Dinitrotoluene	121–14–2	[3] 0.13
D012	Endrin	72–20–8	0.02
D031	Heptachlor (and its epoxide).	76–44–8	0.008
D032	Hexachlorobenzene	118–74–1	[3] 0.13
D033	Hexachlorobutadiene	87–68–3	0.5
D034	Hexachloroethane	67–72–1	3.0
D008	Lead	7439–92–1	5.0
D013	Lindane	58–89–9	0.4
D009	Mercury	7439–97–6	0.2
D014	Methoxychlor	72–43–5	10.0
D035	Methyl ethyl ketone	78–93–3	200.0
D036	Nitrobenzene	98–95–3	2.0
D037	Pentrachlorophenol	87–86–5	100.0
D038	Pyridine	110–86–1	[3] 5.0
D010	Selenium	7782–49–2	1.0
D011	Silver	7440–22–4	5.0
D039	Tetrachloroethylene	127–18–4	0.7
D015	Toxaphene	8001–35–2	0.5
D040	Trichloroethylene	79–01–6	0.5
D041	2,4,5-Trichlorophenol	95–95–4	400.0
D042	2,4,6-Trichlorophenol	88–06–2	2.0
D017	2,4,5-TP (Silvex)	93–72–1	1.0
D043	Vinyl chloride	75–01–4	0.2

[1] Hazardous waste number.

[2] Chemical abstracts service number.

[3] Quantitation limit is greater than the calculated regulatory level. The quantitation limit therefore becomes the regulatory level.

[4] If o-, m-, and p-Cresol concentrations cannot be differentiated, the total cresol (D026) concentration is used. The regulatory level of total cresol is 200 mg/l.

[55 FR 11862, Mar. 29, 1990, as amended at 55 FR 22684, June 1, 1990; 55 FR 26987, June 29, 1990]

Subpart D—Lists of Hazardous Wastes

§ 261.30 General.

(a) A solid waste is a hazardous waste if it is listed in this subpart, unless it has been excluded from this list under §§ 260.20 and 260.22.

(b) The Administrator will indicate his basis for listing the classes or types of wastes listed in this subpart by employing one or more of the following Hazard Codes:

Ignitable Waste	(I)
Corrosive Waste	(C)
Reactive Waste	(R)
Toxicity Characteristic Waste	(E)
Acute Hazardous Waste	(H)
Toxic Waste	(T)

Appendix VII identifies the constituent which caused the Administrator to list the waste as a Toxicity Characteristic Waste (E) or Toxic Waste (T) in §§ 261.31 and 261.32.

(c) Each hazardous waste listed in this subpart is assigned an EPA Hazardous Waste Number which precedes the name of the waste. This number must be used in complying with the notification requirements of Section 3010 of the Act and certain recordkeeping and reporting requirements under parts 262 through 265, 268, and part 270 of this chapter.

(d) The following hazardous wastes listed in § 261.31 or § 261.32 are subject to the exclusion limits for acutely hazardous wastes established in § 261.5: EPA Hazardous Wastes Nos. FO20, FO21, FO22, FO23, FO26, and FO27.

[45 FR 33119, May 19, 1980, as amended at 48 FR 14294, Apr. 1, 1983; 50 FR 2000, Jan. 14, 1985; 51 FR 40636, Nov. 7, 1986; 55 FR 11863, Mar. 29, 1990]

§ 261.31 Hazardous wastes from non-specific sources.

(a) The following solid wastes are listed hazardous wastes from non-specific sources unless they are excluded under §§ 260.20 and 260.22 and listed in appendix IX.

Industry and EPA hazardous waste No.	Hazardous waste	Hazard code
Generic:		
F001	The following spent halogenated solvents used in degreasing: Tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, and chlorinated fluorocarbons; all spent solvent mixtures/blends used in degreasing containing, before use, a total of ten percent or more (by volume) of one or more of the above halogenated solvents or those solvents listed in F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.	(T)
F002	The following spent halogenated solvents: Tetrachloroethylene, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, chlorobenzene, 1,1,2-trichloro-1,2,2-trifluoroethane, ortho-dichlorobenzene, trichlorofluoromethane, and 1,1,2-trichloroethane; all spent solvent mixtures/blends containing, before use, a total of ten percent or more (by volume) of one or more of the above halogenated solvents or those listed in F001, F004, or F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.	(T)
F003	The following spent non-halogenated solvents: Xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol; all spent solvent mixtures/blends containing, before use, only the above spent non-halogenated solvents; and all spent solvent mixtures/blends containing, before use, one or more of the above non-halogenated solvents, and, a total of ten percent or more (by volume) of one or more of those solvents listed in F001, F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.	(I)*
F004	The following spent non-halogenated solvents: Cresols and cresylic acid, and nitrobenzene; all spent solvent mixtures/blends containing, before use, a total of ten percent or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F001, F002, and F005; and still bottoms from *the recovery of these spent solvents and spent solvent mixtures.*	(T)
F005	The following spent non-halogenated solvents: Toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine, benzene, 2-ethoxyethanol, and 2-nitropropane; all spent solvent mixtures/blends containing, before use, a total of ten percent or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F001, F002, or F004; and still bottoms from the recovery of these spent solvents and spent solvent mixtures.	(I,T)
F006	Wastewater treatment sludges from electroplating operations except from the following processes: (1) Sulfuric acid anodizing of aluminum; (2) tin plating on carbon steel; (3) zinc plating (segregated basis) on carbon steel; (4) aluminum or zinc-aluminum plating on carbon steel; (5) cleaning/stripping associated with tin, zinc and aluminum plating on carbon steel; and (6) chemical etching and milling of aluminum.	(T)
F007	Spent cyanide plating bath solutions from electroplating operations	(R, T)
F008	Plating bath residues from the bottom of plating baths from electroplating operations where cyanides are used in the process.	(R, T)
F009	Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process.	(R, T)
F010	Quenching bath residues from oil baths from metal heat treating operations where cyanides are used in the process.	(R, T)
F011	Spent cyanide solutions from salt bath pot cleaning from metal heat treating operations.	(R, T)
F012	Quenching waste water treatment sludges from metal heat treating operations where cyanides are used in the process.	(T)
F019	Wastewater treatment sludges from the chemical conversion coating of aluminum except from zirconium phosphating in aluminum can washing when such phosphating is an exclusive conversion coating process.	(T)
F020	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tri- or tetrachlorophenol, or of intermediates used to produce their pesticide derivatives. (This listing does not include wastes from the production of Hexachlorophene from highly purified 2,4,5-trichlorophenol.).	(H)
F021	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of pentachlorophenol, or of intermediates used to produce its derivatives.	(H)

Industry and EPA hazardous waste No.	Hazardous waste	Hazard code
F022	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tetra-, penta-, or hexachlorobenzenes under alkaline conditions.	(H)
F023	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production of materials on equipment previously used for the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tri- and tetrachlorophenols. (This listing does not include wastes from equipment used only for the production or use of Hexachlorophene from highly purified 2,4,5-trichlorophenol.).	(H)
F024	Process wastes, including but not limited to, distillation residues, heavy ends, tars, and reactor clean-out wastes, from the production of certain chlorinated aliphatic hydrocarbons by free radical catalyzed processes. These chlorinated aliphatic hydrocarbons are those having carbon chain lengths ranging from one to and including five, with varying amounts and positions of chlorine substitution. (This listing does not include wastewaters, wastewater treatment sludges, spent catalysts, and wastes listed in § 261.31 or § 261.32.).	(T)
F025	Condensed light ends, spent filters and filter aids, and spent desiccant wastes from the production of certain chlorinated aliphatic hydrocarbons, by free radical catalyzed processes. These chlorinated aliphatic hydrocarbons are those having carbon chain lengths ranging from one to and including five, with varying amounts and positions of chlorine substitution.	(T)
F026	Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production of materials on equipment previously used for the manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tetra-, penta-, or hexachlorobenzene under alkaline conditions.	(H)
F027	Discarded unused formulations containing tri-, tetra-, or pentachlorophenol or dis*carded unused formulations containing compounds derived from these chlorophenols*. (This listing does not include formulations containing Hexachlorophene sythesized from prepurified 2,4,5-trichlorophenol as the sole component.).	(H)
F028	Residues resulting from the incineration or thermal treatment of soil contaminated with EPA Hazardous Waste Nos. F020, F021, F022, F023, F026, and F027.	(T)
F032 [1]	*Wastewaters, process residuals, preservative drippage, and spent formulations from* wood preserving processes generated at plants that currently use or have previously used chlorophenolic formulations (except potentially cross-contaminated wastes that have had the F032 waste code deleted in accordance with § 261.35 of this chapter and where the generator does not resume or initiate use of chlorophenolic formulations). This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol. (NOTE: The listing of wastewaters that have not come into contact with process contaminants is stayed administratively. The listing for plants that have previously used chlorophenolic formulations is administratively stayed whenever these wastes are covered by the F034 or F035 listings. These stays will remain in effect until further administrative action is taken.).	(T)
F034 [1]	Wastewaters, process residuals, preservative drippage, and spent formulations from wood preserving process generated at plants that use creosote formulations. This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol. (NOTE: The listing of wastewaters that have not come into contact with process contaminants is stayed administratively. The stay will remain in effect until further administrative action is taken.).	(T)
F035 [1]	Wastewaters, process residuals, preservative drippage, and spent formulations from wood preserving process generated at plants that use inorganic preservatives containing arsenic or chromium. This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol. (NOTE: The listing of wastewaters that have not come into contact with process contaminants is stayed administratively. The stay will remain in effect until further administrative action is taken.).	(T)
F037	Petroleum refinery primary oil/water/solids separation sludge—Any sludge generated from the gravitational separation of oil/water/solids during the storage or treatment of process wastewaters and oily cooling wastewaters from petroleum refineries. Such sludges include, but are not limited to, those generated in: oil/water/solids separators; tanks and impoundments; ditches and other conveyances; *sumps; and stormwater units receiving dry weather flow. Sludge generated in* stormwater units that do not receive dry weather flow, sludges generated from non-contact once-through cooling waters segregated for treatment from other process or oily cooling waters, sludges generated in aggressive biological treatment units as defined in § 261.31(b)(2) (including sludges generated in one or more additional units after wastewaters have been treated in aggressive biological treatment units) and K051 wastes are not included in this listing.	(T)

Industry and EPA hazardous waste No.	Hazardous waste	Hazard code
F038	Petroleum refinery secondary (emulsified) oil/water/solids separation sludge—Any sludge and/or float generated from the physical and/or chemical separation of oil/water/solids in process wastewaters and oily cooling wastewaters from petroleum refineries. Such wastes include, but are not limited to, all sludges and floats generated in: induced air flotation (IAF) units, tanks and impoundments, and all sludges generated in DAF units. Sludges generated in stormwater units that do not receive dry weather flow, sludges generated from non-contact once-through cooling waters segregated for treatment from other process or oily cooling waters, sludges and floats generated in aggressive biological treatment units as defined in § 261.31(b)(2) (including sludges and floats generated in one or more additional units after wastewaters have been treated in aggressive biological treatment units) and F037, K048, and K051 wastes are not included in this listing.	(T)
F039	Leachate (liquids that have percolated through land disposed wastes) resulting from the disposal of more than one restricted waste classified as hazardous under subpart D of this part. (Leachate resulting from the disposal of one or more of the following EPA Hazardous Wastes and no other Hazardous Wastes retains its EPA Hazardous Waste Number(s): F020, F021, F022, F026, F027, and/or F028.).	(T)

[1] The F032, F034, and F305 listings are administratively stayed with respect to the process area receiving drippage of these wastes provided persons desiring to continue operating notify EPA by August 6, 1991 of their intent to upgrade or install drip pads, and by November 6, 1991 provide evidence to EPA that they have adequate financing to pay for drip pad upgrades or installation, as provided in the administrative stay. The stay of the listings will remain in effect until February 6, 1992 for existing drip pads and until May 6, 1992 for new drip pads.

[*] (I,T) should be used to specify mixtures containing ignitable and toxic constituents.

(b) Listing Specific Definitions: (1) For the purposes of the F037 and F038 listings, oil/water/solids is defined as oil and/or water and/or solids.

(2) (i) For the purposes of the F037 and F038 listings, aggressive biological treatment units are defined as units which employ one of the following four treatment methods: activated sludge; trickling filter; rotating biological contactor for the continuous accelerated biological oxidation of wastewaters; or high-rate aeration. High-rate aeration is a system of surface impoundments or tanks, in which intense mechanical aeration is used to completely mix the wastes, enhance biological activity, and (A) the units employs a minimum of 6 hp per million gallons of treatment volume; and either (B) the hydraulic retention time of the unit is no longer than 5 days; or (C) the hydraulic retention time is no longer than 30 days and the unit does not generate a sludge that is a hazardous waste by the Toxicity Characteristic.

(ii) Generators and treatment, storage and disposal facilities have the burden of proving that their sludges are exempt from listing as F037 and F038 wastes under this definition. Generators and treatment, storage and disposal facilities must maintain, in their operating or other onsite records, documents and data sufficient to prove that: (A) the unit is an aggressive biological treatment unit as defined in this subsection; and (B) the sludges sought to be exempted from the definitions of F037 and/or F038 were actually generated in the aggressive biological treatment unit.

(3) (i) For the purposes of the F037 listing, sludges are considered to be generated at the moment of deposition in the unit, where deposition is defined as at least a temporary cessation of lateral particle movement.

(ii) For the purposes of the F038 listing,

(A) sludges are considered to be generated at the moment of deposition in the unit, where deposition is defined as at least a temporary cessation of lateral particle movement and

(B) floats are considered to be generated at the moment they are formed in the top of the unit.

[46 FR 4617, Jan. 16, 1981]

EDITORIAL NOTE: For FEDERAL REGISTER citations affecting § 261.31, see the List of CFR Sections Affected in the Finding Aids section of this volume.

§ 261.32 Hazardous wastes from specific sources.

The following solid wastes are listed hazardous wastes from specific sources unless they are excluded under §§ 260.20 and 260.22 and listed in appendix IX.

Industry and EPA hazardous waste No.	Hazardous waste	Hazard code
Wood preservation: K001	Bottom sediment sludge from the treatment of wastewaters from wood preserving processes that use creosote and/or pentachlorophenol.	(T)
Inorganic pigments:		
K002	Wastewater treatment sludge from the production of chrome yellow and orange pigments.	(T)
K003	Wastewater treatment sludge from the production of molybdate orange pigments	(T)
K004	Wastewater treatment sludge from the production of zinc yellow pigments	(T)
K005	Wastewater treatment sludge from the production of chrome green pigments	(T)
K006	Wastewater treatment sludge from the production of chrome oxide green pigments (anhydrous and hydrated).	(T)
K007	Wastewater treatment sludge from the production of iron blue pigments	(T)
K008	Oven residue from the production of chrome oxide green pigments	(T)
Organic chemicals:		
K009	Distillation bottoms from the production of acetaldehyde from ethylene	(T)
K010	Distillation side cuts from the production of acetaldehyde from ethylene	(T)
K011	Bottom stream from the wastewater stripper in the production of acrylonitrile	(R, T)
K013	Bottom stream from the acetonitrile column in the production of acrylonitrile	(R, T)
K014	Bottoms from the acetonitrile purification column in the production of acrylonitrile	(T)
K015	Still bottoms from the distillation of benzyl chloride	(T)
K016	Heavy ends or distillation residues from the production of carbon tetrachloride	(T)
K017	Heavy ends (still bottoms) from the purification column in the production of epichlorohydrin.	(T)
K018	Heavy ends from the fractionation column in ethyl chloride production	(T)
K019	Heavy ends from the distillation of ethylene dichloride in ethylene dichloride production.	(T)
K020	Heavy ends from the distillation of vinyl chloride in vinyl chloride monomer *production*.	(T)
K021	Aqueous spent antimony catalyst waste from fluoromethanes production	(T)
K022	Distillation bottom tars from the production of phenol/acetone from cumene	(T)
K023	Distillation light ends from the production of phthalic anhydride from naphthalene	(T)
K024	Distillation bottoms from the production of phthalic anhydride from naphthalene	(T)
K025	Distillation bottoms from the production of nitrobenzene by the nitration of benzene	(T)
K026	Stripping still tails from the production of methy ethyl pyridines	(T)
K027	Centrifuge and distillation residues from toluene diisocyanate production	(R, T)
K028	Spent catalyst from the hydrochlorinator reactor in the production of 1,1,1-trichloroethane.	(T)
K029	Waste from the product steam stripper in the production of 1,1,1-trichloroethane	(T)
K030	Column bottoms or heavy ends from the combined production of trichloroethylene and perchloroethylene.	(T)
K083	Distillation bottoms from aniline production	(T)
K085	Distillation or fractionation column bottoms from the production of chlorobenzenes	(T)
K093	Distillation light ends from the production of phthalic anhydride from ortho-xylene	(T)
K094	Distillation bottoms from the production of phthalic anhydride from ortho-xylene	(T)
K095	Distillation bottoms from the production of 1,1,1-trichloroethane	(T)
K096	Heavy ends from the heavy ends column from the production of 1,1,1-trichloroethane.	(T)
K103	Process residues from aniline extraction from the production of aniline	(T)
K104	Combined wastewater streams generated from nitrobenzene/aniline production	(T)
K105	Separated aqueous stream from the reactor product washing step in the production of chlorobenzenes.	(T)
K107	Column bottoms from product separation from the production of 1,1-dimethylhydrazine (UDMH) from carboxylic acid hydrazines.	(C,T)
K108	Condensed column overheads from product separation and condensed reactor vent gases from the production of 1,1-dimethylhydrazine (UDMH) from carboxylic acid hydrazides.	(I,T)
K109	Spent filter cartridges from product purification from the production of 1,1-dimethylhydrazine (UDMH) from carboxylic acid hydrazides.	(T)
K110	Condensed column overheads from intermediate separation from the production of 1,1-dimethylhydrazine (UDMH) from carboxylic acid hydrazides.	(T)
K111	Product washwaters from the production of dinitrotoluene via nitration of toluene	(C,T)
K112	Reaction by-product water from the drying column in the production of toluenediamine via hydrogenation of dinitrotoluene.	(T)
K113	Condensed liquid light ends from the purification of toluenediamine in the production of toluenediamine via hydrogenation of dinitrotoluene.	(T)
K114	Vicinals from the purification of toluenediamine in the production of toluenediamine via hydrogenation of dinitrotoluene.	(T)

Industry and EPA hazardous waste No.	Hazardous waste	Hazard code
K115	Heavy ends from the purification of toluenediamine in the production of toluenediamine via hydrogenation of dinitrotoluene.	(T)
K116	Organic condensate from the solvent recovery column in the production of toluene diisocyanate via phosgenation of toluenediamine.	(T)
K117	Wastewater from the reactor vent gas scrubber in the production of ethylene dibromide via bromination of ethene.	(T)
K118	Spent adsorbent solids from purification of ethylene dibromide in the production of ethylene dibromide via bromination of ethene.	(T)
K136	Still bottoms from the purification of ethylene dibromide in the production of ethylene dibromide via bromination of ethene.	(T)
Inorganic chemicals:		
K071	Brine purification muds from the mercury cell process in chlorine production, where separately prepurified brine is not used.	(T)
K073	Chlorinated hydrocarbon waste from the purification step of the diaphragm cell process using graphite anodes in chlorine production.	(T)
K106	Wastewater treatment sludge from the mercury cell process in chlorine production	(T)
Pesticides:		
K031	By-product salts generated in the production of MSMA and cacodylic acid	(T)
K032	Wastewater treatment sludge from the production of chlordane	(T)
K033	Wastewater and scrub water from the chlorination of cyclopentadiene in the production of chlordane.	(T)
K034	Filter solids from the filtration of hexachlorocyclopentadiene in the production of chlordane.	(T)
K035	Wastewater treatment sludges generated in the production of creosote	(T)
K036	Still bottoms from toluene reclamation distillation in the production of disulfoton	(T)
K037	Wastewater treatment sludges from the production of disulfoton	(T)
K038	Wastewater from the washing and stripping of phorate production	(T)
K039	Filter cake from the filtration of diethylphosphorodithioic acid in the production of phorate.	(T)
K040	Wastewater treatment sludge from the production of phorate	(T)
K041	Wastewater treatment sludge from the production of toxaphene	(T)
K042	Heavy ends or distillation residues from the distillation of tetrachlorobenzene in the production of 2,4,5-T.	(T)
K043	2,6-Dichlorophenol waste from the production of 2,4-D	(T)
K097	Vacuum stripper discharge from the chlordane chlorinator in the production of chlordane.	(T)
K098	Untreated process wastewater from the production of toxaphene	(T)
K099	Untreated wastewater from the production of 2,4-D	(T)
K123	Process wastewater (including supernates, filtrates, and washwaters) from the production of ethylenebisdithiocarbamic acid and its salt.	(T)
K124	Reactor vent scrubber water from the production of ethylenebisdithiocarbamic acid and its salts.	(C, T)
K125	Filtration, evaporation, and centrifugation solids from the production of ethylenebisdithiocarbamic acid and its salts.	(T)
K126	Baghouse dust and floor sweepings in milling and packaging operations from the production or formulation of ethylenebisdithiocarbamic acid and its salts.	(T)
K131	Wastewater from the reactor and spent sulfuric acid from the acid dryer from the production of methyl bromide.	(C, T)
K132	Spent absorbent and wastewater separator solids from the production of methyl bromide.	(T)
Explosives:		
K044	Wastewater treatment sludges from the manufacturing and processing of explosives	(R)
K045	Spent carbon from the treatment of wastewater containing explosives	(R)
K046	Wastewater treatment sludges from the manufacturing, formulation and loading of lead-based initiating compounds.	(T)
K047	Pink/red water from TNT operations	(R)
Petroleum refining:		
K048	Dissolved air flotation (DAF) float from the petroleum refining industry	(T)
K049	Slop oil emulsion solids from the petroleum refining industry	(T)
K050	Heat exchanger bundle cleaning sludge from the petroleum refining industry	(T)
K051	API separator sludge from the petroleum refining industry	(T)
K052	Tank bottoms (leaded) from the petroleum refining industry	(T)
Iron and steel:		
K061	Emission control dust/sludge from the primary production of steel in electric furnaces.	(T)
K062	Spent pickle liquor generated by steel finishing operations of facilities within the iron and steel industry (SIC Codes 331 and 332).	(C,T)
Primary copper:		
K064	Acid plant blowdown slurry/sludge resulting from the thickening of blowdown slurry from primary copper production.	(T)

Industry and EPA hazardous waste No.	Hazardous waste	Hazard code
Primary lead:		
K065	Surface impoundment solids contained in and dredged from surface impoundments at primary lead smelting facilities.	(T)
Primary zinc:		
K066	Sludge from treatment of process wastewater and/or acid plant blowdown from primary zinc production.	(T)
Primary aluminum:		
K088	Spent potliners from primary aluminum reduction	(T)
Ferroalloys:		
K090	Emission control dust or sludge from ferrochromiumsilicon production	(T)
K091	Emission control dust or sludge from ferrochromium production	(T)
Secondary lead:		
K069	Emission control dust/sludge from secondary lead smelting. (NOTE: This listing is stayed administratively for sludge generated from secondary acid scrubber systems. The stay will remain in effect until further administrative action is taken. If EPA takes further action effecting this stay, EPA will publish a notice of the action in the **Federal Register**.	(T)
K100	Waste leaching solution from acid leaching of emission control dust/sludge from secondary lead smelting.	(T)
Veterinary pharmaceuticals:		
K084	Wastewater treatment sludges generated during the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds.	(T)
K101	Distillation tar residues from the distillation of aniline-based compounds in the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds.	(T)
K102	Residue from the use of activated carbon for decolorization in the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds.	(T)
Ink formulation:		
K086	Solvent washes and sludges, caustic washes and sludges, or water washes and sludges from cleaning tubs and equipment used in the formulation of ink from pigments, driers, soaps, and stabilizers containing chromium and lead.	(T)
Coking:		
K060	Ammonia still lime sludge from coking operations	(T)
K087	Decanter tank tar sludge from coking operations	(T)

[46 FR 4618, Jan. 16, 1981]

EDITORIAL NOTE: For FEDERAL REGISTER citations affecting § 261.32, see the List of CFR Sections Affected in the Finding Aids section of this volume.

§ 261.33 Discarded commercial chemical products, off-specification species, container residues, and spill residues thereof.

The following materials or items are hazardous wastes if and when they are discarded or intended to be discarded as described in § 261.2(a)(2)(i), when they are mixed with waste oil or used oil or other material and applied to the land for dust suppression or road treatment, when they are otherwise applied to the land in lieu of their original intended use or when they are contained in products that are applied to the land in lieu of their original intended use, or when, in lieu of their original intended use, they are produced for use as (or as a component of) a fuel, distributed for use as a fuel, or burned as a fuel.

(a) Any commercial chemical product, or manufacturing chemical intermediate having the generic name listed in paragraph (e) or (f) of this section.

(b) Any off-specification commercial chemical product or manufacturing chemical intermediate which, if it met specifications, would have the generic name listed in paragraph (e) or (f) of this section.

(c) Any residue remaining in a container or in an inner liner removed from a container that has held any commercial chemical product or manufacturing chemical intermediate having the generic name listed in paragraphs (e) or (f) of this section, unless the container is empty as defined in § 261.7(b) of this chapter.

[*Comment:* Unless the residue is being beneficially used or reused, or legitimately recycled or reclaimed; or being accumulated, stored, transported or treated prior to such use, re-use, recycling or reclamation, EPA considers the residue to be intended for discard, and thus, a hazardous waste. An example of a legitimate re-use of the residue would be where the residue remains in the container and the container is used to hold the same commercial chemical product or manufacturing chemical intermediate it previously held. An example of the discard of the residue would be where the drum is sent to a drum reconditioner who reconditions the drum but discards the residue.]

(d) Any residue or contaminated soil, water or other debris resulting from the cleanup of a spill into or on any land or water of any commercial chemical product or manufacturing chemical intermediate having the generic name listed in paragraph (e) or (f) of this section, or any residue or contaminated soil, water or other debris resulting from the cleanup of a spill, into or on any land or water, of any off-specification chemical product and manufacturing chemical intermediate which, if it met specifications, would have the generic name listed in paragraph (e) or (f) of this section.

[*Comment:* The phrase "commercial chemical product or manufacturing chemical intermediate having the generic name listed in . . ." refers to a chemical substance which is manufactured or formulated for commercial or manufacturing use which consists of the commercially pure grade of the chemical, any technical grades of the chemical that are produced or marketed, and all formulations in which the chemical is the sole active ingredient. It does not refer to a material, such as a manufacturing process waste, that contains any of the substances listed in paragraph (e) or (f). Where a manufacturing process waste is deemed to be a hazardous waste because it contains a substance listed in paragraph (e) or (f), such waste will be listed in either § 261.31 or § 261.32 or will be identified as a hazardous waste by the characteristics set forth in subpart C of this part.]

(e) The commercial chemical products, manufacturing chemical intermediates or off-specification commercial chemical products or manufacturing chemical intermediates referred to in paragraphs (a) through (d) of this section, are identified as acute hazardous wastes (H) and are subject to be the small quantity exclusion defined in § 261.5(e).

[*Comment:* For the convenience of the regulated community the primary hazardous properties of these materials have been indicated by the letters T (Toxicity), and R (Reactivity). Absence of a letter indicates that the compound only is listed for acute toxicity.]

These wastes and their corresponding EPA Hazardous Waste Numbers are:

Hazardous waste No.	Chemical abstracts No.	Substance
P023	107-20-0	Acetaldehyde, chloro-
P002	591-08-2	Acetamide, N-(aminothioxomethyl)-
P057	640-19-7	Acetamide, 2-fluoro-
P058	62-74-8	Acetic acid, fluoro-, sodium salt
P002	591-08-2	1-Acetyl-2-thiourea
P003	107-02-8	Acrolein
P070	116-06-3	Aldicarb
P004	309-00-2	Aldrin
P005	107-18-6	Allyl alcohol
P006	20859-73-8	Aluminum phosphide (R,T)
P007	2763-96-4	5-(Aminomethyl)-3-isoxazolol
P008	504-24-5	4-Aminopyridine
P009	131-74-8	Ammonium picrate (R)
P119	7803-55-6	Ammonium vanadate
P099	506-61-6	Argentate(1-), bis(cyano-C)-, potassium
P010	7778-39-4	Arsenic acid H_3AsO_4
P012	1327-53-3	Arsenic oxide As_2O_3
P011	1303-28-2	Arsenic oxide As_2O_5
P011	1303-28-2	Arsenic pentoxide
P012	1327-53-3	Arsenic trioxide
P038	692-42-2	Arsine, diethyl-
P036	696-28-6	Arsonous dichloride, phenyl-
P054	151-56-4	Aziridine
P067	75-55-8	Aziridine, 2-methyl-
P013	542-62-1	Barium cyanide
P024	106-47-8	Benzenamine, 4-chloro-

Hazardous waste No.	Chemical abstracts No.	Substance
P077	*100-01-6*	*Benzenamine, 4-nitro-*
P028	100-44-7	Benzene, (chloromethyl)-
P042	51-43-4	1,2-Benzenediol, 4-[1-hydroxy-2-(methylamino)ethyl]-, (R)-
P046	122-09-8	Benzeneethanamine, alpha,alpha-dimethyl-
P014	108-98-5	Benzenethiol
P001	[1] 81-81-2	2H-1-Benzopyran-2-one, 4-hydroxy-3-(3-oxo-1-phenylbutyl)-, & salts, when present at concentrations greater than 0.3%
P028	100-44-7	Benzyl chloride
P015	7440-41-7	Beryllium
P017	598-31-2	Bromoacetone
P018	357-57-3	Brucine
P045	39196-18-4	2-Butanone, 3,3-dimethyl-1-(methylthio)-, O-[methylamino)carbonyl] oxime
P021	592-01-8	Calcium cyanide
P021	592-01-8	Calcium cyanide $Ca(CN)_2$
P022	75-15-0	Carbon disulfide
P095	75-44-5	Carbonic dichloride
P023	107-20-0	Chloroacetaldehyde
P024	106-47-8	p-Chloroaniline
P026	5344-82-1	1-(o-Chlorophenyl)thiourea
P027	542-76-7	3-Chloropropionitrile
P029	544-92-3	Copper cyanide
P029	544-92-3	Copper cyanide Cu(CN)
P030		Cyanides (soluble cyanide salts), not otherwise specified
P031	460-19-5	Cyanogen
P033	506-77-4	Cyanogen chloride
P033	506-77-4	Cyanogen chloride (CN)Cl
P034	131-89-5	2-Cyclohexyl-4,6-dinitrophenol
P016	542-88-1	Dichloromethyl ether
P036	696-28-6	Dichlorophenylarsine
P037	60-57-1	Dieldrin
P038	692-42-2	Diethylarsine
P041	311-45-5	Diethyl-p-nitrophenyl phosphate
P040	297-97-2	O,O-Diethy; O-pyrazinyl phosphorothioate
P043	55-91-4	Diisopropylfluorophosphate (DFP)
P004	309-00-2	1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexa- chloro-1,4,4a,5,8,8a,-hexahydro-, (1alpha,4alpha,4abeta,5alpha,8alpha,8abeta)-
P060	465-73-6	1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexa- chloro-1,4,4a,5,8,8a-hexahydro-, (1alpha,4alpha,4abeta,5beta,8beta,8abeta)-
P037	60-57-1	2,7:3,6-Dimethanonaphth[2,3-b]oxirene, 3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-, (1aalpha,2beta,2aalpha,3beta,6beta,6aalpha,7beta, 7aalpha)-
P051	[1] 72-20-8	2,7:3,6-Dimethanonaphth [2,3-b]oxirene, 3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-, (1aalpha,2beta,2abeta,3alpha,6alpha,6abeta,7beta, 7aalpha)-, & metabolites
P044	60-51-5	Dimethoate
P046	122-09-8	alpha,alpha-Dimethylphenethylamine
P047	[1] 534-52-1	4,6-Dinitro-o-cresol, & salts
P048	51-28-5	2,4-Dinitrophenol
P020	88-85-7	Dinoseb
P085	152-16-9	Diphosphoramide, octamethyl-
P111	107-49-3	Diphosphoric acid, tetraethyl ester
P039	298-04-4	Disulfoton
P049	541-53-7	Dithiobiuret
P050	115-29-7	Endosulfan
P088	145-73-3	Endothall
P051	72-20-8	Endrin
P051	72-20-8	Endrin, & metabolites
P042	51-43-4	Epinephrine
P031	460-19-5	Ethanedinitrile
P066	16752-77-5	Ethanimidothioic acid, N-[[(methylamino)carbonyl]oxy]-, methyl ester
P101	107-12-0	Ethyl cyanide
P054	151-56-4	Ethyleneimine
P097	52-85-7	Famphur
P056	7782-41-4	Fluorine
P057	640-19-7	Fluoroacetamide
P058	62-74-8	Fluoroacetic acid, sodium salt
P065	628-86-4	*Fulminic acid, mercury(2+)* salt (R,T)
P059	76-44-8	Heptachlor
P062	757-58-4	Hexaethyl tetraphosphate

Hazardous waste No.	Chemical abstracts No.	Substance
P116	79-19-6	Hydrazinecarbothioamide
P068	60-34-4	Hydrazine, methyl-
P063	74-90-8	Hydrocyanic acid
P063	74-90-8	Hydrogen cyanide
P096	7803-51-2	Hydrogen phosphide
P060	465-73-6	Isodrin
P007	2763-96-4	3(2H)-Isoxazolone, 5-(aminomethyl)-
P092	62-38-4	Mercury, (acetato-O)phenyl-
P065	628-86-4	Mercury fulminate (R,T)
P082	62-75-9	Methanamine, N-methyl-N-nitroso-
P064	624-83-9	Methane, isocyanato-
P016	542-88-1	Methane, oxybis[chloro-
P112	509-14-8	Methane, tetranitro- (R)
P118	75-70-7	Methanethiol, trichloro-
P050	115-29-7	6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-oxide
P059	76-44-8	4,7-Methano-1H-indene, 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-
P066	16752-77-5	Methomyl
P068	60-34-4	Methyl hydrazine
P064	624-83-9	Methyl isocyanate
P069	75-86-5	2-Methyllactonitrile
P071	298-00-0	Methyl parathion
P072	86-88-4	alpha-Naphthylthiourea
P073	13463-39-3	Nickel carbonyl
P073	13463-39-3	Nickel carbonyl Ni(CO)$_4$, (T-4)-
P074	557-19-7	Nickel cyanide
P074	557-19-7	Nickel cynaide Ni(CN)$_2$
P075	[1] 54-11-5	Nicotine, & salts
P076	10102-43-9	Nitric oxide
P077	100-01-6	p-Nitroaniline
P078	10102-44-0	Nitrogen dioxide
P076	10102-43-9	Nitrogen oxide NO
P078	10102-44-0	Nitrogen oxide NO$_2$
P081	55-63-0	Nitroglycerine (R)
P082	62-75-9	N-Nitrosodimethylamine
P084	4549-40-0	*N-Nitrosomethylvinylamine*
P085	152-16-9	Octamethylpyrophosphoramide
P087	20816-12-0	Osmium oxide OsO$_4$, (T-4)-
P087	20816-12-0	Osmium tetroxide
P088	145-73-3	7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
P089	56-38-2	Parathion
P034	131-89-5	Phenol, 2-cyclohexyl-4,6-dinitro-
P048	51-28-5	Phenol, 2,4-dinitro-
P047	[1] 534-52-1	Phenol, 2-methyl-4,6-dinitro-, & salts
P020	88-85-7	Phenol, 2-(1-methylpropyl)-4,6-dinitro-
P009	131-74-8	Phenol, 2,4,6-trinitro-, ammonium salt (R)
P092	62-38-4	Phenylmercury acetate
P093	103-85-5	Phenylthiourea
P094	298-02-2	Phorate
P095	75-44-5	Phosgene
P096	7803-51-2	Phosphine
P041	311-45-5	Phosphoric acid, diethyl 4-nitrophenyl ester
P039	298-04-4	Phosphorodithioic acid, O,O-diethyl S-[2-(ethylthio)ethyl] ester
P094	298-02-2	Phosphorodithioic acid, O,O-diethyl S-[(ethylthio)methyl] ester
P044	60-51-5	Phosphorodithioic acid, O,O-dimethyl S-[2-(methylamino)-2-oxoethyl] ester
P043	55-91-4	Phosphorofluoridic acid, bis(1-methylethyl) ester
P089	56-38-2	Phosphorothioic acid, O,O-diethyl O-(4-nitrophenyl) ester
P040	297-97-2	Phosphorothioic acid, O,O-diethyl O-pyrazinyl ester
P097	52-85-7	Phosphorothioic acid, O-[4-[(dimethylamino)sulfonyl]phenyl] O,O-dimethyl ester
P071	298-00-0	Phosphorothioic acid, O,O,-dimethyl O-(4-nitrophenyl) ester
P110	78-00-2	Plumbane, tetraethyl-
P098	151-50-8	*Potassium cyanide*
P098	151-50-8	Potassium cyanide K(CN)
P099	506-61-6	Potassium silver cyanide
P070	116-06-3	Propanal, 2-methyl-2-(methylthio)-, O-[*(methylamino)carbonyl]oxime*

Hazardous waste No.	Chemical abstracts No.	Substance
P101	107-12-0	Propanenitrile
P027	542-76-7	Propanenitrile, 3-chloro-
P069	75-86-5	Propanenitrile, 2-hydroxy-2-methyl-
P081	55-63-0	1,2,3-Propanetriol, trinitrate (R)
P017	598-31-2	2-Propanone, 1-bromo-
P102	107-19-7	Propargyl alcohol
P003	107-02-8	2-Propenal
P005	107-18-6	2-Propen-1-ol
P067	75-55-8	1,2-Propylenimine
P102	107-19-7	2-Propyn-1-ol
P008	504-24-5	4-Pyridinamine
P075	[1] 54-11-5	Pyridine, 3-(1-methyl-2-pyrrolidinyl)-, (S)-, & salts
P114	12039-52-0	Selenious acid, dithallium(1+) salt
P103	630-10-4	Selenourea
P104	506-64-9	Silver cyanide
P104	506-64-9	Silver cyanide Ag(CN)
P105	26628-22-8	Sodium azide
P106	143-33-9	Sodium cyanide
P106	143-33-9	Sodium cyanide Na(CN)
P108	[1] 57-24-9	Strychnidin-10-one, & salts
P018	357-57-3	Strychnidin-10-one, 2,3-dimethoxy-
P108	[1] 57-24-9	Strychnine, & salts
P115	7446-18-6	Sulfuric acid, dithallium(1+) salt
P109	3689-24-5	Tetraethyldithiopyrophosphate
P110	78-00-2	Tetraethyl lead
P111	107-49-3	Tetraethyl pyrophosphate
P112	509-14-8	Tetranitromethane (R)
P062	757-58-4	Tetraphosphoric acid, hexaethyl ester
P113	1314-32-5	Thallic oxide
P113	1314-32-5	Thallium oxide Tl_2O_3
P114	12039-52-0	Thallium(I) selenite
P115	7446-18-6	Thallium(I) sulfate
P109	3689-24-5	Thiodiphosphoric acid, tetraethyl ester
P045	39196-18-4	Thiofanox
P049	541-53-7	Thioimidodicarbonic diamide $[(H_2N)C(S)]_2NH$
P014	108-98-5	Thiophenol
P116	79-19-6	Thiosemicarbazide
P026	5344-82-1	Thiourea, (2-chlorophenyl)-
P072	86-88-4	Thiourea, 1-naphthalenyl-
P093	103-85-5	Thiourea, phenyl-
P123	8001-35-2	Toxaphene
P118	75-70-7	Trichloromethanethiol
P119	7803-55-6	Vanadic acid, ammonium salt
P120	1314-62-1	Vanadium oxide V_2O_5
P120	1314-62-1	Vanadium pentoxide
P084	4549-40-0	Vinylamine, N-methyl-N-nitroso-
P001	[1] 81-81-2	Warfarin, & salts, when present at concentrations greater than 0.3%
P121	557-21-1	Zinc cyanide
P121	557-21-1	Zinc cyanide $Zn(CN)_2$
P122	1314-84-7	Zinc phosphide Zn_3P_2, when present at concentrations greater than 10% (R,T)

[1] CAS Number given for parent compound only.

(f) The commercial chemical products, manfacturing chemical intermediates, or off-specification commercial chemical products referred to in paragraphs (a) through (d) of this section, are identified as toxic wastes (T), unless otherwise designated and are subject to the small quantity generator exclusion defined in § 261.5 (a) and (g).

[*Comment:* For the convenience of the regulated community, the primary hazardous properties of these materials have been indicated by the letters T (Toxicity), R (Reactivity), I (Ignitability) and C (Corrosivity). Absence of a letter indicates that the compound is only listed for toxicity.]

These wastes and their corresponding EPA Hazardous Waste Numbers are:

Hazardous waste No.	Chemical abstracts No.	Substance
U001	75-07-0	Acetaldehyde (I)
U034	75-87-6	Acetaldehyde, trichloro-
U187	62-44-2	Acetamide, N-(4-ethoxyphenyl)-
U005	53-96-3	Acetamide, N-9H-fluoren-2-yl-
U240	94-75-7	Acetic acid, (2,4-dichlorophenoxy)-, salts & esters
U112	141-78-6	Acetic acid ethyl ester (I)
U144	301-04-2	Acetic acid, lead(2+) salt
U214	563-68-8	Acetic acid, thallium(1+) salt
see F027	93-76-5	Acetic acid, (2,4,5-trichlorophenoxy)-
U002	67-64-1	Acetone (I)
U003	75-05-8	Acetonitrile (I,T)
U004	98-86-2	Acetophenone
U005	53-96-3	2-Acetylaminofluorene
U006	75-36-5	Acetyl chloride (C,R,T)
U007	79-06-1	Acrylamide
U008	79-10-7	Acrylic acid (I)
U009	107-13-1	Acrylonitrile
U011	61-82-5	Amitrole
U012	62-53-3	Aniline (I,T)
U136	75-60-5	Arsinic acid, dimethyl-
U014	492-80-8	Auramine
U015	115-02-6	Azaserine
U010	50-07-7	Azirino[2',3':3,4]pyrrolo[1,2-a]indole-4,7-dione, 6-amino-8-[[(aminocarbonyl)oxy]methyl]-1,1a,2,8,8a,8b-hexahydro-8a-methoxy-5-methyl-, [1aS-(1aalpha, 8beta,8aalpha,8balpha)]-
U157	56-49-5	Benz[j]aceanthrylene, 1,2-dihydro-3-methyl-
U016	225-51-4	Benz[c]acridine
U017	98-87-3	Benzal chloride
U192	23950-58-5	Benzamide, 3,5-dichloro-N-(1,1-dimethyl-2-propynyl)-
U018	56-55-3	Benz[a]anthracene
U094	57-97-6	Benz[a]anthracene, 7,12-dimethyl-
U012	62-53-3	Benzenamine (I,T)
U014	492-80-8	Benzenamine, 4,4'-carbonimidoylbis[N,N-dimethyl-
U049	3165-93-3	Benzenamine, 4-chloro-2-methyl-, hydrochloride
U093	60-11-7	Benzenamine, N,N-dimethyl-4-(phenylazo)-
U328	95-53-4	Benzenamine, 2-methyl-
U353	106-49-0	Benzenamine, 4-methyl-
U158	101-14-4	Benzenamine, 4,4'-methylenebis[2-chloro-
U222	636-21-5	Benzenamine, 2-methyl-, hydrochloride
U181	99-55-8	Benzenamine, 2-methyl-5-nitro-
U019	71-43-2	Benzene (I,T)
U038	510-15-6	Benzeneacetic acid, 4-chloro-alpha-(4-chlorophenyl)-alpha-hydroxy-, ethyl ester
U030	101-55-3	Benzene, 1-bromo-4-phenoxy-
U035	305-03-3	Benzenebutanoic acid, 4-[bis(2-chloroethyl)amino]-
U037	108-90-7	Benzene, chloro-
U221	25376-45-8	Benzenediamine, ar-methyl-
U028	117-81-7	1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester
U069	84-74-2	1,2-Benzenedicarboxylic acid, dibutyl ester
U088	84-66-2	1,2-Benzenedicarboxylic acid, diethyl ester
U102	131-11-3	1,2-Benzenedicarboxylic acid, dimethyl ester
U107	117-84-0	1,2-Benzenedicarboxylic acid, dioctyl ester
U070	95-50-1	Benzene, 1,2-dichloro-
U071	541-73-1	Benzene, 1,3-dichloro-
U072	106-46-7	Benzene, 1,4-dichloro-
U060	72-54-8	Benzene, 1,1'-(2,2-dichloroethylidene)bis[4-chloro-
U017	98-87-3	Benzene, (dichloromethyl)-
U223	26471-62-5	Benzene, 1,3-diisocyanatomethyl- (R,T)
U239	1330-20-7	Benzene, dimethyl- (I,T)
U201	108-46-3	1,3-Benzenediol
U127	118-74-1	Benzene, hexachloro-
U056	110-82-7	Benzene, hexahydro- (I)
U220	108-88-3	Benzene, methyl-
U105	121-14-2	Benzene, 1-methyl-2,4-dinitro-
U106	606-20-2	Benzene, 2-methyl-1,3-dinitro-
U055	98-82-8	Benzene, (1-methylethyl)- (I)
U169	98-95-3	Benzene, nitro-
U183	608-93-5	Benzene, pentachloro-
U185	82-68-8	Benzene, pentachloronitro-
U020	98-09-9	Benzenesulfonic acid chloride (C,R)
U020	98-09-9	Benzenesulfonyl chloride (C,R)

Hazardous waste No.	Chemical abstracts No.	Substance
U207	95-94-3	Benzene, 1,2,4,5-tetrachloro-
U061	50-29-3	Benzene, 1,1'-(2,2,2-trichloroethylidene)bis[4-chloro-
U247	72-43-5	Benzene, 1,1'-(2,2,2-trichloroethylidene)bis[4- methoxy-
U023	98-07-7	Benzene, (trichloromethyl)-
U234	99-35-4	Benzene, 1,3,5-trinitro-
U021	92-87-5	Benzidine
U202	[1] 81-07-2	1,2-Benzisothiazol-3(2H)-one, 1,1-dioxide, & salts
U203	94-59-7	1,3-Benzodioxole, 5-(2-propenyl)-
U141	120-58-1	1,3-Benzodioxole, 5-(1-propenyl)-
U090	94-58-6	1,3-Benzodioxole, 5-propyl-
U064	189-55-9	Benzo[rst]pentaphene
U248	[1]81-81-2	2H-1-Benzopyran-2-one, 4-hydroxy-3-(3-oxo-1-phenyl-butyl)-, & salts, when present at concentrations of 0.3% or less
U022	50-32-8	Benzo[a]pyrene
U197	106-51-4	p-Benzoquinone
U023	98-07-7	Benzotrichloride (C,R,T)
U085	1464-53-5	2,2'-Bioxirane
U021	92-87-5	[1,1'-Biphenyl]-4,4'-diamine
U073	91-94-1	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dichloro-
U091	119-90-4	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethoxy-
U095	119-93-7	[1,1'-Biphenyl]-4,4'-diamine, 3,3'-dimethyl-
U225	75-25-2	Bromoform
U030	101-55-3	4-Bromophenyl phenyl ether
U128	87-68-3	1,3-Butadiene, 1,1,2,3,4,4-hexachloro-
U172	924-16-3	1-Butanamine, N-butyl-N-nitroso-
U031	71-36-3	1-Butanol (I)
U159	78-93-3	2-Butanone (I,T)
U160	1338-23-4	2-Butanone, peroxide (R,T)
U053	*4170-30-3*	*2-Butenal*
U074	764-41-0	2-Butene, 1,4-dichloro- (I,T)
U143	303-34-4	2-Butenoic acid, 2-methyl-, 7-[[2,3-dihydroxy-2-(1-methoxyethyl)-3-methyl-1-oxobutoxy]methyl]-2,3,5,7a-tetrahydro-1H-pyrrolizin-1-yl ester, [1S-[1alpha(Z),7(2S*,3R*),7aalpha]]-
U031	71-36-3	n-Butyl alcohol (I)
U136	75-60-5	Cacodylic acid
U032	13765-19-0	Calcium chromate
U238	51-79-6	Carbamic acid, ethyl ester
U178	615-53-2	Carbamic acid, methylnitroso-, ethyl ester
U097	79-44-7	Carbamic chloride, dimethyl-
U114	[1] 111-54-6	Carbamodithioic acid, 1,2-ethanediylbis-, salts & esters
U062	2303-16-4	Carbamothioic acid, bis(1-methylethyl)-, S-(2,3-dichloro-2-propenyl) ester
U215	6533-73-9	Carbonic acid, dithallium(1 +) salt
U033	353-50-4	Carbonic difluoride
U156	79-22-1	Carbonochloridic acid, methyl ester (I,T)
U033	353-50-4	Carbon oxyfluoride (R,T)
U211	56-23-5	Carbon tetrachloride
U034	75-87-6	Chloral
U035	305-03-3	Chlorambucil
U036	57-74-9	Chlordane, alpha & gamma isomers
U026	494-03-1	Chlornaphazin
U037	108-90-7	Chlorobenzene
U038	510-15-6	Chlorobenzilate
U039	59-50-7	p-Chloro-m-cresol
U042	110-75-8	2-Chloroethyl vinyl ether
U044	67-66-3	Chloroform
U046	107-30-2	Chloromethyl methyl ether
U047	91-58-7	beta-Chloronaphthalene
U048	95-57-8	o-Chlorophenol
U049	3165-93-3	4-Chloro-o-toluidine, hydrochloride
U032	13765-19-0	Chromic acid H_2CrO_4, calcium salt
U050	218-01-9	Chrysene
U051		Creosote
U052	1319-77-3	Cresol (Cresylic acid)
U053	4170-30-3	Crotonaldehyde
U055	98-82-8	Cumene (I)
U246	506-68-3	Cyanogen bromide (CN)Br
U197	106-51-4	2,5-Cyclohexadiene-1,4-dione
U056	110-82-7	Cyclohexane (I)

Hazardous waste No.	Chemical abstracts No.	Substance
U129	58-89-9	Cyclohexane, 1,2,3,4,5,6-hexachloro-, (1alpha,2alpha,3beta,4alpha,5alpha,6beta)-
U057	108-94-1	Cyclohexanone (I)
U130	77-47-4	1,3-Cyclopentadiene, 1,2,3,4,5,5-hexachloro-
U058	50-18-0	Cyclophosphamide
U240	[1] 94-75-7	2,4-D, salts & esters
U059	20830-81-3	Daunomycin
U060	72-54-8	DDD
U061	50-29-3	DDT
U062	2303-16-4	Diallate
U063	53-70-3	Dibenz[a,h]anthracene
U064	189-55-9	Dibenzo[a,i]pyrene
U066	96-12-8	1,2-Dibromo-3-chloropropane
U069	84-74-2	Dibutyl phthalate
U070	95-50-1	o-Dichlorobenzene
U071	541-73-1	m-Dichlorobenzene
U072	106-46-7	p-Dichlorobenzene
U073	91-94-1	3,3'-Dichlorobenzidine
U074	764-41-0	1,4-Dichloro-2-butene (I,T)
U075	75-71-8	Dichlorodifluoromethane
U078	75-35-4	1,1-Dichloroethylene
U079	156-60-5	1,2-Dichloroethylene
U025	111-44-4	Dichloroethyl ether
U027	108-60-1	Dichloroisopropyl ether
U024	111-91-1	Dichloromethoxy ethane
U081	120-83-2	2,4-Dichlorophenol
U082	87-65-0	2,6-Dichlorophenol
U084	542-75-6	1,3-Dichloropropene
U085	1464-53-5	1,2:3,4-Diepoxybutane (I,T)
U108	123-91-1	1,4-Diethyleneoxide
U028	117-81-7	Diethylhexyl phthalate
U086	1615-80-1	N,N'-Diethylhydrazine
U087	3288-58-2	O,O-Diethyl S-methyl dithiophosphate
U088	84-66-2	Diethyl phthalate
U089	56-53-1	Diethylstilbesterol
U090	94-58-6	Dihydrosafrole
U091	119-90-4	3,3'-Dimethoxybenzidine
U092	124-40-3	Dimethylamine (I)
U093	60-11-7	p-Dimethylaminoazobenzene
U094	57-97-6	7,12-Dimethylbenz[a]anthracene
U095	119-93-7	3,3'-Dimethylbenzidine
U096	80-15-9	alpha,alpha-Dimethylbenzylhydroperoxide (R)
U097	79-44-7	Dimethylcarbamoyl chloride
U098	57-14-7	1,1-Dimethylhydrazine
U099	540-73-8	1,2-Dimethylhydrazine
U101	105-67-9	2,4-Dimethylphenol
U102	131-11-3	Dimethyl phthalate
U103	77-78-1	Dimethyl sulfate
U105	121-14-2	2,4-Dinitrotoluene
U106	606-20-2	2,6-Dinitrotoluene
U107	117-84-0	Di-n-octyl phthalate
U108	123-91-1	1,4-Dioxane
U109	122-66-7	1,2-Diphenylhydrazine
U110	142-84-7	Dipropylamine (I)
U111	621-64-7	Di-n-propylnitrosamine
U041	106-89-8	Epichlorohydrin
U001	75-07-0	Ethanal (I)
U174	55-18-5	Ethanamine, N-ethyl-N-nitroso-
U155	91-80-5	1,2-Ethanediamine, N,N-dimethyl-N'-2-pyridinyl-N'-(2-thienylmethyl)-
U067	106-93-4	Ethane, 1,2-dibromo-
U076	75-34-3	Ethane, 1,1-dichloro-
U077	107-06-2	Ethane, 1,2-dichloro-
U131	67-72-1	Ethane, hexachloro-
U024	111-91-1	Ethane, 1,1'-[methylenebis(oxy)]bis[2-chloro-
U117	60-29-7	Ethane, 1,1'-oxybis-(I)
U025	111-44-4	Ethane, 1,1'-oxybis[2-chloro-
U184	76-01-7	Ethane, pentachloro-
U208	630-20-6	Ethane, 1,1,1,2-tetrachloro-
U209	79-34-5	Ethane, 1,1,2,2-tetrachloro-
U218	62-55-5	Ethanethioamide

Hazardous waste No.	Chemical abstracts No.	Substance
U226	71-55-6	Ethane, 1,1,1-trichloro-
U227	79-00-5	Ethane, 1,1,2-trichloro-
U359	110-80-5	Ethanol, 2-ethoxy-
U173	1116-54-7	Ethanol, 2,2'-(nitrosoimino)bis-
U004	98-86-2	Ethanone, 1-phenyl-
U043	75-01-4	Ethene, chloro-
U042	110-75-8	Ethene, (2-chloroethoxy)-
U078	75-35-4	Ethene, 1,1-dichloro-
U079	156-60-5	Ethene, 1,2-dichloro-, (E)-
U210	127-18-4	Ethene, tetrachloro-
U228	79-01-6	Ethene, trichloro-
U112	141-78-6	Ethyl acetate (I)
U113	140-88-5	Ethyl acrylate (I)
U238	51-79-6	Ethyl carbamate (urethane)
U117	*60-29-7*	*Ethyl ether (I)*
U114	[1] 111-54-6	Ethylenebisdithiocarbamic acid, salts & esters
U067	106-93-4	Ethylene dibromide
U077	107-06-2	Ethylene dichloride
U359	110-80-5	Ethylene glycol monoethyl ether
U115	75-21-8	Ethylene oxide (I,T)
U116	96-45-7	Ethylenethiourea
U076	75-34-3	Ethylidene dichloride
U118	97-63-2	Ethyl methacrylate
U119	62-50-0	Ethyl methanesulfonate
U120	206-44-0	Fluoranthene
U122	50-00-0	Formaldehyde
U123	64-18-6	Formic acid (C,T)
U124	110-00-9	Furan (I)
U125	98-01-1	2-Furancarboxaldehyde (I)
U147	108-31-6	2,5-Furandione
U213	109-99-9	Furan, tetrahydro-(I)
U125	98-01-1	Furfural (I)
U124	110-00-9	Furfuran (I)
U206	18883-66-4	Glucopyranose, 2-deoxy-2-(3-methyl-3-nitrosoureido)-, D-
U206	18883-66-4	D-Glucose, 2-deoxy-2-[[(methylnitrosoamino)-carbonyl]amino]-
U126	765-34-4	Glycidylaldehyde
U163	70-25-7	Guanidine, N-methyl-N'-nitro-N-nitroso-
U127	118-74-1	Hexachlorobenzene
U128	87-68-3	Hexachlorobutadiene
U130	77-47-4	Hexachlorocyclopentadiene
U131	67-72-1	Hexachloroethane
U132	70-30-4	Hexachlorophene
U243	1888-71-7	Hexachloropropene
U133	302-01-2	Hydrazine (R,T)
U086	1615-80-1	Hydrazine, 1,2-diethyl-
U098	57-14-7	Hydrazine, 1,1-dimethyl-
U099	540-73-8	Hydrazine, 1,2-dimethyl-
U109	122-66-7	Hydrazine, 1,2-diphenyl-
U134	7664-39-3	Hydrofluoric acid (C,T)
U134	7664-39-3	Hydrogen fluoride (C,T)
U135	7783-06-4	Hydrogen sulfide
U135	7783-06-4	Hydrogen sulfide H_2S
U096	80-15-9	Hydroperoxide, 1-methyl-1-phenylethyl- (R)
U116	96-45-7	2-Imidazolidinethione
U137	193-39-5	Indeno[1,2,3-cd]pyrene
U190	85-44-9	1,3-Isobenzofurandione
U140	78-83-1	Isobutyl alcohol (I,T)
U141	120-58-1	Isosafrole
U142	143-50-0	Kepone
U143	303-34-4	Lasiocarpine
U144	301-04-2	Lead acetate
U146	1335-32-6	Lead, bis(acetato-O)tetrahydroxytri-
U145	7446-27-7	Lead phosphate
U146	1335-32-6	Lead subacetate
U129	58-89-9	Lindane
U163	70-25-7	MNNG
U147	108-31-6	Maleic anhydride
U148	123-33-1	Maleic hydrazide
U149	109-77-3	Malononitrile

Hazardous waste No.	Chemical abstracts No.	Substance
U150	148–82–3	Melphalan
U151	7439–97–6	Mercury
U152	126–98–7	Methacrylonitrile (I, T)
U092	124–40–3	Methanamine, N-methyl- (I)
U029	74–83–9	Methane, bromo-
U045	74–87–3	Methane, chloro- (I, T)
U046	107–30–2	Methane, chloromethoxy-
U068	74–95–3	Methane, dibromo-
U080	75–09–2	Methane, dichloro-
U075	75–71–8	Methane, dichlorodifluoro-
U138	74–88–4	Methane, iodo-
U119	62–50–0	Methanesulfonic acid, ethyl ester
U211	56–23–5	Methane, tetrachloro-
U153	74–93–1	Methanethiol (I, T)
U225	75–25–2	Methane, tribromo-
U044	67–66–3	Methane, trichloro-
U121	75–69–4	Methane, trichlorofluoro-
U036	57–74–9	4,7-Methano-1H-indene, 1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-
U154	67–56–1	Methanol (I)
U155	91–80–5	Methapyrilene
U142	143–50–0	1,3,4-Metheno-2H-cyclobuta[cd]pentalen-2-one, 1,1a,3,3a,4,5,5,5a,5b,6-decachlorooctahydro-
U247	72–43–5	Methoxychlor
U154	67–56–1	Methyl alcohol (I)
U029	74–83–9	Methyl bromide
U186	504–60–9	1-Methylbutadiene (I)
U045	74–87–3	Methyl chloride (I,T)
U156	79–22–1	Methyl chlorocarbonate (I,T)
U226	71–55–6	Methyl chloroform
U157	56–49–5	3-Methylcholanthrene
U158	101–14–4	4,4′-Methylenebis(2-chloroaniline)
U068	74–95–3	Methylene bromide
U080	75–09–2	Methylene chloride
U159	78–93–3	Methyl ethyl ketone (MEK) (I,T)
U160	1338–23–4	Methyl ethyl ketone peroxide (R,T)
U138	74–88–4	Methyl iodide
U161	108–10–1	Methyl isobutyl ketone (I)
U162	80–62–6	Methyl methacrylate (I,T)
U161	108–10–1	4-Methyl-2-pentanone (I)
U164	56–04–2	Methylthiouracil
U010	50–07–7	Mitomycin C
U059	20830–81–3	5,12-Naphthacenedione, 8-acetyl-10-[(3-amino-2,3,6-trideoxy)-alpha-L-lyxo-hexopyranosyl)oxy]-7,8,9,10-tetrahydro-6,8,11-trihydroxy-1-methoxy-, (8S-cis)-
U167	134–32–7	1-Naphthalenamine
U168	91–59–8	2-Naphthalenamine
U026	494–03–1	Naphthalenamine, N,N′-bis(2-chloroethyl)-
U165	91–20–3	Naphthalene
U047	91–58–7	Naphthalene, 2-chloro-
U166	130–15–4	1,4-Naphthalenedione
U236	72–57–1	2,7-Naphthalenedisulfonic acid, 3,3′-[(3,3′-dimethyl[1,1′-biphenyl]-4,4′-diyl)bis(azo)bis[5-amino-4-hydroxy]-, tetrasodium salt
U166	130–15–4	1,4-Naphthoquinone
U167	134–32–7	alpha-Naphthylamine
U168	91–59–8	beta-Naphthylamine
U217	10102–45–1	Nitric acid, thallium(1+) salt
U169	98–95–3	Nitrobenzene (I,T)
U170	100–02–7	p-Nitrophenol
U171	79–46–9	2-Nitropropane (I,T)
U172	924–16–3	N-Nitrosodi-n-butylamine
U173	1116–54–7	N-Nitrosodiethanolamine
U174	55–18–5	N-Nitrosodiethylamine
U176	759–73–9	N-Nitroso-N-ethylurea
U177	684–93–5	N-Nitroso-N-methylurea
U178	615–53–2	N-Nitroso-N-methylurethane
U179	100–75–4	N-Nitrosopiperidine
U180	930–55–2	N-Nitrosopyrrolidine
U181	99–55–8	5-Nitro-o-toluidine
U193	1120–71–4	1,2-Oxathiolane, 2,2-dioxide
U058	50–18–0	2H-1,3,2-Oxazaphosphorin-2-amine, N,N-bis(2-chloroethyl)tetrahydro-, 2-oxide
U115	75–21–8	Oxirane (I,T)

Hazardous waste No.	Chemical abstracts No.	Substance
U126	765-34-4	Oxiranecarboxyaldehyde
U041	106-89-8	Oxirane, (chloromethyl)-
U182	123-63-7	Paraldehyde
U183	608-93-5	Pentachlorobenzene
U184	76-01-7	Pentachloroethane
U185	82-68-8	Pentachloronitrobenzene (PCNB)
See F027	87-86-5	Pentachlorophenol
U161	108-10-1	Pentanol, 4-methyl-
U186	504-60-9	1,3-Pentadiene (I)
U187	62-44-2	Phenacetin
U188	108-95-2	Phenol
U048	95-57-8	Phenol, 2-chloro-
U039	59-50-7	Phenol, 4-chloro-3-methyl-
U081	120-83-2	Phenol, 2,4-dichloro-
U082	87-65-0	Phenol, 2,6-dichloro-
U089	56-53-1	Phenol, 4,4'-(1,2-diethyl-1,2-ethenediyl)bis-, (E)-
U101	105-67-9	Phenol, 2,4-dimethyl-
U052	1319-77-3	Phenol, methyl-
U132	70-30-4	Phenol, 2,2'-methylenebis[3,4,6-trichloro-
U170	100-02-7	Phenol, 4-nitro-
See F027	87-86-5	Phenol, pentachloro-
See F027	58-90-2	Phenol, 2,3,4,6-tetrachloro-
See F027	95-95-4	Phenol, 2,4,5-trichloro-
See F027	88-06-2	Phenol, 2,4,6-trichloro-
U150	148-82-3	L-Phenylalanine, 4-[bis(2-chloroethyl)amino]-
U145	7446-27-7	Phosphoric acid, lead(2+) salt (2:3)
U087	3288-58-2	Phosphorodithioic acid, O,O-diethyl S-methyl ester
U189	1314-80-3	Phosphorus sulfide (R)
U190	85-44-9	Phthalic anhydride
U191	109-06-8	2-Picoline
U179	100-75-4	Piperidine, 1-nitroso-
U192	23950-58-5	Pronamide
U194	107-10-8	1-Propanamine (I,T)
U111	621-64-7	1-Propanamine, N-nitroso-N-propyl-
U110	142-84-7	1-Propanamine, N-propyl- (I)
U066	96-12-8	Propane, 1,2-dibromo-3-chloro-
U083	78-87-5	Propane, 1,2-dichloro-
U149	109-77-3	Propanedinitrile
U171	79-46-9	Propane, 2-nitro- (I,T)
U027	108-60-1	Propane, 2,2'-oxybis[2-chloro-
U193	1120-71-4	1,3-Propane sultone
See F027	93-72-1	Propanoic acid, 2-(2,4,5-trichlorophenoxy)-
U235	126-72-7	1-Propanol, 2,3-dibromo-, phosphate (3:1)
U140	78-83-1	1-Propanol, 2-methyl- (I,T)
U002	67-64-1	2-Propanone (I)
U007	79-06-1	2-Propenamide
U084	542-75-6	1-Propene, 1,3-dichloro-
U243	1888-71-7	1-Propene, 1,1,2,3,3,3-hexachloro-
U009	107-13-1	2-Propenenitrile
U152	126-98-7	2-Propenenitrile, 2-methyl- (I,T)
U008	79-10-7	2-Propenoic acid (I)
U113	140-88-5	2-Propenoic acid, ethyl ester (I)
U118	97-63-2	2-Propenoic acid, 2-methyl-, ethyl ester
U162	80-62-6	2-Propenoic acid, 2-methyl-, methyl ester (I,T)
U194	107-10-8	n-Propylamine (I,T)
U083	78-87-5	Propylene dichloride
U148	123-33-1	3,6-Pyridazinedione, 1,2-dihydro-
U196	110-86-1	Pyridine
U191	109-06-8	Pyridine, 2-methyl-
U237	66-75-1	2,4-(1H,3H)-Pyrimidinedione, 5-[bis(2-chloroethyl)amino]-
U164	56-04-2	4(1H)-Pyrimidinone, 2,3-dihydro-6-methyl-2-thioxo-
U180	930-55-2	Pyrrolidine, 1-nitroso-
U200	50-55-5	Reserpine

Hazardous waste No.	Chemical abstracts No.	Substance
U201	108-46-3	Resorcinol
U202	[1] 81-07-2	Saccharin, & salts
U203	94-59-7	Safrole
U204	7783-00-8	Selenious acid
U204	7783-00-8	Selenium dioxide
U205	7488-56-4	Selenium sulfide
U205	7488-56-4	Selenium sulfide SeS_2 (R,T)
U015	115-02-6	L-Serine, diazoacetate (ester)
See F027	93-72-1	Silvex (2,4,5-TP)
U206	18883-66-4	Streptozotocin
U103	77-78-1	Sulfuric acid, dimethyl ester
U189	1314-80-3	Sulfur phosphide (R)
See F027	93-76-5	2,4,5-T
U207	95-94-3	1,2,4,5-Tetrachlorobenzene
U208	630-20-6	1,1,1,2-Tetrachloroethane
U209	79-34-5	1,1,2,2-Tetrachloroethane
U210	127-18-4	Tetrachloroethylene
See F027	58-90-2	2,3,4,6-Tetrachlorophenol
U213	109-99-9	Tetrahydrofuran (I)
U214	563-68-8	Thallium(I) acetate
U215	6533-73-9	Thallium(I) carbonate
U216	7791-12-0	Thallium(I) chloride
U216	7791-12-0	Thallium chloride Tlcl
U217	10102-45-1	Thallium(I) nitrate
U218	62-55-5	Thioacetamide
U153	74-93-1	Thiomethanol (I,T)
U244	137-26-8	Thioperoxydicarbonic diamide $[(H_2N)C(S)]_2S_2$, tetramethyl-
U219	62-56-6	Thiourea
U244	137-26-8	Thiram
U220	108-88-3	Toluene
U221	25376-45-8	Toluenediamine
U223	26471-62-5	Toluene diisocyanate (R,T)
U328	95-53-4	o-Toluidine
U353	106-49-0	p-Toluidine
U222	636-21-5	o-Toluidine hydrochloride
U011	61-82-5	1H-1,2,4-Triazol-3-amine
U227	79-00-5	1,1,2-Trichloroethane
U228	79-01-6	Trichloroethylene
U121	75-69-4	Trichloromonofluoromethane
See F027	95-95-4	2,4,5-Trichlorophenol
See F027	88-06-2	2,4,6-Trichlorophenol
U234	99-35-4	1,3,5-Trinitrobenzene (R,T)
U182	123-63-7	1,3,5-Trioxane, 2,4,6-trimethyl-
U235	126-72-7	Tris(2,3-dibromopropyl) phosphate
U236	72-57-1	Trypan blue
U237	66-75-1	Uracil mustard
U176	759-73-9	Urea, N-ethyl-N-nitroso-
U177	684-93-5	Urea, N-methyl-N-nitroso-
U043	75-01-4	Vinyl chloride
U248	[1] 81-81-2	Warfarin, & salts, when present at concentrations of 0.3% or less
U239	1330-20-7	Xylene (I)
U200	50-55-5	Yohimban-16-carboxylic acid, 11,17-dimethoxy-18-[(3,4,5-trimethoxybenzoyl)oxy]-, methyl ester, (3beta,16beta,17alpha,18beta,20alpha)-
U249	1314-84-7	Zinc phosphide Zn_3P_2, when present at concentrations of 10% or less

[1] CAS Number given for parent compound only.

(Approved by the Office of Management and Budget under control number 2050-0047)

[45 FR 78529, 78541, Nov. 25, 1980]

EDITORIAL NOTE: For FEDERAL REGISTER citations affecting § 261.33, see the List of CFR Sections Affected in the Finding Aids section of this volume.

Appendix B

Determining When LDRs Are Applicable to CERCLA Response Actions

EPA
United States Environmental Protection Agency
Office of Solid Waste and Emergency Response
Directive: 9347.3-05FS
July 1989

Superfund LDR Guide #5

Determining When Land Disposal Restrictions (LDRs) Are Applicable to CERCLA Response Actions

CERCLA Section 121(d)(2) specifies that on-site Superfund remedial actions shall attain "other Federal standards, requirements, criteria, limitations, or more stringent State requirements that are determined to be legally applicable or relevant and appropriate (ARAR) to the specified circumstances at the site." In addition, the National Contingency Plan (NCP) requires that on-site removal actions attain ARARs to the extent practicable. Off-site removal and remedial actions must comply with legally applicable requirements. This guide outlines the process used to determine whether the Resource Conservation and Recovery Act (RCRA) land disposal restrictions (LDRs) established under the Hazardous and Solid Waste Amendments (HSWA) are "applicable" to a CERCLA response action. More detailed guidance on Superfund compliance with the LDRs is being prepared by the Office of Solid Waste and Emergency Response (OSWER).

For the LDRs to be applicable to a CERCLA response, the action must constitute placement of a restricted RCRA hazardous waste. Therefore, site managers (OSCs, RPMs) must answer three separate questions to determine if the LDRs are applicable:

(1) Does the response action constitute placement?

(2) Is the CERCLA substance being placed also a RCRA hazardous waste? and if so

(3) Is the RCRA waste restricted under the LDRs?

Site managers also must determine if the CERCLA substances are California list wastes, which are a distinct category of RCRA hazardous wastes restricted under the LDRs (see Superfund LDR Guide #2).

(1) DOES THE RESPONSE CONSTITUTE PLACEMENT?

The LDRs place specific restrictions (e.g., treatment of waste to concentration levels) on RCRA hazardous wastes prior to their placement in land disposal units. Therefore, a key [illegible] is whether the response action will constitute placement of wastes into a land disposal unit. As defined by RCRA, land disposal units include landfills, surface impoundments, waste piles, injection wells, land treatment facilities, salt dome formations, underground mines or caves, and concrete bunkers or vaults. If a CERCLA response includes disposal of wastes in any of these types of off-site land disposal units, placement will occur. However, uncontrolled hazardous waste sites often have widespread and dispersed contamination, making the concept of a RCRA unit less useful for actions involving on-site disposal of wastes. Therefore, to assist in defining when "placement" does and does not occur for CERCLA actions involving on-site disposal of wastes, EPA uses the concept of "areas of contamination" (AOCs), which may be viewed as equivalent to RCRA units, for the purposes of LDR applicability determinations.

An AOC is delineated by the areal extent (or boundary) of contiguous contamination. Such contamination must be continuous, but may contain varying types and concentrations of hazardous substances. Depending on site characteristics, one or more AOCs may be delineated. Highlight 1 provides some examples of AOCs.

Highlight 1: EXAMPLES OF AREAS OF CONTAMINATION (AOCs)

- A waste source (e.g., waste pit, landfill, waste pile) and the surrounding contaminated soil.
- A waste source, and the sediments in a stream contaminated by the source, where the contamination is continuous from the source to the sediments.*
- Several lagoons separated only by dikes, where the dikes are contaminated and the lagoons share a common liner.

---

* The AOC does not include any contaminated surface or ground water that may be associated with the land-based waste source.

For on-site disposal, placement occurs when wastes are moved from one AOC (or unit) into another AOC (or unit). Placement does not occur when wastes are left in place, or moved within a single AOC. Highlight 2 provides scenarios of when placement does and does not occur, as defined in the proposed NCP. The Agency is current reevaluating the definition of placement prior to the promulgation of the final NCP, and therefore, these scenarios are subject to change.

Highlight 2: PLACEMENT

Placement <u>does</u> occur when wastes are:

- Consolidated from different AOCs into a single AOC;
- Moved outside of an AOC (for treatment or storage, for example) and returned to the same or a different AOC; or
- Excavated from an AOC, placed in a separate unit, such as an incinerator or tank that is within the AOC, and redeposited into the same AOC.

Placement <u>does not</u> occur when wastes are:

- Treated in situ;
- Capped in place;
- Consolidated within the AOC; or
- Processed within the AOC (but not in a separate unit, such as a tank) to improve its structural stability (e.g., for capping or to support heavy machinery).

In summary, if placement on-site or off-site does not occur, the LDRs are not applicable to the Superfund action.

(2) IS THE CERCLA SUBSTANCE A RCRA HAZARDOUS WASTE?

Because a CERCLA response must constitute placement of a restricted <u>RCRA hazardous waste</u> for the LDRs to be applicable, site managers must evaluate whether the contaminants at the CERCLA site are RCRA hazardous wastes. Highlight 3 briefly describes the two types of RCRA hazardous wastes --listed and characteristic wastes.

Highlight 3: RCRA HAZARDOUS WASTES

A RCRA solid waste[*] is hazardous if it is <u>listed</u> or exhibits a hazardous <u>characteristic</u>.

<u>Listed RCRA Hazardous Wastes</u>

Any waste listed in Subpart D of 40 CFR 261, including:

- F waste codes (Part 261.31)
- K waste codes (Part 261.32)
- P waste codes (Part 261.33(e))
- U waste codes (Part 261.33(f))

<u>Characteristic RCRA Hazardous Wastes</u>

Any waste exhibiting one of the following characteristics, as defined in 40 CFR 261:

- Ignitability
- Corrosivity
- Reactivity
- Extraction Procedure (EP) Toxicity

---

[*] A solid waste is any material that is discarded or disposed of (i.e., abandoned, recycled in certain ways, or considered inherently waste-like). The waste may be solid, semi-solid, liquid, or a contained gaseous material. Exclusions from the definition (e.g., domestic sewage sludge) appear in 40 CFR 261.4(a). Exemptions (e.g., household wastes) are found in 40 CFR 261.4(b).

Site managers are not required to presume that a CERCLA hazardous substance is a RCRA hazardous waste unless there is affirmative evidence to support such a finding. Site managers, therefore, should use "reasonable efforts" to determine whether a substance is a RCRA listed or characteristic waste. (Current data collection efforts during CERCLA removal and remedial site investigations should be sufficient for this purpose.) For listed hazardous wastes, if manifests or labels are not available, this evaluation likely will require fairly specific information about the waste (e.g., source, prior use, process type) that is "reasonably ascertainable" within the scope of a Superfund investigation. Such information may be obtained from facility business records or from an examination of the processes used at the facility. For characteristic wastes, site managers may rely on the results of the tests described in 40 CFR 261.21 - 261.24 for each characteristic or on knowledge of the properties of the substance. Site managers should work with Regional RCRA staff, Regional Counsel, State RCRA staff, and Superfund enforcement personnel, as appropriate, in making these determinations.

In addition to understanding the two categories of RCRA hazardous wastes, site managers will also need to understand the derived-from rule, the mixture rule, and the contained-in interpretation to identify correctly whether a CERCLA substance is a RCRA hazardous waste. *These three principles*, as well as an introduction to the RCRA delisting process, are described below.

Derived-from Rule (40 CFR 261.3(c)(2))

The derived-from rule states that any solid waste derived from the treatment, storage, or disposal of a listed RCRA *hazardous waste is itself a listed* hazardous waste (regardless of the concentration of hazardous constituents). For example, ash and scrubber water from the incineration of a listed waste are hazardous wastes *on the basis of the derived-from rule*. Solid wastes derived from a characteristic hazardous waste are hazardous wastes only if they exhibit a characteristic.

Mixture Rule (40 CFR 261.3(a)(2))

Under the mixture rule, when any solid waste and a listed hazardous waste are mixed, the entire mixture is a listed hazardous waste. For example, if a generator mixes a drum of listed F006 electroplating waste with a non-hazardous wastewater (wastewaters are solid wastes - see **Highlight 3**), the entire mixture of the F006 and wastewater is a listed hazardous waste. Mixtures of solid wastes and characteristic hazardous wastes are hazardous only if the mixture exhibits a characteristic.

Contained-in Interpretation (OSW Memorandum dated November 13, 1986)

The contained-in interpretation states that any mixture of a non-solid waste and a RCRA listed hazardous waste must be managed as a hazardous waste as long as the material contains (i.e., is above health-based levels) the listed hazardous waste. For example, if soil or ground water (i.e., both non-solid wastes) contain an F001 spent solvent, that soil or ground water must be managed as a RCRA hazardous waste, as long as it "contains" the F001 spent solvent.

Delisting (40 CFR 260.20 and .22)

To be exempted from the RCRA hazardous waste "system," a listed hazardous waste, a mixture of a listed and solid waste, or a derived-from waste must be delisted (according to 40 CFR 260.20 and .22). Characteristic hazardous wastes never need to be delisted, but can be treated to no longer exhibit the characteristic. A contained-in waste also does not have to be delisted; it only has to "*no longer contain*" the hazardous waste.

If site managers determine that the hazardous *substance(s) at the site is a RCRA hazardous waste(s)*, they should also determine whether that RCRA waste is a California list waste. California list wastes are a distinct category of RCRA wastes restricted under the *LDRs (see Superfund LDR Guide #2)*.

(3) IS THE RCRA WASTE RESTRICTED UNDER THE LDRs?

If a site manager determines that a CERCLA waste is a RCRA hazardous waste, this waste also must be restricted for the LDRs to be an applicable *requirement*. A RCRA hazardous waste becomes a restricted waste on its HSWA statutory deadline or sooner if the Agency promulgates a standard before the deadline. Because the LDRs are being phased in *over a period of time (see* ***Highlight 4****), site managers* may need to determine what type of restriction is in

Highlight 4: LDR STATUTORY DEADLINES

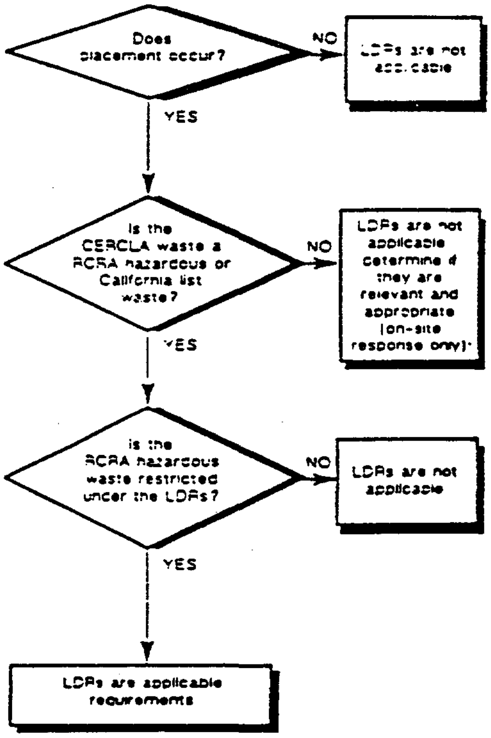
Waste	Statutory Deadline
Spent Solvent and Dioxin-Containing Wastes	November 8, 1986
California List Wastes	July 8, 1987
First Third Wastes	August 8, 1988
Spent Solvent, Dioxin-Containing, and California List Soil and Debris From CERCLA/RCRA Corrective Actions	November 8, 1988
Second Third Wastes	June 8, 1989
Third Third Wastes	May 8, 1990
Newly Identified Wastes	Within 6 months of identification as a hazardous waste

effect at the time placement is to occur. For example, if the RCRA hazardous wastes at a site are currently under a national capacity extension when the CERCLA decision document is signed, site managers should evaluate whether the response action will be completed before the extension expires. If these wastes are disposed of in surface impoundments or landfills prior to the expiration of the extension, the receiving unit would have to meet minimum technology requirements, but the wastes would not have to be treated to meet the LDR treatment standards.

APPLICABILITY DETERMINATIONS

If the site manager determines that the LDRs are applicable to the CERCLA response based on the previous three questions, the site manager must: (1) comply with the LDR restriction in effect, (2) comply with the LDRs by choosing one of the LDR compliance options (e.g., Treatability Variance, No Migration Petition), or (3) invoke an ARAR waiver (available only for on-site actions). If the LDRs are determined not to be applicable, then, for on-site actions only, the site manager should determine if the LDRs are relevant and appropriate. The process for determining whether the LDRs are applicable to a CERCLA action is summarized in Highlight 5.

Highlight 5 - DETERMINING WHEN LDRS ARE APPLICABLE REQUIREMENTS



Appendix C

RCRA Wastes That Have Been Successfully Delisted

(40 CFR 261, Appendix IX; July 1, 1992)

Contents of Appendix C

[53 FR 13388, Apr. 22, 1988, as amended at 53 FR 43881, Oct. 31, 1988; 54 FR 50978, Dec. 11, 1989; 55 FR 50483, Dec. 6, 1990; 56 FR 7568, Feb. 25, 1991]

APPENDIX IX TO PART 261—WASTES EXCLUDED UNDER §§ 260.20 AND 260.22

TABLE 1—WASTES EXCLUDED FROM NON-SPECIFIC SOURCES

Facility	Address	Waste description
Aptus, Inc.	Coffeyville, Kansas.	Kiln residue and spray dryer/baghouse residue (EPA Hazardous Waste No. F027) generated during the treatment of cancelled pesticides containing 2,4,5-T and Silvex and related materials by Aptus' incinerator at Coffeyville, Kansas after December 27, 1991, so long as: (1) The incinerator is monitored continuously and is in compliance with operating permit conditions. Should the incinerator fail to comply with the permit conditions relevant to the mechanical operation of the incinerator, Aptus must test the residues generated during the run when the failure occurred according to the requirements of Conditions (2) through (4), regardless of whether or not the demonstration in Condition (5) has been made. (2) A minimum of four grab samples must be taken from each hopper (or other container) of kiln residue generated during each 24 hour run; all grabs collected during a given 24 hour run must then be composited to form one composite sample. A minimum of four grab samples must also be taken from each hopper (or other container) of spray dryer/baghouse residue generated during each 24 hour run; all grabs collected during a given 24 hour run must then be composited to form one composite sample. Prior to the disposal of the residues from each 24 hour run, a TCLP leachate test must be performed on these composite samples and the leachate analyzed for the TC toxic metals, nickel, and cyanide. If arsenic, chromium, lead or silver TC leachate test results exceed 1.6 ppm, barium levels exceed 32 ppm, cadmium or selenium levels exceed 0.3 ppm, mercury levels exceed 0.07 ppm, nickel levels exceed 10 ppm, or cyanide levels exceed 6.5 ppm, the wastes must be retreated to achieve these levels or must be disposed in accordance with subtitle C of RCRA. Analyses must be performed according to SW-846 methodologies. (3) Aptus must generate, prior to the disposal of the residues, verification data from each 24 hour run for each treatment residue (i.e., kiln residue, spray dryer/baghouse residue) to demonstrate that the maximum allowable treatment residue concentrations listed below are not exceeded. Samples must be collected as specified in Condition (2). Analyses must be performed according to SW-846 methodologies. Any residues which exceed any of the levels listed below must be retreated or must be disposed of as hazardous. Kiln residue and spray dryer/baghouse residue must not exceed the following levels: Aldrin—0.015 ppm Benzene—9.7 ppm Benzo(a)pyrene—0.43 ppm Benzo(b)fluoranthene—1.8 ppm Chlordane—0.37 ppm Chloroform—5.4 ppm Chrysene—170 ppm Dibenz(a,h)anthracene—0.083 ppm 1,2-Dichloroethane—4.1 ppm Dichloromethane—2.4 ppm 2,4-Dichlorophenol—480 ppm Dichlorvos—260 ppm Disulfaton—23 ppm Endosulfan I—310 ppm Fluorene—120 ppm Indeno(1,2,3,cd)-pyrene—330 ppm Methyl parathion—210 ppm Nitrosodiphenylamine—130 ppm Phenanthrene—150 ppm Polychlorinated biphenyls—0.31 ppm Tetrachloroethylene—59 ppm 2,4,5-TP (silvex)—110 ppm 2,4,6-Trichlorophenol—3.9 ppm

TABLE 1—WASTES EXCLUDED FROM NON-SPECIFIC SOURCES—Continued

Facility	Address	Waste description
		(4) Aptus must generate, prior to disposal of residues, verification data from each 24 hour run for each treatment residue (*i.e.*, kiln residue, spray dryer/baghouse residue) to demonstrate that the residues do not contain tetra-, penta-, or hexachlorodibenzo-p-dioxins or furans at levels of regulatory concern. Samples must be collected as specified in Condition (2). The TCDD equivalent levels for the solid residues must be less than 5 ppt. Any residues with detected dioxins or furans in excess of this level must be retreated or must be disposed of as acutely hazardous. SW-846 Method 8290, a high resolution gas chromatography and high resolution mass spectroscopy (HRGC/HRMS) analytical method must be used. For tetra- and penta-chlorinated dioxin and furan homologs, the maximum practical quantitation limit must not exceed 15 ppt for the solid residues. For hexachlorinated dioxin and furan homologs, the maximum practical quantitation limit must not exceed 37 ppt for the solid residues. (5) The test data from Conditions (1), (2), (3), and (4) must be kept on file by Aptus for inspection purposes and must be compiled, summarized, and submitted to the Director for the Characterization and Assessment Division, Office of Solid Waste, by certified mail on a monthly basis and when the treatment of the cancelled pesticides and related materials is concluded. The testing requirements for Conditions (2), (3), and (4) will continue until Aptus provides the Director with the results of four consecutive batch analyses for the petitioned wastes, none of which exceed the maximum allowable levels listed in these conditions and the director notifies Aptus that the conditions have been lifted. All data submitted will be placed in the RCRA public docket. (6) Aptus must provide a signed copy of the following certification statement when submitting data in response to the conditions listed above: "Under civil and criminal penalty of law for the making or submission of false or fraudulent statements or representations, I certify that the information contained in or accompanying this document is true, accurate, and complete. As to the (those) identified section(s) of this document for which I cannot personally verify its (their) truth and accuracy,I certify as the company official having supervisory responsibility for the persons who, acting under my direct instructions, made the verification that this information is true, accurate, and complete."
Arco Building Products.	Sugarcreek, Ohio.	Dewatered wastewater treatment sludge (EPA Hazardous Waste No. F019) generated from the chemical conversion coating of aluminum after August 15, 1986.
Arco Chemical Co.	Miami, FL..........	Dewatered wastewater treatment sludge (EPA Hazardous Waste No. FO19) generated from the chemical conversion coating of aluminum after April 29, 1986.
Arkansas Department of Pollution Control and Ecology.	Vertac Superfund site, Jacksonville, Arkansas.	Kiln ash, cyclone ash, and calcium chloride salts from incineration of residues (EPA Hazardous Waste No. F020 and F023) generated from the primary production of 2,4,5-T and 2,4-D after August 24, 1990. This one-time exclusion applies only to the incineration of the waste materials described in the petition, and it is conditional upon the data obtained from ADPC&E's full-scale incineration facility. To ensure that hazardous constituents are not present in the waste at levels of regulatory concern once the full-scale treatment facility is in operation, ADPC&E must implement a testing program for the petitioned waste. This testing program must meet the following conditions for the exclusion to be valid: (1) *Testing:* Sample collection and analyses (including quality control (QC) procedures) must be performed according to SW-846 methodologies. (A) *Initial testing:* Representative grab samples must be taken from each drum and kiln ash and cyclone ash generated from each 24 hours of operation, and the grab samples composited to form one composite sample of ash for each 24-hour period. Representative grab samples must also be taken from each drum of calcium chloride salts generated from each 24 hours of operation and composited to form one composite sample of calcium chloride salts for each 24-hour period. The initial testing requirements must be fullfilled for the following wastes: (i) Incineration by-products generated prior to and during the incinerator's trial burn; (ii) incineration by-products from the treatment of 2,4-D wastes for one week (or 7 days if incineration is not on consecutive days) after completion of the trial burn; (iii) incineration by-products from the treatment of blended 2,4-D and 2,4, 5-T wastes for two weeks (or 14 days if incineration is not on consecutive days) after completion of the trial burn; and (iv) incineration by-products from the treatment of blended 2,4-D and 2,4,5-T wastes for one week (or 7 days if incineration is not on consecutive days) when the percentage of 2, 4, 5-T wastes exceeds the maximum percentage treated under Condition (1)(A)(iii). Prior to disposal of the residues from each 24-hour sampling period, the daily composite must be analyzed for all the constituents listed in Condition (3). ADPC&E must report the analytical test data, including quality control information, obtained during this initial period no later than 90 days after the start of the operation.

TABLE 1—WASTES EXCLUDED FROM NON-SPECIFIC SOURCES—Continued

Facility	Address	Waste description
		(B) *Subsequent testing:* Representative grab samples of each drum of kiln and cyclone ash generated from each week of operation must be composited to form one composite sample of ash for each weekly period. Representative grab samples of each drum of calcium chloride salts generated from each week of operation must also be composited to form one composite sample of calcium chloride salts for each weekly period. Prior to disposal of the residues from each weekly sampling period, the weekly composites must be analyzed for all of the constituents listed in Condition (3). The analytical data, including quality control information, must be compiled and maintained on site for a minimum of three years. These data must be furnished upon request and made available for inspection by any employee or representative of EPA. (2) *Waste holding:* The incineration residues that are generated must be stored as hazardous until the initial verification analyses or subsequent analyses are completed. If the composite incineration residue samples (from either Condition (1)(A) or Condition (1)(B)) do not exceed any of the delisting levels set in Condition (3), the incineration residues corresponding to these samples may be managed and disposed of in accordance with all applicable solid waste regulations. If any composite incineration residue sample exceeds any of the delisting levels set in Condition (3), the incineration residues generated during the time period corresponding to this sample must be retreated until they meet these levels (analyses must be repeated) or managed and disposed of in accordance with subtitle C of RCRA. Incineration residues which are generated but for which analysis is not complete or valid must be managed and disposed of in accordance with subtitle C of RCRA, until valid analyses demonstrate that the wastes meet the delisting levels. (3) *Delisting levels:* If concentrations in one or more of the incineration residues for any of the hazardous constituents listed below exceed their respective maximum allowable concentrations also listed below, the batch of failing waste must either be re-treated until it meets these levels or managed and disposed of in accordance with subtitle C of RCRA. (A) Inorganics (Leachable): Arsenic, 0.32 ppm; Barium, 6.3 ppm; Cadmium, 0.06 ppm; Chromium, 0.32 ppm; Cyanide, 4.4 ppm; Lead, 0.32 ppm; Mercury, 0.01 ppm; Nickel, 4.4 ppm; Selenium, 0.06 ppm; Silver, 0.32 ppm. Metal concentrations must be measured in the waste leachate as per 40 CFR 261.24. Cyanide extractions must be conducted using distilled water. (B) Organics: Benzene, 0.87 ppm; Benzo(a)anthracene, 0.10 ppm; Benzo(a)pyrene, 0.04 ppm; Benzo (b)fluoranthene, 0.16 ppm; Chlorobenzene, 152 ppm; o-Chlorophenol, 44 ppm; Chrysene, 15 ppm; 2, 4-D, 107 ppm; DDE, 1.0 ppm; Dibenz(a,h)anthracene, 0.007 ppm; 1, 4-Dichlorobenzene, 265 ppm; 1, 1-Dichloroethylene, 1.3 ppm; trans-1,2-Dichloroethylene, 37 ppm; Dichloromethane, 0.23 ppm; 2,4-Dichlorophenol, 43 ppm; Hexachlorobenzene, 0.26 ppm; Indeno (1,2,3-cd) pyrene, 30 ppm; Polychlorinated biphenyls, 12 ppm; 2,4,5-T, 1×10^{6} ppm; 1,2,4,5-Tetrachlorobenzene, 56 ppm; Tetrachloroethylene, 3.4 ppm; Trichloroethylene, 1.1 ppm; 2,4,5-Trichlorophenol, 21,000 ppm; 2,4,6-Trichlorophenol, 0.35 ppm. (C) Chlorinated dioxins and furans: 2,3,7,8-Tetrachlorodibenzo-p-dioxin equivalents, $4 \times 10^{-7\ \mathrm{ppm}}$. The petitioned by-product must be analyzed for the tetra-, penta-, hexa-, and heptachlorodibenzo-p-dioxins, and the tetra-, penta-, hexa-, and heptachlorodibenzofurans to determine the 2, 3, 7, 8-tetra- chlorodibenzo-p-dioxin equivalent concentration. The analysis must be conducted using Method 8290, a high resolution gas chromatography/high resolution mass spectrometry method, and must achieve practical quantitation limits of 15 parts per trillion (ppt) for the tetra- and penta- homologs, and 37 ppt for the hexa- and hepta- homologs. (4) *Termination of testing:* Due to the possible variability of the incinerator feeds, the testing requirements of Condition (1)(B) will continue indefinitely.

TABLE 1—WASTES EXCLUDED FROM NON-SPECIFIC SOURCES—Continued

Facility	Address	Waste description
		(5) *Data submittals:* Within one week of system start-up, ADPC&E must notify the Section Chief, Variances Section (see address below) when the full-scale incineration system is on-line and waste treatment has begun. The data obtained through Condition (1)(A) must be submitted to the Section Chief, Variances Section, PSPD/OSW (OS-343), U.S. EPA, 401 M Street SW., Washington, DC 20460, within the time period specified. At the Section Chief's request, ADPC&E must submit analytical data obtained through Condition (1)(B) within the time period specified by the Section Chief. Failure to submit the required data obtained from Condition (1)(A) within the specified time period or to maintain the required records for the time specified in Condition (1)(B) (or to submit data within the time specified by the Section Chief) will be considered by the Agency, at its discretion, sufficient basis to revoke ADPC&E's exclusion to the extent directed by EPA. All data must be accompanied by the following certification statement: "Under civil and criminal penalty of law for the making or submission of false or fraudulent statements or representations (pursuant to the applicable provisions of the Federal Code, which include, but may not be limited to, 18 U.S.C. 1001 and 42 U.S.C. 6928), I certify that the information contained in or accompanying this document is true, accurate and complete. As to the (those) identified section(s) of this document for which I cannot personally verify its (their) truth and accuracy, I certify as the company official having supervisory responsibility for the persons who, acting under my direct instructions, made the verification that this information is true, accurate and complete. In the event that any of this information is determined by EPA in its sole discretion to be false, inaccurate or incomplete, and upon conveyance of this fact to the company, I recognize and agree that this exclusion of wastes will be void as if it never had effect or to the extent directed by EPA and that the company will be liable for any actions taken in contravention of the company's RCRA and CERCLA obligations premised upon the company's reliance on the void exclusion."
BBC Brown Boveri, Inc.	Sanford, FL	Dewatered Wastewater treatment sludges (EPA Hazardous Waste No. F006) generated from electroplating operations after October 17, 1986.
Boeing Commercial Airplane Co.	Auburn, Washington.	Residually contaminated soils in an inactive sludge pile containment area on March 27, 1990, previously used to store wastewater treatment sludges generated from electroplating operations (EPA Hazardous Waste No. F006).
Bommer Industries Inc.	Landrum, SC	Wastewater treatment sludges (EPA Hazardous Waste No. F006) generated from their electroplating operations and contained in evaporation ponds #1 and #2 on August 12, 1987.
Capitol Products Corp.	Harrisburg, PA	Dewatered wastewater treatment slugdges (EPA Hazardous Waste No. FO19) generated from the chemical conversion coating of aluminum after September 12, 1986.
Capitol Products Corporation.	Kentland, IN	Dewatered wastewater treatment sludges (EPA Hazardous Waste No. F019) generated from the chemical conversion coating of aluminum after November 17, 1986.
Chamberlian-Featherlite, Inc.	Hot Springs, AR.	Dewatered wastewater treatment sludges (EPA Hazardous Waste No. F019) generated from the chemical conversion coating of aluminum after July 16, 1986.
Cincinnati Metropolitan Sewer District.	Cincinnati, OH	Sluiced bottom ash (approximately 25,000 cubic yards) contained in the South Lagoon, on September 13, 1985 which contains EPA Hazardous Waste Nos. F001, F002, F003, F004, and F005.
Clay Equipment Corporation.	Cedar Falls, Iowa.	Dewatered wastewater treatment sludges (EPA Hazardous Waste No. F006) and spent cyanide bath solutions (EPA Hazardous Waste No. F009) generated from electroplating operations and disposed of in an on-site surface impoundment. This is a onetime exclusion. This exclusion was published on August 1, 1989.
Continental Can Co.	Olympia, WA	Dewatered wastewater treatment sludges (DPA Hazardous Waste No. FO19) generated from the chemical conversion coating of aluminum after September 12, 1986.
Dover Corp., Norris Div.	Tulsa, OK	Dewatered wastewater treatment sludge (EPA Hazardous Waste No. FO06) generated from their electroplating operations after April 29, 1986.
Eli Lilly and Company.	Clinton, Indiana.	Incinerator scrubber liquids, entering and contained in their onsite surface impoundment, and solids settling from these liquids originating from the burning of spent solvents (EPA Hazardous Waste Nos. F002, F003, and F005) contained in their onsite surface impoundment and solids retention area on August 18, 1988 and any new incinerator scubber liquids and settled solids generated in the surface impoundment and and disposed of in the retention are after August 12, 1988.

TABLE 1—WASTES EXCLUDED FROM NON-SPECIFIC SOURCES—Continued

Facility	Address	Waste description
EPA's Mobile Incineration System.	Denney Farm Site; McDowell, MO.	Process wastewater, rotary kiln ash, CHEAF media, and other solids (except spent activated carbon) (EPA Hazardous Waste Nos. F020, F022, F023, F026, F027, and F028) generated during the field demonstration of EPA's Mobile Incinerator at the Denney Farm Site in McDowell, Missouri, after July 25, 1985, so long as: (1) The incinerator is functioning properly; (2) a grab sample is taken from each tank of wastewater generated and the EP leachate values do not exceed 0.03 ppm for mercury, 0.14 ppm for selenium, and 0.68 ppm for chromium; and (3) a grab sample is taken from each drum of soil or ash generated and a core sample is collected from each CHEAF roll generated and the EP leachate values of daily composites do not exceed 0.044 ppm in ash or CHEAF media for mercury or 0.22 ppm in ash or CHEAF media for selenium.
Envirite Corporation.	Canton, Ohio; Harvey, Illinois; Thomaston, Connecticut; and York, PA.	Dewatered wastewater sludges (EPA Hazardous Waste No. F006) generated from electroplating operations; spent cyanide plating solutions (EPA Hazardous Waste No. F007) generated from electroplating operations; plating bath residues from the bottom of plating baths (EPA Hazardous Waste No. F008) generated from electroplating operations where cyanides are used in the process; spent stripping and cleaning bath solutions (EPA Hazardous Waste No. F009) generated from electro-plating operations where cyanides are used in the process; spent cyanide solutions from salt bath pot cleaning (EPA Hazardous Waste No. F011) generated from Metal heat treating operations; quenching wastewater treatment sludges (EPA Hazardous Waste No. F012) generated from metal heat treating where cyanides are used in the process; wastewater treatment sludges (EPA Hazardous Waste No. F019) generated from the chemical conversion coating of aluminum after November 14, 1986. To ensure that hazardous constituents are not present in the waste at levels of regulatory concern, the facility must implement a contingency testing program for the petitioned wastes. This testing program must meet the following conditions for the exclusions to be valid: (1) Each batch of treatment residue must be representatively sampled and tested using the EP Toxicity test for arsenic, barium, cadmium, chromium, lead, selenium, silver, mercury, and nickel. If the extract concentrations for chromium, lead, arsenic, and silver exceed 0.315 ppm; barium levels exceed 6.3 ppm; cadmium and selenium exceed 0.063 ppm; mercury exceeds 0.0126 ppm; or nickel levels exceed 2.205 ppm, the waste must be re-treated or managed and disposed as a hazardous waste under 40 CFR Parts 262 to 265 and the permitting standards of 40 CFR Part 270. (2) Each batch of treatment residue must be tested for reactive and leachable cyanide. If the reactive cyanide levels exceed 250 ppm or leachable cyanide levels (using the EP Toxicity test without acetic acid adjustment) exceed 1.26 ppm, the waste must be re-treated or managed and disposed as a hazardous waste under 40 CFR Parts 262 to 265 and the permitting standards of 40 CFR Part 270. (3) Each batch of waste must be tested for the total content of specific organic toxicants. If the total content of anthracene exceeds 76.8 ppm, 1,2-diphenyl hydrazine exceeds 0.001 ppm, methylene chloride exceeds 8.18 ppm, methyl ethyl ketone exceeds 326 ppm, n-nitrosodiphenylamine exceeds 11.9 ppm, phenol exceeds 1,566 ppm, tetrachloroethylene exceeds 0.188 ppm, or trichloroethylene exceeds 0.592 ppm, the waste must be managed and disposed as a hazardous waste under 40 CFR Parts 262 and 265 and the permitting standards of 40 CFR Part 270. (4) A grab sample must be collected from each batch to form one monthly composite sample which must be tested using GC/MS analysis for the compounds listed in #3 above as well as the remaining organics on the priority pollutant list. (See 47 FR 52309 November 19, 1982, for a list of the priority pollutants.) (5) The data from conditions 1–4 must be kept on file at the facility for inspection purposes and must be compiled, summarized, and submitted to the Administrator by certified mail semi-annually. The Agency will review this information and if needed will propose to modify or withdraw the exclusion. The organics testing described in conditions 3 and 4 above are not required until six months from the date of promulgation. The Agency's decision to conditionally exclude the treatment residue generated from the wastewater treatment systems at these facilities applies only to the wastewater and solids treatment systems as they presently exist as described in the delisting petition. The exclusion does not apply to the proposed process additions described in the petition as recovery including crystalization, electrolytic metals recovery, evaporative recovery, and ion exchange.
Falconer Glass Indust., Inc.	Falconer, NY	Wastewater treatment sludges from the filter press and magnetic drum separator (EPA Hazardous Waste No. F006) generated from electroplating operations after July 16, 1986.
Florida Production Engineering Company.	Daytona Beach, Florida.	This is a one-time exclusion. Wastewater treatment sludges (EPA Hazardous Waste No. F006) generated from electroplating operations and contained in four on-site trenches on January 23, 1987.
General Cable Co.	Muncie, IN	Dewatered wastewater treatment sludges (EPA Hazardous Waste Nos. F006 and K062) generated from electroplating operations and steel finishing operations after October 24, 1986. This exclusion does not apply to sludges in any on-site impoundments as of this date.

Table 1—Wastes Excluded From Non-Specific Sources—Continued

Facility	Address	Waste description
General Electric Company.	Shreveport Louisiana.	Wastewater treatment sludges (EPA Hazardous Waste No. F006) generated from electroplating operations and contained in four on-site treatment ponds on August 12, 1987.
General Motors Corp., Fisher Body Division.	Elyria, OH	The residue generated from the use of the Chemfix® treatment process on sludge (EPA Hazardous Waste No. F006) generated from electroplating operations and contained in three on-site surface impoundments on November 14, 1986. To assure that stabilization occurs, the following conditions apply to this exclusion: (1) Mixing ratios shall be monitored continuously to assure consistent treatment. (2) One grab sample of the treated waste shall be taken each hour as it is pumped to the holding area (cell) from each trailer unit. At the end of each production day, the grab samples from the individual trailer units will be composited and the EP toxicity test will be run on each composite sample. If lead or total chromium concentrations exceed 0.315 ppm or if nickel exceeds 2.17 ppm, in the EP extract, the waste ill be removed and retreated or disposed of as a hazardous waste. (3) The treated waste shall be pumped into bermed cells which are constructed to assure that the treated waste is identifiable and retrievable (*i.e.*, the material can be removed and either disposed of as a hazardous waste or retreated if conditions 1 or 2 are not met). Failure to satisfy any of these conditions would render the exclusion void. This is a one-time exclusion, applicable only to the residue generated from the use of the Chemfix® treatment process on the sludge currently contained in the three on-site surface impoundments.
Geological Reclamation Operations and Systems, Inc.	Morrisville, PA	Wastewater treatment sludge filter cake from the treatment of EPA Hazardous Waste No. *F039*, generated at a maximum annual rate of 1,000 cubic yards. This exclusion was published on August 20, 1991. This exclusion covers the filter cake resulting from the treatment of hazardous leachate derived from only "old" GROWS and non-hazardous leachate derived from only non-hazardous sources. This exclusion does not address the wastes disposed of in the "old" GROWS Landfill or the grit generated during the removal of heavy solids from the landfill leachate. To ensure that hazardous constituents are not present in the filter cake at levels of regulatory concern, GROWS must implement a testing program for the petitioned waste. This testing program must meet the conditions listed below in order for the exclusion to be valid: (1) *Testing:* Sample collection and analyses, including quality control (QC) procedures, must be performed according to SW-846 methodologies. (A) *Sample Collection:* Each batch of waste generated over a four-week period must be collected in containers with a maximum capacity of 20-cubic yards. At the end of the four-week period, each container must be divided into four quadrants and a single, full-depth core sample shall be collected from each quadrant. All of the full-depth core samples then must be composited under laboratory conditions to produce one representative composite sample for the four-week period. (B) *Sample Analysis:* Each four-week composite sample must be analyzed for all of the constituents listed in Condition (3). The analytical data, including quality control information, must be compiled and maintained on site for a minimum of three years. These data must be furnished upon request by any employee or representative of EPA or state of Pennsylvania. (2) *Waste Holding:* The dewatered filter cake waste must be stored as hazardous until the verification analyses are completed. If the four-week composite sample does not exceed any of the delisting levels set in Condition (3), the filter cake waste corresponding to this sample may be managed and disposed of in accordance with all applicable solid waste regulations. If the four-week composite sample exceeds any of the delisting levels set in Condition (3), the filter cake waste generated during the time period corresponding to the four-week composite sample must be retreated until it meets these levels (analyses must be repeated) or managed and disposed of in accordance with subtitle C of RCRA. Filter cake waste which is generated but for which analyses are not complete or valid must be managed and disposed of in accordance with subtitle C of RCRA, until valid analyses demonstrate that the waste meets the delisting levels. (3) *Delisting Levels:* If the concentrations in the four-week composite sample of the filter cake waste for any of the hazardous constituents listed below exceed their respective maximum allowable concentrations (ppm) also listed below, the four-week batch of failing filter cake waste must either be retreated until it meets these levels or managed and disposed of in accordance with subtitle C of RCRA. (A) Inorganics (Leachable): Arsenic—0.79 Barium—15.9 Cadmium—0.16 Chromium—0.79 Cyanide—11.1 Lead—0.79 Mercury—0.032 Selenium—0.16

TABLE 1—WASTES EXCLUDED FROM NON-SPECIFIC SOURCES—Continued

Facility	Address	Waste description
		Silver—0.79
		Nickel—11.1
		Leachable metal concentrations must be measured in the filter cake leachate as per 40 CFR § 261.24. Cyanide extractions must be conducted using distilled water in place of the leaching media per 40 CFR § 261.24.
		(B) Organics:
		Acetone—2.02E+03
		Acetophenone—3.53E+04
		Acetonitrile; Methyl cyanide—2.43E+01
		Acrolein—1.38E+02
		Acrylonitrile—6.26E-04
		Aldrin—5.27E-03
		Aniline—8.72E-01
		Anthracene—3.01E+02
		Benzene—3.47E+00
		Benzo[a]anthracene—5.78E-01
		Benzo(b)fluoranthene—6.41E-01
		Benzo(k)fluoranthene—3.04E+03
		Benzo[a]pyrene—1.51E-01
		gamma-BHC; Lindane—5.90E-01
		Bis(2-chloroethyl) ether—6.94E-04
		Bis(2-ethylhexyl) phthalate—1.64E+02
		Bromodichloromethane—2.94E+03
		Bromoform; Tribromomethane—3.76E+03
		Butyl benzyl phthalate—2.49E+05
		Carbon disulfide—4.98E+04
		Carbon tetrachloride—5.49E+00
		Chlordane—7.51E+01
		p-Chloroaniline—1.85E+02
		Chlorobenzene—5.95E+02
		Chlorobenzilate—1.68E+03
		p-Chloro-m-cresol—5.18E+02
		Chloroform—1.94E+00
		2-Chlorophenol—1.72E+02
		Chrysene—5.92E+01
		Cresol—4.91E+03
		2,4-D; 2,4-Dichlorophenoxyacetic acid—4.17E+02
		4,4'-DDD; DDD—2.33E+00
		4,4'-DDE; DDE—3.86E+00
		4,4'-DDT; DDT—1.21E+01
		Dibenz[a,h]anthracene—2.86E-02
		Dibromochloromethane; Chlorodibromomethane—3.05E+03
		1,2-Dibromo-3-chloropropane—4.09E-02
		1,2-Dibromoethane; Ethylene dibromide—2.37E-03
		Di-n-butyl phthalate—9.84E+05
		o-Dichlorobenzene; 1,2-Dichlorobenzene—1.95E+04
		m-Dichlorobenzene; 1,3-Dichlorobenzene—1.87E+05
		p-Dichlorobenzene; 1,4-Dichlorobenzene—1.03E+03
		3,3'-Dichlorobenzidine—2.21E-01
		Dichlorodifluoromethane—4.15E+05
		1,1-Dichloroethane—4.45E-02
		1,2-Dichloroethane; Ethylene dichloride—1.45E+00
		1,1-Dichloroethylene—4.96E+00
		trans-1,2-Dichloroethylene—1.42E+02
		2,4-Dichlorophenol—1.69E+02
		1,2-Dichloropropane—2.73E+00
		1,3-Dichloropropene (total cis and trans isomers)—2.32E-02
		Dieldrin—5.04E-03
		Diethyl phthalate—1.00E+06
		Dimethoate—1.32E+00
		7,12-Dimethylbenz[a]anthracene—1.46E-02
		2,4-Dimethylphenol—4.87E+01
		Dimethyl phthalate—1.00E+06
		m-Dinitrobenzene—5.14E+00
		4,6-Dinitro-o-cresol—2.00E+02
		2,4-Dinitrophenol—8.96E+01
		Dinitrotoluene (total of-2,4- and 2,6- isomers)—4.54E-03
		Dinoseb; DNBP—5.26E+02
		Di-n-octyl phthalate—1.34E+05
		1,4-Dioxane—7.89E-02

TABLE 1—WASTES EXCLUDED FROM NON-SPECIFIC SOURCES—Continued

Facility	Address	Waste description
		Diphenylamine—4.81E+04
		Disulfoton—3.34E+00
		Endosulfan I and Endosulfan II (total)—7.74E+01
		Endrin—3.92E+00
		Ethylbenzene—1.94E+04
		Fluoranthene—1.16E+05
		Fluorene—4.09E+01
		Heptachlor—1.31E+01
		Heptachlor epoxide—3.26E+00
		Hexachlorobenzene—1.02E+00
		Hexachlorobutadiene—2.01E+01
		Hexachlorocyclopentadiene—3.23E+04
		Hexachloroethane—1.15E+01
		Hexachlorophene;—1.22E+04
		Indeno (1,2,3-cd) pyrene—1.16E+02
		Isobutyl alcohol; Isobutanol—3.22E+04
		Isophorone—2.86E+00
		Methacrylonitrile; 2-methyl-2-Propenenitrile—5.77E−01
		Methoxychlor—1.03E+05
		Methylbromide; Bromomethane—1.41E+02
		Methyl chloride; Chloromethane—3.22E+04
		Methylene chloride; Dichloromethane—9.07E−01
		Methyl ethyl ketone; 2-Butanone—1.50E+03
		Methyl methacrylate—5.08E+05
		Methyl parathion; Phosphorothioic acid—5.27E+01
		4-Methyl-2-pentanone; Methyl isobutyl ketone—6.40E+03
		Naphthalene—1.00E+06
		Nitrobenzene—2.56E+01
		N-Nitroso-di-n-butylamine—8.15E−05
		N-Nitrosodiethylamine—2.00E−07
		N-Nitrosodimethylamine—2.19E−05
		N-Nitrosodiphenylamine—4.55E+01
		N-Nitrosodipropylamine; Di-n-propylnitrosamine; N-Nitrosodi-n-propylamine—5.02E−05
		Nitrosopyrrolidine; N-Nitrosopyrrolidine; l-nitroso-Pyrrolidine—3.06E−05
		Polychlorinated biphenyls;—4.77E+01
		Pentachlorobenzene—8.91E+03
		Pentachloronitrobenzene—2.62E+00
		Pentachlorophenol—1.14E+04
		Phenanthrene—5.46E+01
		Phenol—8.00E+04
		Pronamide—2.13E+05
		Pyrene—1.00E+06
		Pyridine—1.31E+01
		Silvex; 2,4,5-TP; 2-(2,4,5-trichlorophenoxy)-Propanoic acid—3.87E+01
		Styrene—9.14E+00
		2,4,5-T; 2,4,5-Trichlorophenoxyacetic acid—6.63E+03
		1,2,4,5-Tetrachlorobenzene—2.19E+02
		1,1,2,2-Tetrachloroethane—2.28E−02
		Tetrachloroethene; Tetrachloroethylene—1.34E+01
		2,3,4,6-Tetrachlorophenol—1.17E+04
		Tetraethyl dithiopyrophosphate—2.51E+02
		Toluene—4.58E+04
		Toxaphene—3.09E+02
		1,2,4-Trichlorobenzene—4.75E+04
		1,1,1-Trichloroethane—8.70E+02
		1,1,2-Trichloroethane—9.03E−02
		Trichloroethylene; Trichloroethene—4.47E+00
		Trichlorofluoromethane—3.31E+05
		2,4,5-Trichlorophenol—8.20E+04
		2,4,6-Trichlorophenol—1.38E+00
		1,2,3-Trichloropropane—5.46E+02
		sym-Trinitrobenzene—2.17E+00
		Vinyl chloride—7.11E−01
		Xylene (total)—8.49E+05
Goodyear Tire and Rubber Co.	Randleman, NC.	Dewatered wastewater treatment sludges (EPA Hazardous Waste No. F006) generated from electroplating operations.
Gould, Inc	McConnelsville, OH.	Wastewater treatment sludge (EPA Hazardous Waste No. F006) generated from electroplating operations after November 27, 1985.

TABLE 1—WASTES EXCLUDED FROM NON-SPECIFIC SOURCES—Continued

Facility	Address	Waste description
Hoechst Celanese Corporation.	Bucks, Alabama.	Distillation bottoms generated (at a maximum annual rate of 31,500 cubic yards) from the production of sodium hydrosulfite (EPA Hazardous Waste No. F003). This exclusion was published on July 17, 1990. This exclusion does not include the waste contained in Hoechst Celanese's on-site surface impoundment.
Hoechst Celanese Corporation.	Leeds, South Carolina.	Distillation bottoms generated (at a maximum annual rate of 38,500 cubic yards) from the production of sodium hydrosulfite (EPA Hazardous Waste No. F003). This exclusion was published on July 17, 1990.
Hanover Wire Cloth Division.	Hanover, Pennsylvania.	Dewatered filter cake (EPA Hazardous Waste No. F006) generated from electroplating operations after August 15, 1986.
Holston Army Ammunition Plant.	Kingsport, Tennessee.	Dewatered wastewater treatment sludges (EPA Hazardous Waste Nos. F003, F005, and K044) generated from the manufacturing and processing of explosives and containing spent non-halogenated solvents after November 14, 1986.
Imperial Clevite.	Salem, IN	Solid resin cakes containing EPA Hazardous Waste No. F002 generated after August 27, 1985, from solvent recovery operations.
International Minerals and Chemical Corporation.	Terre Haute, Indiana.	Spent non-halogenated solvents and still bottoms (EPA Hazardous Waste No. F003) generated from the recovery of n-butyl alchohol after August 15, 1986.
Kawneer Company, Incorporated.	Springdale, Arkansas.	Wastewater treatment filter press sludge (EPA Hazardous Waste No. F019) generated (at a maximum annual rate of 26 cubic yards) from the chemical conversion coating of aluminum. This exclusion was published on November 13, 1990.
Kay-Fries, Inc	Stoney Point, NY.	Biological aeration lagoon sludge and filter press sludge generated after September 21, 1984, which contain EPA Hazardous Waste Nos. F003 and F005 as well as that disposed of in a holding lagoon as of September 21, 1984.
Keymark Corp	Fonda, NY	Wastewater treatment sludge (EPA Hazardous Waste No. F019) generated from chemical conversion coating of aluminum after November 27, 1985.
Keymark Corp	Fonda, New York.	Wastewater treatment sludges (EPA Hazardous Waste No. F019) generated from the chemical conversion coating of aluminum and contained in an on-site impoundment on August 12, 1987. This is a one-time exclusion.
Lederle Laboratories.	Pearl River, NY.	Spent non-halogenated solvents and still bottoms (EPA Hazardous Waste Nos. F003 and F005) generated from the recovery of the following solvents: Xylene, acetone, ethyl acetate, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, methanol, toluene, and pyridine after August 2, 1988. Excusion applies to primary and secondary filter press sludges and compost soils generated from these sludges.
Lincoln Plating Company.	Lincoln, NE	Wastewater treatment sludges (EPA Hazardous Waste No. F006) generated from electroplating operations after November 17, 1986.
Loxcreen Company, Inc.	Hayti, MO	Dewatered wastewater treatment sludges (EPA Hazardous Waste No. F019) generated from the chemical conversion coating of aluminum after July 16, 1986.
Marquette Electronics Incorporated.	Milwaukee, Wisconsin.	Wastewater treatment sludge (EPA Hazardous Waste No. F006) generated from electroplating operations. This exclusion was published on April 20, 1989.
Martin Marietta Aerospace.	Ocala, Florida	Dewatered wastewater treatment sludges (EPA Hazardous Waste No. F006) generated from electroplating operations after January 23, 1987.
Mason Chamberlain, Incorporated.	Bay St. Louis, Mississippi.	Wastewater treatment sludge filter cake (EPA Hazardous Waste No. F019) generated (at a maximum annual rate of 1,262 cubic yards) from the chemical conversion coating of aluminum. This exclusion was published on October 27, 1989.
Merck & Company, Incorporated.	Elkton, Virginia.	One-time exclusion for fly ash (EPA Hazardous Waste No. F002) from the incineration of wastewater treatment sludge generated from pharmaceutical production processes and stored in an on-site fly ash lagoon. This exclusion was published on May 12, 1989.
Maytag Company.	Newton, IA	Wastewater treatment sludges (EPA Hazardous Waste No. F006) generated from electroplating operations and wastewater treatment sludges (EPA Hazardous Waste No. F019) generated from the chemical conversion coating of aluminum November 17, 1986.
Metropolitan Sewer District of Greater Cincinnati.	Cincinnati, OH	Sluiced bottom ash sludge (approximately 25,000 cubic yards), contained in the North Lagoon, on September 21, 1984, which contains EPA Hazardous Wastes Nos. F001, F002, F003, F004, and F005.
Michelin Tire Corp.	Sandy Springs, South Carolina.	Dewatered wastewater treatment sludge (EPA Hazardous Wastes No. F006) generated from electroplating operations after November 14, 1986.

TABLE 1—WASTES EXCLUDED FROM NON-SPECIFIC SOURCES—Continued

Facility	Address	Waste description
Monroe Auto Equipment.	Paragould, AR	Wastewater treatment sludge (EPA Hazardous Waste No. F006) generated from electroplating operations after vacuum filtration after November 27, 1985. This exclusion does not apply to the sludge contained in the on-site impoundment.
North American Philips Consumer Electronics Corporation.	Greenville, Tennessee.	Wastewater treatment sludges (EPA Hazardous Waste No. F006) generated from electroplating operations. This exclusion was published on April 20, 1989.
Pamcor C, Inc	Las Piedras, PR.	Dewatered Wastewater treatment sludges (EPA Hazardous Waste No. F006) generated from electroplating operations after October 17, 1986.
Philway Products, Incorporated.	Ashland, Ohio	Filter press sludge generated (at a maximum annual rate of 96 cubic yards) during the treatment of electroplating wastewaters using lime (EPA Hazardous Waste No. F006). This exclusion was published on October 26, 1990.
Plastene Supply Company.	Portageville, Missouri.	Dewatered wastewater treatment sludges (EPA Hazardous Waste No. F006) generated from electroplating operations after August 15, 1986.
Reynolds Metals Company.	Sheffield, AL	Dewatered wastewater treatment sludges (EPA Hazardous Waste No. F019) generated from the chemical conversion coating of aluminum after August 15, 1986.
Reynolds Metals Company.	Sheffield, AL	Wastewater treatment filter press sludge (EPA Hazardous Waste No. F019) generated (at a maximum annual rate of 3,840 cubic yards) from the chemical conversion coating of aluminum. This exclusion was published on July 17, 1990.
Siegel-Robert, Inc.	St. Louis, MO	Wastewater treatment sludge (EPA Hazardous Waste No. F006) generated from electroplating operations after November 27, 1985.
Square D Company.	Oxford, Ohio	Dewatered filter press sludge (EPA Hazardous Waste No. F006) generated from electroplating operations after August 15, 1986.
Syntex Agribusiness.	Springfield, MO.	Kiln ash, cyclone ash, separator sludge, and filtered wastewater (except spent activiated carbon) (EPA Hazardous Waste No. F020 generated during the treatment of wastewater treatment sludge by the EPA's Mobile Incineration System at the Denney Farm Site in McDowell, Missouri after June 2, 1988, so long as: (1) The incinerator is monitored continuously and is in compliance with operating permit conditions. Should the incinerator fail to comply with the permit conditions relevant to the mechanical operation of the incinerator, Syntex must test the residues generated during the run when the failure occurred according to the requirements of Conditions (2) through (6), regardless of whether or not the demonstration in Condition (7) has been made. (2) Four grab samples of wastewater must be composited from the volume of filtered wastewater collected after each eight hour run and, prior to disposal the composite samples must be analyzed for the EP toxic metals, nickel, and cyanide. If arsenic, chromium, lead, and silver EP leachate test results exceed 0.61 ppm; barium levels exceed 12 ppm; cadmium and selenium levels exceed 0.12 ppm; mercury levels exceed 0.02 ppm; nickel levels exceed 6.1 ppm; or cyanide levels exceed 2.4 ppm, the wastewater must be retreated to achieve these levels or must be disposed in accordance with all applicable hazardous waste regulations. Analyses must be performed according to SW-846 methodologies. (3) One grab sample must be taken from each drum of kiln and cyclone ash generated during each eight hour run; all grabs collected during a given eight hour run must then be composited to form one composite sample. A composite sample of four grab samples of the separator sludge must be collected at the end of each eight hour run. Prior to the disposal of the residues from each eight hour run, an EP leachate test must be performed on these composite samples and the leachate analyzed for the EP toxic metals, nickel, and cyanide (using a distilled water extraction for the cyanide extraction) to demonstrate that the following maximum allowable treatment residue concentrations listed below are not exceeded. Analyses must be performed according to SW-846 methodologies. Any residues which exceed any of the levels listed below must be retreated to achieve these levels or must be disposed in accordance with all applicable hazardous waste regulations. Maximum Allowable Solids Treatment Residue EP Leachate Concentrations (mg/L) Arsenic—1.6 Barium—32 Cadmium—0.32 Chromium—1.6 Lead—1.6 Mercury—0.065 Nickel—16 Selenium—0.32 Silver—1.6 Cyanide—6.5

TABLE 1—WASTES EXCLUDED FROM NON-SPECIFIC SOURCES—Continued

Facility	Address	Waste description
		(4)—If Syntex stabilizes any of the kiln and cyclone ash or separator sludge, a Portland cement-type stabilization process must be used and Syntex must collect a composite sample of four grab samples from each batch of stabilized waste. An MEP leachate test must be performed on these composite samples and the leachate analyzed for the EP toxic metals, nickel, and cyanide (using a distilled water extraction for the cyanide leachate analysis) to demonstrate that the maximum allowable treatment residue concentrations listed in Condition (3) are not exceeded during any run of the MEP extraction. Analyses must be performed according to SW-846 methodologies. Any residues which exceed any of the levels listed in Condition (3) must be retreated to achieve these levels or must be disposed in accordance with all applicable hazardous waste regulations. (If the residues are stabilized, the analyses required in this condition supercede the analyses required in Condition (3).)
		(5) Syntex must generate, prior to disposal of residues, verification data from each eight hour run from each treatment residue (*i.e.,* kiln and cyclone ash, separator sludge, and filtered wastewater) to demonstrate that the maximum allowable treatment residue concentrations listed below are not exceeded. Samples must be collected as specified in Conditions (2) and (3). Analyses must be performed according to SW-846 methodologies. Any solid or liquid residues which exceed any of the levels listed below must be retreated to achieve these levels or must be disposed in accordance with Subtitle C of RCRA.
		Maximum Allowable Wastewater Concentrations (ppm): Benz(a)anthracene—1×10^{-4} Benzo(a)pyrene—4×10^{-5} Benzo(b)fluoranthene—2×10^{-4} Chloroform—0.07 Chrysene—0.002 Dibenz(a,h)anthracene—9×10^{-6} 1,2-Dichloroethane—0.06 Dichloromethane—0.06 Indeno(1,2,3-cd)pyrene—0.002 Polychlorinated biphenyls—1×10^{-4} 1,2,4,5-Tetrachlorobenzene—0.13 2,3,4,6-Tetrachlorophenol—12 Toluene—120 Trichloroethylene—0.04 2,4,5-Trichlorophenol—49 2,4,6-Trichlorophenol—0.02
		Maximum Allowable Solid Treatment Residue Concentrations (ppm): Benz(a)anthracene—1.1 Benzo(a)pyrene—0.43 Benzo(b)fluoranthene—1.8 Chloroform—5.4 Chrysene—170 Dibenz(a,h)anthracene—0.083 Dichloromethane—2.4 1,2-Dichloroethane—4.1 Indeno(1,2,3-cd)pyrene—330 Polychlorinated biphenyls—0.31 1,2,4,5-Tetrachlorobenzene—720 Trichloroethylene—6.6 2,4,6-Trichlorophenol—3.9
		(6) Syntex must generate, prior to disposal of residues, verification data from each eight hour run for each treatment residue (*i.e.,* kiln and cyclone ash, separator sludge, and filtered wastewater) to demonstrate that the residues do not contain tetra-, penta-, or hexachloro*dibenzo-p-dioxins or furans at levels of regulatory concern. Samples must be collected* as specified in Conditions (2) and (3). The TCDD equivalent levels for wastewaters must be less than 2 ppq and less than 5 ppt for the solid treatment residues. Any residues with detected dioxins or furans in excess of these levels must be retreated or must be disposed as acutely hazardous. Method 8290, a high resolution gas chromatography and high resolution mass spectroscopy (HRGC/HRMS) analytical method, must be used. For tetra- and pentachloronated dioxin and furan homologs, the maximum practical quantitation *limit must not exceed 15 ppt for solids and 120 ppq* for wastewaters. For hexachlorinated homologs, the maximum practical quantitation limit must not exceed 37 ppt for solids and 300 ppq for wastewaters.
		(7)(A) The test data from Conditions (1), (2), (3), (4), (5) and (6) must be kept on file by Syntex for inspection purposes and must be compiled, summarized, and submitted to the Section Chief, Variances Section, PSPD/OSW (WH-563), US EPA, 401 M Street, S.W., Washington, D.C. 20460 by certified mail on a monthly basis and when the treatment of the lagoon sludge is concluded. All data submitted will be placed in the RCRA docket.

TABLE 1—WASTES EXCLUDED FROM NON-SPECIFIC SOURCES—Continued

Facility	Address	Waste description
		(B) The testing requirements for Conditions (2), (3), (4), (5), and (6) will continue until Syntex provides the Section Chief, Variances Section, with the results of four consecutive batch analyses for the petitioned wastes, none of which exceed the maximum allowable treatment residue concentrations listed in these conditions and the Section Chief, Variances Section, notifies Syntex that the conditions have been lifted. (8) Syntex must provide a signed copy of the following certification statement when submitting data in response to the conditions listed above: "Under civil and criminal penalty of law for the making or submission of false or fraudulent statements or representations, I certify that the information contained in or accompanying this document is true, accurate, and complete. As to the (those) identified section(s) of this document for which I cannot personally verify its (their) accuracy, I certify as the company official having supervisory responsibility for the persons who, acting under my direct instructions, made the verification that this information is true, accurate and complete."
SR of Tennessee.	Ripley, TN	Dewatered wastewater treatment sludges (EPA Hazardous Waste No. F006) generated from the copper, nickel, and chromium electroplating of plastic parts after November 17, 1986.
Tennessee Electroplating.	Ripley, Tennessee.	Dewatered wastewater treatment sludges (EPA Hazardous Waste Nos. F006) generated from electroplating operations after November 17, 1986. To ensure chromium levels do not exceed the regulatory standards there must be continuous batch testing of the filter press sludge for chromium for 45 days after the exclusion is granted. Each batch of treatment residue must be representatively sampled and tested using the EP toxicity test for chromium. This data must be kept on file at the facility for inspection purposes. If the extract levels exceed 0.922 ppm of chromium the waste must be managed and disposed of as hazardous. If these conditions are not met, the exclusion does not apply. This exclusion does not apply to sludges in any on-site impoundments as of this date.
Tennessee Electroplating.	Ripley, TN	Wastewater treatment sludge (EPA Hazardous Waste No. F006) generated from electroplating operations and contained in an on-site surface impoundment (maximum volume of 6,300 cubic yards). This is a one-time exclusion. This exclusion was published on April 8, 1991.
Texas Instruments, Inc.	Dallas, TX	Wastewater treatment sludges (EPA Hazardous Waste Nos. F006 and F019) generated after August 27, 1985, from their electroplating operations that have been batch tested for cadmium using the EP toxicity procedure and have been found to contain less than 0.30 ppm cadmium in the EP extract. Wastewater treatment sludges that exceed this level will be considered a hazardous waste.
Tricil Environmental Systems, Inc.	Hilliard, Ohio	Dewatered wastewater treatment sludges (EPA Hazardous Waste No. F006) generated from electroplating operations after November 17, 1986. To ensure that hazardous constituents are not present in the waste at levels of regulatory concern, the facility must implement a contingency testing program for the petitioned wastes. This testing program must meet the following conditions for the exclusion to be valid: (1) Each batch of treatment residue must be representatively sampled and tested using the total oil and grease test and the EP Toxicity test (or the Oily Waste EP test, if the oil and grease content of the waste exceeds one percent) for arsenic, barium, cadmium, chromium, lead, selenium, silver, mercury, and nickel. If the extract concentrations for chromium, lead, arsenic, and silver exceed 0.315 ppm; barium levels exceed 6.3 ppm; cadmium and selenium levels exceed 0.063 ppm; mercury levels exceed 0.013 ppm; or nickel levels exceed 2.2 ppm, the waste will be re-treated or managed and disposed as a hazardous waste under 40 CFR Parts 262 to 265 and the permitting standards of 40 CFR Part 270. (2) Each batch of treatment residue must be tested for reactive and leachable cyanide. If the reactive cyanide levels exceed 250 ppm or leachable cyanide levels (using the EP Toxicity test without acetic acid adjustment) exceed 1.26 ppm, the waste must be re-treated or managed and disposed as a hazardous waste under 40 CFR Parts 262 to 265 and the permitting standards of 40 CFR Part 270. (3) Each batch of the waste must be tested for the total content of the following organic toxicants. If the total content of any of the constituents exceeds the maximum levels shown, the waste must be managed and disposed as a hazardous waste under 40 CFR Parts 262 to 265 and the permitting standards of 40 CFR Part 270. Compound and Maximum Acceptable Levels (ppm) Acrolein—56.8 Anthracene—76.8 Benzene—0.106 p-Chloro-m-cresol—133 1,1-Dichloroethane—0.01 Fluorene—10.4 Methylene chloride—8.2 Methyl ethyl ketone—326 n-Nitrosodiphenylamine—11.9 Phenanthrene—14 Tetrachloroethylene—0.188 Trichloroethylene—0.59 Chloroform—0.013

TABLE 1—WASTES EXCLUDED FROM NON-SPECIFIC SOURCES—Continued

Facility	Address	Waste description
		1,2-Dichloroethane—0.0083 1,2-trans-Dichloroethylene—231 2,4-Dimethylphenol—12.5 Vinyl chloride—0.18 (4) A grab sample must be collected from each batch to form one monthly composite sample, which must be tested using GC/MS analysis for the compounds shown above as well as the remaining organics on the priority pollutant list. (See 47 FR 52309, November 19, 1982, for a list of the priority pollutants.) (5) The test data from conditions 1–4 must be kept on file at the facility for inspection purposes and must be compiled, summarized, and submitted to the Administrator by certified mail on a semiannual basis. The Agency will review this information and if needed, will propose to modify or withdraw the exclusion. The organics testing described in conditions 3 and 4 above is not required until May 18, 1987. The Agency's decision to conditionally exclude the treatment residue generated from the wastewater treatment system at this facility applies only to the wastewater treatment residue as described in this petition.
Tricil Environmental Systems, Inc.	Nashville, Tennessee	Dewatered wastewater treatment sludges (EPA Hazardous Waste No. F019) generated from chemical conversion coating of aluminum after November 17, 1986. To ensure that hazardous constituents are not present in the waste at levels of regulatory concern, the facility must implement a contingency testing program for the petitioned wastes. This testing program must meet the following conditions for the exclusion to be valid: (1) Each batch of treatment residue must be representatively sampled and tested using the total oil and grease test and the EP Toxicity test (or the Oily Waste EP test, if the oil and grease content of the waste exceeds one percent) for arsenic, barium, cadmium, chromium, lead, selenium, silver, mercury, and nickel. If the extract concentrations for chromium, lead, arsenic, and silver exceed 1.1 ppm; barium levels exceed 22.2 ppm; cadmium and selenium levels exceed 0.22 ppm; mercury levels exceed 0.044 ppm; or nickel levels exceed 7.8 ppm, the waste will be re-treated or managed and disposed as a hazardous waste under 40 CFR Parts 262 to 265 and the permitting standards of 40 CFR Part 270. (2) Each batch of treatment residue must be tested for reactive and leachable cyanide. If the reactive cyanide levels exceed 250 ppm or leachable cyanide levels (using the EP Toxicity test without acetic acid adjustment) exceed 4.4 ppm, the waste must be re-treated or managed and disposed as a hazardous waste under 40 CFR Parts 262 to 265 and the permitting standards of 40 CFR Part 270. (3) Each batch of the waste must be tested for the total content of the following organic toxicants. If the total content of any of the constituents exceeds the maximum levels shown, the waste must be managed and disposed as a hazardous waste under 40 CFR Parts 262 to 265 and the permitting standards of 40 CFR Part 270. Compound and Maximum Acceptable Levels (ppm) Acrolein—363 Anthracene—492 Benzene—0.68 p-Chloro-m-cresol—848 1,1-Dichloroethane—0.068 Fluorene—66.7 Methylene chloride—52.4 n-Nitrosodiphenylamine—76.1 Phenanthrene—89 Tetrachloroethylene—1.2 Trichloroethylene—3.78 Chloroform—0.081 1,2-Dichloroethane—0.053 2,4-Dimethylphenol—79.7 Vinyl chloride—1.16 1,2-Diphenyl hydrazine—0.005 (4) A grab sample must be collected from each batch to form one monthly composite sample, which must be tested using GC/MS analysis for the compounds shown above as well as the remaining organics on the priority pollutant list. (See 47 FR 52309, November 19, 1982, for a list of the priority pollutants.) (5) The test data from conditions 1–4 must be kept on file at the facility for inspection purposes and must be compiled, summarized, and submitted to the Administrator by certified mail on a semiannual basis. The Agency will review this information and if needed, will propose to modify or withdraw the exclusion. The organics testing described in conditions 3 and 4 above is not required until May 18, 1987. The Agency's decision to conditionally exclude the treatment residue generated from the wastewater treatment system at this facility applies only to the wastewater treatment residue as described in this petition.

TABLE 1—WASTES EXCLUDED FROM NON-SPECIFIC SOURCES—Continued

Facility	Address	Waste description
Tricil Environmental Systems, Inc.	Muskegon, Michigan.	Dewatered wastewater treatment sludges (EPA Hazardous Waste No. F006) generated from electroplating operations after November 17, 1986. To ensure that hazardous constituents are not present in the waste at levels of regulatory concern, the facility must implement a contingency testing program for the petitioned wastes. This testing program must meet the following conditions for the exclusion to be valid: (1) Each batch of treatment residue must be representatively sampled and tested using the total oil and grease test and the EP Toxicity test (or the Oily Waste EP test, if the oil and grease content of the waste exceeds one percent) for arsenic, barium, cadmium, chromium, lead, selenium, silver, mercury, and nickel. If the extract concentrations for chromium, lead, arsenic, and silver exceed 0.315 ppm; barium levels exceed 6.3 ppm; cadmium and selenium levels exceed 0.063 ppm; mercury levels exceed 0.013 ppm; or nickel levels exceed 2.2 ppm, the waste will be re-treated or managed and disposed as a hazardous waste under 40 CFR Parts 262 to 265 and the permitting standards of 40 CFR Part 270. (2) Each batch of treatment residue must be tested for reactive and leachable cyanide. If the reactive cyanide levels exceed 250 ppm or leachable cyanide levels (using the EP Toxicity test without acetic acid adjustment) exceed 1.26 ppm, the waste must be re-treated or managed and disposed as a hazardous waste under 40 CFR parts 262 to 265 and the permitting standards of 40 CFR part 270. (3) Each batch of the waste must be tested for the total content of the following organic toxicants. If the total content of any of the constituents exceeds the maximum levels shown, the waste must be managed and disposed as a hazardous waste under 40 CFR parts 262 to 265 and the permitting standards of 40 CFR part 270. Compound and Maximum Acceptable Levels (ppm) Acrolein—56.8 Anthracene—76.8 Benzene—0.106 p-Chloro-m-cresol—133 1,1-Dichloroethane—0.01 Fluorene—10.4 Methylene chloride—8.2 Methyl ethyl ketone—326 n-Nitrosodiphenylamine—11.9 Phenanthrene—14 Tetrachloroethylene—0.188 Trichloroethylene—0.59 Chloroform—0.013 1,2-Dichloroethane—0.0083 1,2-trans-Dichloroethylene—231 2,4-Dimethylphenol—12.5 Vinyl chloride—0.18 (4) A grab sample must be collected from each batch to form one monthly composite sample, which must be tested using GC/MS analysis for the compounds shown above as well as the remaining organics on the priority pollutant list. (See 47 FR 52309, November 19, 1982, for a list of the priority pollutants.) (5) The test data from conditions 1–4 must be kept on file at the facility for inspection purposes and must be compiled, summarized, and submitted to the Administrator by certified mail on a semiannual basis. The Agency will review this information and if needed, will propose to modify or withdraw the exclusion. The organics testing described in conditions 3 and 4 above is not required until May 18, 1987. The Agency's decision to conditionally exclude the treatment residue generated from the wastewater treatment system at this facility applies only to the wastewater treatment residue as described in this petition.
United Technologies Automotive, Inc.	Jeffersonville, IN.	Dewatered wastewater treatment sludge (EPA Hazardous Waste No. FO19) generated from the chemical conversion of aluminum after April 29, 1986.
Universal Oil Products.	Decatur, Alabama.	Wastewater treatment sludges (EPA Hazardous Waste No. F006) generated from electroplating operations and contained in two on-site lagoons on August 15, 1986. This is a one-time exclusion.
U.S. EPA Combustion Research Facility.	Jefferson, Arkansas.	One-time exclusion for scrubber water (EPA Hazardous Waste No. F020) generated in 1985 from the incineration of Vertac still bottoms. This exclusion was published on June 28, 1989.
U.S. Nameplate Company, Inc.	Mount Vernon, Iowa.	Retreated wastewater treatment sludges (EPA Hazardous Waste No. F006) previously generated from electroplating operations and currently contained in an on-site surface impoundment after September 28, 1988. This is a one-time exclusion for the reteated wastes only. This exclution does not relieve the waste unit from regulatory compliance under Subtitle C.

TABLE 1—WASTES EXCLUDED FROM NON-SPECIFIC SOURCES—Continued

Facility	Address	Waste description
VAW of America Incorporated.*	St. Augustine, Florida.	Wastewater treatment sludge filter cake (EPA Hazardous Waste No. F019) generated from the chemical conversion coating of aluminum. This exclusion was published on February 1, 1989.
Vermont American, Corp.	Newark, OH	Wastewater treatment sludge (EPA Hazardous Waste No. F006) generated from electroplating operations after November 27, 1985.
Waterloo Industries.	Pocahontas, AR.	Wastewater treatment sludges (EPA Hazardous Waste No. F006) generated from electroplating operations after dewatering and held on-site on July 17, 1986 and any such sludge generated (after dewatering) after July 17, 1986.
Watervliet Arsenal.	Watervliet, NY	Wastewater treatment sludges (EPA Hazardous Waste No F006) generated from electroplating operations after January 10, 1986.
William L. Bonnell Co.	Carthage, TN	Dewatered Wastewater treatment sludges (Vacuum filter sludge) (EPA Hazardous Waste No. F019) currently generated from the chemical conversion coating of aluminum after October 17, 1986. This exclusion does not apply to sludges in the on-site surface impoundments.
William L. Bonnell Co.	Newnan, Georgia.	Dewatered wastewater treatment sludges (EPA Hazardous Waste No. F019) generated from the chemical conversion coating of aluminum after November 14, 1986. This exclusion does not include sludges contained in Bonnell's on-site surface impoundments.
Windsor Plastics, Inc.	Evansville, IN	Spent non-halogenated solvents and still bottoms (EPA Hazardous Waste No. F003) generated from the recovery of acetone after November 17, 1986.

TABLE 2—WASTES EXCLUDED FROM SPECIFIC SOURCES

Facility	Address	Waste description
American Cyanamid.	Hannibal, Missouri.	Wastewater and sludge (EPA Hazardous Waste No. K038) generated from the washing and stripping of phorate production and contained in on-site lagoons on May 8, 1987, and such wastewater and sludge generated after May 8, 1987.
Amoco Oil Co.	Wood River, IL.	150 million gallons of DAF from petroleum refining contained in in four surge ponds after treatment with the Chemfix[c] stabilization process. This waste contains EPA Hazardous Waste No. K048. This exclusion applies to the 150 million gallons of waste after chemical stabilization as long as the mixing ratios of the reagent with the waste are monitored continuously and do not vary outside of the limits presented in the demonstration samples; one grab sample is taken each hour from each treatment unit, composited, and EP toxicity tests performed on each sample. If the levels of lead or total chromium exceed 0.5 ppm in the EP extract, then the waste that was processed during the compositing period is considered hazardous; the treatment residue shall be pumped into bermed cells to ensure that the waste is identifiable in the event that removal is necessary.
Akzo Chemicals Inc. (formerly Stauffer Chemical Company).	Axis, AL	Brine purification muds generated from their chlor-alkali manufacturing operations (EPA Hazardous Waste No. K071) and disposed of in brine mud pond HWTF: 5 EP-201.
Bethlehem Steel Corp.	Steelton, PA	Uncured and cured chemically stabilized electric arc furnace dust/sludge (CSEAFD) treatment residue (K061) generated from the primary production of steel after May 22, 1989. This exclusion is conditioned upon the data obtained from Bethlehem's full-scale CSEAFD treatment facility because Bethlehem's original data were obtained from a laboratory-scale CSEAFD treatment process. To ensure that hazardous constituents are not present in the waste at levels of regulatory concern once the full-scale treatment facility is in operation, Bethlehem must implement a testing program for the petitioned waste. This testing program must meet the following conditions for the exclusion to be valid: (1) *Testing:* (A) *Initial Testing:* During the first four weeks of operation of the full-scale treatment system, Bethlehem must collect representative grab samples of each treated batch of the CSEAFD and composite the grab samples daily. The daily composites, prior to disposal, must be analyzed for the EP leachate concentrations of all the EP toxic metals, nickel and cyanide (using distilled water in the cyanide extractions), and the total constituent concentrations of reactive sulfide and reactive cyanide. Analyses must be performed according to SW-846 methodologies. Bethlehem must report the analytical test data obtained during this initial period no later than 90 days after the treatment of the first full-scale batch.

TABLE 2—WASTES EXCLUDED FROM SPECIFIC SOURCES—Continued

Facility	Address	Waste description
		(B) *Subsequent Testing:* Bethlehem must collect representative grab samples from every treated batch of CSEAFD generated daily and composite all of the grab samples to produce a weekly composite sample. Bethlehem then must analyze each weekly composite sample for the EP leachate concentrations of all the EP toxic metals and nickel. Analyses must be performed according to SW-846 methodologies. The analytical data, including all quality control information, must be compiled and maintained on site for a minimum of three years. These data must be furnised upon request and made available for inspection by any employee or representative of EPA or the State of Pennsylvania. (2) *Delisting Levels:* If the EP extract concentrations resulting from the testing in condition (1)(A) or (1)(B) for chromium, lead, arsenic, or silver exceed 0.315 mg/L, for barium exceeds 6.3 mg/l; for cadmium or selenium exceed 0.063 mg/l; for mercury exceeds 0.0126 mg/l; for nickel exceeds 3.15 mg/l; or for cyanide exceeds 4.42 mg/L, or total reactive cyanide or total reactive sulfide levels exceed 250 mg/kg and 500 mg/kg, respectively, the waste must either be re-treated or managed and disposed in accordance with subtitle C of RCRA. (3) *Data submittals:* Within one week of system start-up, Bethlehem must notify the Section Chief, Variances Section (see address below) when their full-scale stabilization system is on-line and waste treatment has begun. All data obtained through the initial testing condition (1)(A), must be submitted to the Section Chief, Variances Section, PSPD/OSW, (OS-343), U.S. EPA, 401 M Street, S.W., Washington, DC 20460 within the time period specified in condition (1)(A). At the Section Chief's request, Bethlehem must submit analytical data obtained through condition (1)(B) to the above address, within the time period specified by the Section Chief. Failure to submit the required data obtained from either condition (1)(A) or (1)(B) within the specified time periods will be considered by the Agency sufficient basis to revoke Bethlehem's exclusion to the extent directed by EPA. All data must be accompanied by the following certification statement: "Under civil and criminal penalty of law for the making or submission of false or fraudulent statements or representations (pursuant to the applicable provisions of the Federal Code which include, but may not be limited to, 18 U.S.C. 6928), I certify that the information contained in or accompanying this document is true, accurate and complete. "As to the (those) identified section(s) of this document for which I cannot personally verify its (their) truth and accuracy, I certify as the company official having supervisory responsibility for the persons who, acting under my direct instructions, made the verification that this information is true, accurate and complete. "In the event that any of this information is determined by EPA in its sole discretion to be false, inaccurate or incomplete, and upon conveyance of this fact to the company, I recognize and agree that this exclusion of wastes will be void as if it never had effect or to the extent directed by EPA and that the company will be liable for any actions taken in contravention of the company's RCRA and CERCLA obligations premised upon the company's reliance on the void exclusion."
Bethlehem Steel Corp.	Johnstown, PA.	Uncured and cured chemically stabilized electric arc furnace dust/sludge (CSEAFD) treatment residue (K061) generated from the primary production of steel after May 22, 1989. This exclusion is conditioned upon the data obtained from Bethlehem's full-scale CSEAFD treatment facility because Bethlehem's original data were obtained from a labortory-scale CSEAFD treatment process. To ensure that hazardous constituents are not present in the waste at levels of regulatory concern once the full-scale treatment facility is in operation, Bethlehem must implement a testing program for the petitioned waste. This testing program must meet the following conditions for the exclusion to be valid: (1) *Testing:* (A) *Initial Testing:* During the first four weeks of operation of the full-scale treatment system, Bethlehem must collect representative grab samples of each treated batch of the CSEAFD and composite the grab samples daily. The daily composites, prior to disposal, must be analyzed for the EP leachate concentrations of all the EP toxic metals, nickel and cyanide (using distilled water in the cyanide extractions), and the total constituent concentrations of reactive sulfide and reactive cyanide. Analyses must be performed according to SW-846 methodologies. Bethlehem must report the analytical test data obtained during this initial period no later than 90 days after the treatment of the first full-scale batch. (B) *Subsequent Testing:* Bethlehem must collect representative grab samples from every treated batch of CSEAFD generated daily and composite all of the grab samples to produce a weekly composite sample. Bethlehem then must analyze each weekly composite sample for the EP leachate concentrations of all the EP toxic metals and nickel. Analyses must be performed according to SW-846 methodologies. The analytical data, including all quality control information, must be compiled and maintained on site for a minimum of three years. These data must be furnished upon request and made available for inspection by any employeee or representative of EPA or the State of Pennsylvania.

TABLE 2—WASTES EXCLUDED FROM SPECIFIC SOURCES—Continued

Facility	Address	Waste description
		(2) *Delisting Levels:* If the EP extract concentrations resulting from the testing in condition (1)(A) or (1)(B) for chromium, lead, arsenic, or silver exceed 0.315 mg/L, for barium exceeds 6.3 mg/l; for cadmium or selenium exceed 0.063 mg/l; for mercury exceeds 0.0126 mg/l; for nickel exceeds 3.15 mg/l; or for cyanide exceeds 4.42 mg/L, or total reactive cyanide or total reactive sulfide levels exceed 250 mg/kg and 500 mg/kg, respectively, the waste must either be re-treated or managed and disposed in accordance with subtitle C of RCRA. (3) *Data submittals:* Within one week of system start-up, Bethlehem must notify the Section Chief, Variances Section (see address below) when their full-scale stabilization system is on-line and waste treatment has begun. All data obtained through the initial testing condition (1)(A), must be submitted to the Section Chief, Variances Section, PSPD/OSW, (OS-343), U.S. EPA, 401 M Street, SW., Washington, DC 20406 within the time period specified in condition (1)(A). At the Section Chief's request, Bethlehem must submit analytical data obtained through condition (1)(B) to the above address, within the time period specified by the Section Chief. Failure to submit the required data obtained from either condition (1)(A) or (1)(B) within the specified time periods will be considered by the Agency sufficient basis to revoke Bethlehem's exclusion to the extent directed by EPA. All data must be accompanied by the following certification statement: "Under civil and criminal penalty of law for the making or submission of false or fraudulent statements or representations (pursuant to the applicable provisions of the Federal Code which include, but may not be limited to, 18 U.S.C. 6928), I certify that the information contained in or accompanying this document is true, accurate and complete. "As to the (those) identified section(s) of this document for which I cannot personally verify its (their) truth and accuracy, I certify as the company official having supevisory responsibility for the persons who, acting under my direct instructions, made the verification that this information is true, accurate and complete. "In the event that any of this information is determined by EPA in its sole discretion to be false, inaccurate or incomplete, and upon conveyance of this fact to the company, I recognize and agree that this exclusion of wastes will be void as if it never had effect or to the extent directed by EPA and that the company will be liable for any actions taken in contravention of the company's RCRA and CERCLA obligations premised upon the company's reliance on the void exclusion."
BF Goodrich Intermediates Company, Inc.	Calvert City, Kentucky.	Brine purification muds and saturator insolubles (EPA Hazardous Waste No. K071) after August 18, 1989. This exclusion is conditional upon the collection and submission of data obtained from BFG's full-scale treatment system because BFG's original data was based on data presented by another petitioner using an identical treatment process. To ensure that hazardous constituents are not present in the waste at levels of regulatory concern once the full-scale treatment facility is in operation, BFG must implement a testing program. All sampling and analyses (including quality control procedures) must be performed according to SW-846 procedures. This testing program must meet the following conditions for the exclusion to be valid: (1) Initial Testing: During the first four weeks of full-scale operation, BFG must do the following: (A) Collect representative grab samples from every batch of the treated mercury brine purification muds and treated saturator insolubles on a daily basis and composite the grab samples to produce two separate daily composite samples (one of the treated mercury brine purification muds and one of the treated saturator insolubles). Prior to disposal of the treated batches, two daily composite samples must be analyzed for EP leachate concentration of mercury. BFG must report the analytical test data, including all quality control data, within 90 days after the treatment of the first full-scale batch. (B) Collect representative grab samples from every batch of the treated mercury brine purification muds and treated saturator insolubles on a daily basis and composite the grab samples to produce two separate weekly composite samples (one of the treated mercury brine muds and one of the treated saturator insolubles). Prior to disposal of the treated batches, two weekly composite samples must be analyzed for the EP leachate concentrations of all the EP toxic metals (except mercury), nickel, and cyanide (using distilled water in the cyanide extractions), and the total constituent concentrations of reactive sulfide and reactive cyanide. BFG must report the analytical test data, including all quality control data, obtained during this initial period no later than 90 days after the treatment of the first full-scale batch. (2) Subsequent Testing: After the first four weeks of full-scale operation, BFG must do the following: (A) Continue to sample and test as described in condition (1)(A). BFG must compile and store on-site for a minimum of three years all analytical data and quality control data. These data must be furnished upon request and made available for inspection by any employee or representative of EPA or the State of Kentucky.

TABLE 2—WASTES EXCLUDED FROM SPECIFIC SOURCES—Continued

Facility	Address	Waste description
		(B) Continue to sample and test as described in condition (1)(B). BFG must compile and store on-site for a minimum of three years all analytical data and quality control data. These data must be furnished upon request and made available for inspection by any employee or representative of EPA or the State of Kentucky. These testing requirements shall be terminated by EPA when the results of four consecutive weekly composite samples of both the treated mercury brine muds and treated saturator insolubles, obtained from either the initial testing or subsequent testing, show the maximum allowable levels in condition (3) are not exceeded and the Section Chief, Variances Section, notifies BFG that the requirements of this condition have been lifted. (3) If, under condition (1) or (2), the EP leachate concentrations for chromium, lead, arsenic, or silver exceed 0.316 mg/l; for barium exceeds 6.31 mg/l; for cadmium or selenium exceed 0.063 mg/l; for mercury exceeds 0.0126 mg/l, for nickel exceeds 3.16 mg/l; for cyanide exceeds 4.42 mg/l; or for total reactive cyanide or total reactive sulfide levels exceed 250 mg/kg and 500 mg/kg, respectively, the waste must either be retreated until it meets these levels or managed and disposed of in accordance with subtitle C of RCRA. (4) Within one week of system start-up, BFG must notify the Section Chief, Variances Section (see address below) when the full-scale system is on-line and waste treatment has begun. All data obtained through condition (1) must be submitted to the Section Chief, Variances Section, PSPD/OSW (OS-343), U.S. EPA, 401 M Street, SW., Washington, DC 20460 within the time period specified in condition (1). At the Section Chief's request, BFG must submit any other analytical data obtained through condition (2) to the above address, within the time period specified by the Section Chief. Failure to submit the required data will be considered by the Agency sufficient basis to revoke BFG's exclusion to the extent directed by EPA. All data must be accompanied by the following certification statement: "Under civil and criminal penalty of law for the making or submission of false or fraudulent statements or representations (pursuant to the applicable provisions of the Federal Code which include, but may not be limited to, 18 U.S.C. § 6928), I certify that the information contained in or accompanying this document is true, accurate and complete. As to the (those) identified section(s) of this document for which I cannot personally verify its (their) truth and accuracy, I certify as the company official having supervisory responsibility for the persons who, acting under my direct instructions, made the verification that this information is true, accurate and complete. In the event that any of this information is determined by EPA in its sole discretion to be false, inaccurate or incomplete, and upon conveyance of this fact to the company, I recognize and agree that this exclusion of wastes will be void as if it never had effect or to the extent directed by EPA and that the company will be liable for any actions taken in contravention of the company's RCRA and CERCLA obligations premised upon the company's reliance on the void exclusion."
CF&I Steel Corporation.	Pueblo, Colorado.	Fully-cured chemically stabilized electric arc furnace dust/sludge (CSEAFD) treatment residue (EPA Hazardous Waste No. K061) generated from the primary production of steel after May 9, 1989. This exclusion is conditioned upon the data obtained from CF&I's full-scale CSEAFD treatment facility because CF&I's original data was obtained from a laboratory-scale CSEAFD treatment process. To ensure that hazardous constituents are not present in the waste at levels of regulatory concern once the full-scale treatment facility is in operation, CF&I must implement a testing program for the petitioned waste. This testing program must meet the following conditions for the exclusion to be vaild: (1) *Testing:* (A) *Initial Testing:* During the first four weeks of operation of the full-scale treatment system, CF&I must collect representative grab samples of each treated batch of the CSEAFD and composite the grab samples daily. The daily composites, prior to disposal, must be analyzed for the EP leachate concentrations of all the EP toxic metals, nickel, and cyanide (using distilled water in the cyanide extractions), and the total constituent concentrations of reactive sulfide and reactive cyanide. Analyses must be performed according to SW-846 methodologies. CF&I must report the analytical test data obtained during this initial period no later than 90 days after the treatment of the first full-scale batch. (B) *Subsequent Testing:* CF&I must collect representative grab samples from every treated batch of CSEAFD generated daily and composite all of the grab samples to produce a weekly composite sample. CF&I then must analyze each weekly composite sample for the EP leachate concentrations of all of the EP toxic metals and nickel. Analyses must be performed according to SW-846 methodologies. The analytical data, including all quality control information, must be compiled and maintained on site for a minimum of three years. These data must be furnished upon request and made available for inspection by any employee or representative of EPA or the State of Colorado. (2) *Delisting levels:* If the EP extract concentrations determined in conditions (1)(A) or (1)(B) for chromium, lead, arsenic, or silver exceed 0.315 mg/1; for barium exceeds 6.3 mg/1; for cadmium or selenium exceed 0.063 mg/1; for mercury exceeds 0.0126 mg/1; for nickel exceeds 3.15 mg/1; or for cyanide exceeds 4.4 mg/1, or total reactive cyanide or total reactive sulfide levels exceed 250 mg/kg and 500 mg/kg, respectively, the waste must either be re-treated or managed and disposed in accordance with Subtitle C of RCRA.

TABLE 2—WASTES EXCLUDED FROM SPECIFIC SOURCES—Continued

Facility	Address	Waste description
		(3) *Data submittals:* Within one week of system start-up, CF&I must notify the Section Chief, Variances Section (see address below) when their full-scale stabilization system is on-line and waste treatment has begun. All data obtained through the initial testing condition (1)(A), must be submitted to the Section Chief, Variances Section, PSPD/OSW, (OS-343), U.S. EPA, 401 M Street, SW., Washington, DC 20460 within the time period specified in condition (1)(A). At the Section Chief's request, CF&I must submit analytical data obtained through condition (1)(B) to the above address, within the time period specified by the Section Chief. Failure to submit the required data obtained from either condition (1)(A) or (1)(B) within the specified time periods will be considered by the Agency sufficient basis to revoke CF&I's exclusion to the extent directed by EPA. All data must be accompanied by the following certification statement: "Under civil and criminal penalty of law for the making of submission of false or fraudulent statements or representations (pursuant to the applicable provisions of the Federal Code which include, but may not be limited to, 18 U.S.C. 6928), I certify that the information contained in or accompanying this document is true, accurate and complete. As to the (those) identified section(s) of this document for which I cannot personally verify its (their) truth and accuracy, I certify as the company official having supervisory responsibility for the persons who, acting under my direct instructions, made the verification that this information is true, accurate and complete. In the event that any of this information is determined by EPA in its sole discretion to be false, inaccurate or incomplete, and upon conveyance of this fact to the company, I recognize and agree that this exclusion of wastes will be void as if it never had effect or to the extent directed by EPA and that the company will be liable for any actions taken in contravention of the company's RCRA and CERCLA obligations premised upon the company's reliance on the void exclusion."
Envirite Corporation.	Canton, Ohio; Harvey, Illinois; Thomaston, Connecticut; and York PA.	Spent pickle liquor (EPA Hazardous Waste No. K062) generated from steel finishing operations of facilities within the iron and steel industry (SIC Codes 331 and 332); wastewater treatment sludge (EPA Hazardous Waste No. K002) generated from the production of chrome yellow and orange pigments; wastewater treatment sludge (EPA Hazardous Waste No. K003) generated from the production of molybdate orange pigments; wastewater treatment sludge (EPA Hazardous Waste No. K004) generated from the production of zinc yellow pigments; wastewater treatment sludge (EPA Hazardous Waste No. K005) generated from the production of chrome green pigments; wastewater treatment sludge (EPA Hazardous Waste No. K006) generated from the production of chrome oxide green pigments (anhydrous and hydrated); wastewater treatment sludge (EPA Hazardous Waste No. K007) generated from the production of iron blue pigments; oven residues (EPA Hazardous Waste No. K008) generated from the production of chrome oxide green pigments after November 14, 1986. To ensure that hazardous constituents are not present in the waste at levels of regulatory concern, the facility must implement a contingency testing program for the petitioned wastes. This testing program must meet the following conditions for the exclusions to be valid: (1) Each batch of treatment residue must be representatively sampled and tested using the EP Toxicity test for arsenic, barium, cadmium, chromium, lead, selenium, silver, mercury, and nickel. If the extract concentrations for chromium, lead, arsenic, and silver exceed 0.315 ppm; barium levels exceed 6.3 ppm; cadmium and selenium exceed 0.063 ppm; mercury exceeds 0.0126 ppm; or nickel levels exceed 2.205 ppm, the waste must be re-treated or managed and disposed as a hazardous waste under 40 CFR Parts 262 to 265 and the permitting standards of 40 CFR Part 270. (2) Each batch of treatment residue must be tested for reactive and leachable cyanide. If the reactive cyanide levels exceed 250 ppm; or leachable cyanide levels (using the EP Toxicity test without acetic acid adjustment) exceed 1.26 ppm, the waste must be re-treated or managed and disposed as hazardous waste under 40 CFR Parts 262 to 265 and the permitting standards of 40 CFR 270. (3) Each batch of waste must be tested for the total content of specific organic toxicants. If the total content of anthracene exceeds 76.8 ppm, 1,2-diphenyl hydrazine exceeds 0.001 ppm, methylene chloride exceeds 8.18 ppm, methyl ethyl ketone exceeds 326 ppm, n-nitrosodiphenylamine exceeds 11.9 ppm, phenol exceeds 1,566 ppm, tetrachloroethylene exceeds 0.188 ppm, or trichloroethylene exceeds 0.592 ppm, the waste must be managed and disposed as a hazardous waste under 40 CFR Parts 262 to 265 and the permitting standards of 40 CFR Part 270. (4) A grab sample must be collected from each batch to form one monthly composite sample which must be tested using GC/MS analysis for the compounds listed in #3 above as well as the remaining organics on the priority pollutan list. (See 47 FR 52309, November 19, 1982, for a list of the priority pollutants.)

TABLE 2—WASTES EXCLUDED FROM SPECIFIC SOURCES—Continued

Facility	Address	Waste description
		(5) The data from conditions 1–4 must be kept on file at the facility for inspection purposes and must be compiled, summarized, and submitted to the Administrator by certified mail semi-annually. The Agency will review this information and if needed will propose to modify or withdraw the exclusion. The organics testing described in conditions 3 and 4 above is not required until six months from the date of promulgation. The Agency's decision to conditionally exclude the treatment residue generated from the wastewater treatment systems at these facilities applies only to the wastewater and solids treatment systems as they presently exist as described in the delisting petition. The exclusion does not apply to the proposed process additions described in the petition as recovery, including crystalization, electrolytic metals recovery, evaporative recovery, and ion exchange.
LCP Chemical ..	Orrington, ME...	Brine purification muds and wastewater treatment sludges generated after August 27, 1985 from their chlor-alkali manufacturing operations (EPA Hazardous Waste Nos. K071 and K106) that have been batch tested for mercury using the EP toxicity procedures and have been found to contain less than 0.05 ppm mercury in the EP extract. Brine purification muds and wastewater treatment sludges that exceed this level will be considered a hazardous waste.
Mearl Corp........	Peekskill, NY....	Wastewater treatment sludge (EPA Hazardous Waste Nos. K006 and K007) generated from the production of chrome oxide green and iron blue pigments after November 27, 1985.
Monsanto Industrial Chemicals Company.	Sauget, Illinois..	Brine purification muds (EPA Hazardous Waste No. K071) generated from the mercury cell process in chlorine production, where separately prepurified brine is not used after August 15, 1986.
Occidental Chemical Corp. Muscle Shoals Plant.	Sheffield, Alabama.	Retorted wastewater treatment sludge from the mercury cell process in chlorine production (EPA Hazardous Waste No. K106) after September 19, 1989. This exclusion is conditional upon the submission of data obtained from Occidental's full-scale retort treatment system because Occidental's original data were based on a pilot-scale retort system. To ensure that hazardous constituents are not present in the waste at levels of regulatory concern once the full-scale treatment facility is in operation, Occidental must implement a testing program. All sampling and analyses (including quality control procedures) must be performed according to SW-846 procedures. This testing program must meet the following conditions for the exclusion to be valid: (1) Initial Testing—During the first four weeks of full-scale retort operation, Occidental must do the following: (A) Collect representative grab samples from every batch of retorted material and composite the grab samples to produce a weekly composite sample. The weekly composite samples, prior to disposal or recycling, must be analyzed for the EP leachate concentrations of all the EP toxic metals (except mercury), nickel, and cyanide (using distilled water in the cyanide extractions), and the total constitutent concentrations of reactive sulfide and reactive cyanide. Occidental must report the analytical test data, including all quality control data, obtained during this initial period no later than 90 days after the treatment of the first full-scale batch. (B) Collect representative grab samples of every batch of retorted material prior to its disposal or recycling and analyze the sample for EP leachate concentration of mercury. Occidental must report the analytical test data, including all quality control data, within 90 days after the treatment of the first full-scale batch. (2) Subsequent Testing—After the first four weeks of full-scale retort operation, Occidental must do the following: (A) Continue to sample and test as described in condition (1)(A). Occidental must compile and store on-site for a minimum of three years all analytical data and quality control data. These data must be furnished upon request and made available for inspection by any employee or representative of EPA or the State of Alabama. These testing requirements shall be terminated by EPA when the results of four consecutive weekly composite samples of the petitioned waste, obtained from either the initial testing or subsequent testing show the maximum allowable levels in condition (3) are not exceeded and the Section Chief, Variances Section, notifies Occidental that the requirements of this condition have been lifted. (B) Continue to sample and test for mercury as described in condition (1)(B). Occidental must compile and store on-site for a minimum of three years all analytical data and quality control data. These data must be furnished upon request and made available for inspection by any employee or representative of EPA or the State of Alabama. These testing requirements shall remain in effect until Occidental provides EPA with analytical and quality control data for thirty consecutive batches of retorted material, collected as described in condition (1)(B), demonstrating that the EP leachable levels of mercury are below the maximum allowable level in condition (3) and the Section Chief, Variances Section, notifies Occidental that the testing in condition (2)(B) may be replaced with (2)(C).

TABLE 2—WASTES EXCLUDED FROM SPECIFIC SOURCES—Continued

Facility	Address	Waste description
		(C) [If the conditions in (2)(B) are satisfied, the testing requirements for mercury in (2)(B) shall be replaced with the following condition]. Collect representative grab samples from every batch of retorted material on a daily basis and composite the grab samples to produce a weekly composite sample. Occidental must analyze each weekly composite sample prior to its disposal or recycling for the EP leachate concentration of mercury. Occidental must compile and store on-site for a minimum of three years all analytical data and quality control data. These data must be furnished upon request and made available for inspection by any employee or representative cf EPA or the State of Alabama. (3) If, under condition (1) or (2), the EP leachate concentrations for chromium, lead, arsenic, or silver exceed 1.616 mg/l; for barium exceeds 32.3 mg/l; for cadmium or selenium exceed 0.323 mg/l; for mercury exceeds 0.065 mg/l, for nickel exceeds 16.15 mg/l; for cyanide exceeds 22.61 mg/l; or for total reactive cyanide or total reactive sulfide levels exceed 250 mg/kg and 500 mg/kg, respectively, the waste must either be retreated until it *meets these levels or managed and disposed of in accordance with subtitle C of RCRA.* (4) Within one week of system start-up, Occidental must notify the Section Chief, Variances Section (see address below) when the full-scale retort system is on-line and waste treatment has begun. All data obtained through condition (1) must be submitted to the Section Chief, Variances Section, PSPD/OSW (OS-343), U.S. EPA, 401 M Street SW., Washington, DC 20460 within the time period specified in condition (1). At the Section Chief's request, Occidental must submit any other analytical data obtained through condition (2) to the above address, within the time period specified by the Section Chief. Failure to submit the required data will be considered by the Agency sufficient basis to revoke Occidental's exclusion to the extent directed by EPA. All data must be accompanied by the following certification statement: "*Under civil and criminal penalty of law for the making or submission of false or fraudulent* statements or representations (pursuant to the applicable provisions of the Federal Code which include, but may not be limited to, 18 U.S.C. 6928), I certify that the information contained in or accompanying this document is true, accurate and complete. As to the (those) identified section(s) of this document for which I cannot personnal verify its (their) truth and accuracy, I certify as the company official having supervisory responsibility for the persons who, acting under my direct instructions, made the verification that this information is true, accurate and complete. In the event that any of this information is determined by EPA in its sole discretion to be false, inaccurate or incomplete, and upon conveyance of this fact to the company, I recognize and agree that this exclusion of wastes will be void as if it never had effect or to the extent *directed by EPA and that the company will be liable for any actions taken in* contravention of the company's RCRA and CERCLA obligations premised upon the company's reliance on the void exclusion."
Occidental Chemical Corporation.	Delaware City, Delaware.	Sodium chloride treatment *muds* (NaCl–TM), sodium chloride saturator cleanings (NaCl–SC), and potassium chloride treatment muds (KCl–TM) (*all classified as* EPA Hazardous Waste No. K071) generated at a maximum combined rate (for all three wastes) of 1,018 tons per year. This exclusion was published on April 29, 1991 and is conditioned upon the collection of data from Occidental's full-scale brine treatment system because Occidental's request for exclusion was based on data from a laboratory-scale brine treatment process. To ensure that hazardous constituents are not present in the waste at levels of regulatory concern once the full-scale treatment system is in operation, Occidental must implement a testing program for the petitioned waste. All sampling and analyses (including quality control procedures) must be performed according to SW–846 methodologies. This testing program must meet the following conditions for the exclusion to be valid: (1) *Initial Testing:* During the first four weeks of full-scale treatment system operation, *Occidental must do the following:* (A) Collect representative grab samples from each batch of the three treated wastestreams (sodium chloride saturator cleanings (NaCl–SC), sodium chloride treatment muds (NaCl–TM) and potassium chloride treatment muds (KCl–TM)) on an as generated basis, and composite the samples to produce three separate weekly composite samples (of each type of K071 waste). The three weekly composite samples, prior to disposal, must be analyzed for the EP leachate concentrations of all the EP toxic metals (except mercury), nickel and cyanide (using deionized water in the cyanide extractions), and the total constituent concentrations of reactive sulfide and reactive cyanide. Occidental must report the waste volumes produced and the analytical test data, including all quality control data, obtained during this initial period, no later than 90 days after the treatment of the first full-scale batch. (B) Collect representative grab samples of each batch of the three treated wastestreams (NaCl–SC, NACl–TM and KCl–TM) and composite the grab samples to produce three separate daily composite samples (of each type of K071 waste) on an as generated basis. *The three daily composite samples, prior to disposal, must be analyzed for the EP* leachate concentration of mercury. Occidental must report the waste volumes produced and the analytical test data, including all quality control data, obtained during this initial period, no later than 90 days after the treatment of the first full-scale batch.

TABLE 2—WASTES EXCLUDED FROM SPECIFIC SOURCES—Continued

Facility	Address	Waste description
		(2) *Subsequent Testing:* After the first four weeks of full-scale treatment operations, Occidental must do the following (all sampling and analyses (including quality control procedures) must be performed according to SW-846 procedures): (A) Continue to sample and test as described in condition (1)(A). Occidental must compile and store on-site for a minimum of three years the records of waste volumes produced and all analytical data and quality control data. These data must be furnished upon request and made available for inspection by any employee or representative of EPA or the State of Delaware. These testing requirements shall be terminated by EPA when the results of four consecutive weekly composite samples of the petitioned waste, obtained from either the initial testing or subsequent testing, show the maximum allowable levels in condition (3) are not exceeded and the Section Chief, Variances Section, notifies Occidental that the requirements of this condition have been lifted. (B) Continue to sample and test for mercury as described in condition (1)(B). Occidental must compile and store on-site for a minimum of three years the records of waste volumes produced and all analytical data and quality control data. These data must be furnished upon request and made available for inspection by any employee or representative of EPA or the State of Delaware. These testing requirements shall be terminated and replaced with the requirements of condition (2)(C) if Occidental provides EPA with analytical and quality control data for thirty consecutive batches of treated material, collected as described in condition (1)(B), demonstrating that the EP leachable level of mercury in condition (3) is not exceeded (in all three treated wastes), and the Section Chief, Variances Section, notifies Occidental that the testing in condition (2)(B) may be replaced with (2)(C). (C) [If the conditions in (2)(B) are satisfied, the testing requirements for mercury in (2)(B) shall be replaced with the following condition.] Collect representative grab samples from each batch of the three treated wastestreams (NaCl-SC, NaCl-TM and KCl-TM) on an as generated basis and composite the grab samples to produce three separate weekly composite samples (of each type of K071 waste). The three weekly composite samples, prior to disposal, must be analyzed for the EP leachate concentration of mercury. Occidental must compile and store on-site for a minimum of three years the records of waste volumes produced and all analytical data and quality control data. These data must be furnished upon request and made available for inspection by any employee or representative of EPA or the State of Delaware. (3) If under conditions (1) or (2), the EP leachate concentration for chromium, lead, arsenic, or silver exceeds 0.77 mg/L; for barium exceeds 15.5 mg/L; for cadmium or selenium exceeds 0.16 mg/L; for mercury exceeds 0.031 mg/L; for nickel or total cyanide exceeds 10.9 mg/L; or the total reactive cyanide or total reactive sulfide levels exceeds 250 mg/kg and 500 mg/kg, the waste must either be retreated or managed and disposed of in accordance with all applicable hazardous waste regulations. (4) Within one week of system start-up, Occidental must notify the Section Chief, Variances Section (see address below) when the full-scale system is on-line and waste treatment has begun. All data obtained through condition (1) must be submitted to the Section Chief, Variances Section, PSPD/OSW, (OS-333), U.S. EPA, 401 M Street, SW., Washington, DC 20460 within the time period required in condition (1). At the Section Chief's request, Occidental must submit any other analytical data obtained through conditions (1) and (2) to the above address within the time period specified by the Section Chief. Failure to submit the required data will be considered by the Agency sufficient basis to revoke Occidental's exclusion to the extent directed by EPA. All data (either submitted to EPA or maintained at the site) must be accompanied by the following statement: "Under civil and criminal penalty of law for the making or submission of false or fraudulent statements or representations (pursuant to the applicable provisions of the Federal Code, which include, but may not be limited to 18 U.S.C. 1001 and 42 U.S.C. 6926), I certify that the information contained in or accompanying this document is true, accurate and complete. As to the (those) identified section(s) of this document for which I cannot personally verify its (their) truth and accuracy, I certify as the company official having supervisory responsibility for the persons who, acting under my direct instructions, made the verification that this information is true, accurate and complete. In the event that any of this information is determined by EPA in its sole discretion to be false, inaccurate or incomplete, and upon conveyance of this fact to the company, I recognize and agree that this exclusion of wastes will be void as if it never had effect or to the extent directed by EPA and that the company will be liable for any actions taken in contravention of the company's RCRA and CERCLA obligations premised upon the company's reliance on the void exclusion."
Perox, Incorporated.	Sharon, Pennsylvania.	Iron oxide (EPA Hazardous Waste No. K062) generated (at a maximum annual rate of 4800 cubic yards) from a spent hydrochloric acid pickle liquor regeneration plant for spent pickle liquor generated from steel finishing operations. This exclusion was published on, November 13, 1990.

TABLE 2—WASTES EXCLUDED FROM SPECIFIC SOURCES—Continued

Facility	Address	Waste description
Pioneer Chlor Alkai Company, Inc. (formerly Stauffer Chemical Company).	St. Gabriel, LA.	Brine purification muds, which have been washed and vacuum filtered, generated after August 27, 1985 from their chlor-alkali manufacturing operations (EPA Hazardous Waste No. K071) that have been batch tested for mercury using the EP toxicity procedure and have been found to contain less than 0.05 ppm in mercury in the EP extract. Brine purification muds that exceed this level will be considered a hazardous waste.
Reynolds Metals Company.	Gum Springs, Arkansas.	Kiln residue (generated at a maximum annual volume of 300,000 cubic yards per year) from rotary kiln treatment of spent potliners (EPA Hazardous Waste No. K088). This exclusion was published on December 30, 1991. This exclusion does not apply to electrostatic precipitator dust generated by the rotary kiln. This exclusion initially applies only to the treatment by one rotary kiln of potliners generated by Reynolds Metals' four primary aluminum facilities (Massena, New York; Longview, Washington; Troutdale, Oregon; and Baie Comeau, Quebec) described in the petition. Reynolds may only accept spent potliners from other sources, or modify its treatment process, or add an additional rotary kiln in accordance with Condition (5). This exclusion is conditional upon the submission of data obtained from each rotary kiln after it is established at the R.P. Patterson facility in Gum Springs, Arkansas. To ensure that hazardous constituents are not present in the waste at levels of regulatory concern while the treatment facility is in operation, Reynolds must implement a testing program. This testing program must meet the following conditions for the exclusion to be valid: (1) *Operating Conditions:* (A) *Initial Verification Testing:* During the first 20 days of full-scale operation of the rotary kiln, at typical operating conditions, Reynolds must monitor and submit to EPA the rotary kiln operating conditions (including, but not limited to: Temperature range of the kiln (hot and cold end), kiln residue exit temperature, spent potliner feed rate, brown sand feed rate, limestone feed rate, natural gas feed rate, oxygen/air feed rate, and rotary kiln residence time of the raw materials). The ratio of the spent potliner feed rate to the combined feed rates of the spent potliner, brown sand, and limestone must be no more than 0.35. Information on all other operating conditions should encompass all conditions used for preliminary testing runs and those anticipated for subsequent waste processing. During initial verification testing, the petitioner must also demonstrate to EPA how the range of operating conditions could affect the process (*i.e.*, submit analyses of representative grab samples, as specified under Condition (2), of the kiln residue generated under the expected range of operating conditions). The source of the brown sand must be from Reynolds' dry lake beds at the Bauxite, Arkansas facility. Reynolds must submit the information specified in this condition and obtained during this initial period no later than 90 days after the treatment of the first full-scale batch of spent potliner. (B) *Subsequent Verification Testing:* During subsequent verification testing, Reynolds must monitor the performance of the rotary kiln at all times to ensure that it falls within the range of operating conditions demonstrated during initial verification testing, to be adequate to maintain the levels of hazardous constituents below the delisting levels specified in Condition (4). The feed rates of spent potliner, lime and brown sand are to be as that described in Condition (1)(A). Records of the operating conditions of the rotary kiln (including, but not limited to: Temperature range of the kiln, kiln residue exit temperature, spent potliner feed rate, brown sand feed rate, limestone feed rate, natural gas feed rate, oxygen/air feed rate, and rotary kiln residence time of the raw materials) should be maintained on site for a minimum of five years. This information must be furnished upon request and made available for inspection by any employee or representative of EPA or the State of Arkansas. (2) *Testing:* Sample collection and analyses (including quality control (QC) procedures) must be performed according to SW-846 methodologies. For fluoride, samples must be analyzed using Method 340.2 from "Methods for Chemical Analysis of Water and Waste". If the EPA judges the treatment process to be effective under the operating conditions used during the initial verification testing, Reynolds may replace the testing required in Condition (2)(A) with the testing required in Condition (2)(B). Reynolds must continue to test daily composites of kiln residue generated beyond the time period specified in Condition (2)(A) until and unless notified by EPA in writing that testing in Condition (2)(A) may be replaced by Condition (2)(B) (to the extent directed by EPA). (A) *Initial Verification Testing:* During the first 20 operating days of full-scale operation of the new on-line rotary kiln, Reynolds must collect and analyze daily composites of kiln residue. Daily composites must be composed of representative grab samples collected every 6 hours during each 24-hour kiln operating cycle. The kiln residue samples must be analyzed, prior to the disposal of the kiln residue, for all constituents listed in Condition (4). Reynolds must report the analytical test data, including quality control information, obtained during this initial period no later than 90 days after the treatment of the first full-scale batch of untreated spent potliner.

TABLE 2—WASTES EXCLUDED FROM SPECIFIC SOURCES—Continued

Facility	Address	Waste description
		(B) *Subsequent Verification Testing:* Following notification by EPA, Reynolds may substitute the testing conditions in (2)(B) for (2)(A). Reynolds must collect and analyze both daily and weekly composites of kiln residue. Daily composites must be composed of representative grab samples collected every 6 hours during a 24-hour kiln operating cycle and these samples must be analyzed, prior to the disposal of the kiln residue, for leachable concentrations of cyanide and fluoride. Weekly composites must be composed of representative grab samples collected every 6 hours during a 24-hour kiln operating cycle for each day in the week that the kiln is operating. The weekly samples must be analyzed, prior to the disposal of the kiln residue, for the leachable concentrations of the inorganics listed in Condition (4)(A) and leachable levels of the semi-volatile organic compounds listed in Condition (4)(B). Analyses of both daily and weekly samples must be completed prior to the disposal of waste generated during that week as set forth in Condition (3). The analytical data, including quality control information, must be compiled, summarized, and maintained on site for a minimum of five years. These data must be furnished upon request and made available for inspection by any employee or representative of EPA or the State of Arkansas. (3) *Waste Holding and Handling:* Reynolds must store, as hazardous, all kiln residue generated until verification testing (as specified in Condition (2)(A) and (2)(B)) is completed and compared, by the petitioner, with the delisting levels set forth in Condition (4). If the levels of hazardous constituents measured in the samples of kiln residue generated do not exceed any of the levels set forth in Condition (4), then the kiln residue is non-hazardous and may be managed and disposed of in accordance with all applicable solid waste regulations. If hazardous constituent levels in any daily or weekly sample exceed any of the delisting levels set in Condition (4), the kiln residue generated during the time period corresponding to this sample must be retreated until it meets these levels (analyses must be repeated) or managed and disposed of in accordance with Subtitle C of RCRA. Kiln residue which is generated but for which the required analysis is not complete or valid must be managed and disposed of in accordance with Subtitle C of RCRA, until valid analysis demonstrates that Condition (4) is satisfied. (4) *Delisting Levels:* All concentrations must be measured in the waste leachate by the method specified in 40 CFR 261.24. (A) The leachable concentrations for metals may not exceed the following levels (ppm): arsenic, selenium, or silver—0.60; barium—12.0; antimony—0.12; lead—0.18; cadmium—0.06, chromium or nickel—1.2; mercury—0.024; beryllium—0.012; fluoride—48.0; and cyanide—2.4 (cyanide extraction must be conducted using deionized water). (B) The leachable constituent concentrations for organics may not exceed the levels listed below (ppm): Acenapthene—24 Benz(a)anthracene—$1.2x10^{-4}$ Benzo(b)fluoranthene—$2.4x10^{-4}$ Benzo(a)pyrene—$2.4x10^{-3}$ Chrysene—$2.4x10^{-3}$ Fluoranthene—12 Indeno (1,2,3-cd)pyrene—$2.4x10^{-3}$ Pyrene—12 (5) *Changes in Operating Conditions and Waste Sources:* If after completing the initial verification test period in Conditions (1)(A) and (2)(A), Reynolds decides to treat spent potliner from any other primary aluminum reduction facility; or use a new source for brown sand; or otherwise significantly change the operating conditions developed under Condition (1); then Reynolds must notify EPA in writing prior to instituting the change. Reynolds must also reinstitute the testing and reporting required in Conditions (1)(A) and (2)(A) for a minimum period of four operating days and fulfill all other requirements in Conditions (1) and (2), as appropriate. Reynolds may also add one additional kiln at its R.P. Patterson facility in Gum Springs, Arkansas if it can demonstrate that the new kiln can successfully treat spent potliners. Reynolds must fulfill all requirements contained in Conditions (1) and (2) for the second kiln. Reynolds must continue to test any kiln residue generated beyond the time period specified in Condition (2)(A) until and unless notified in writing by EPA that testing Condition (2)(A) may be replaced by (2)(B) to the extent directed by EPA. (6) *Data Submittals:* Reynolds must notify in writing the Section Chief, Delisting Section (see address below) when the rotary kiln is on-line and two weeks prior to when waste treatment will begin. The data obtained through Conditions (1)(A) and (2)(A) must be submitted to the Section Chief, Delisting Section, OSW (OS-333), U.S. EPA, 401 M Street, SW, Washington, DC 20460 within the time period specified. At the Section Chief's request, Reynolds must submit any other

TABLE 2—WASTES EXCLUDED FROM SPECIFIC SOURCES—Continued

Facility	Address	Waste description
		analytical data obtained through Conditions (1)(B) and (2)(B) within the time period specified by the Section Chief. Failure to submit the required data within the specified time period or maintain the required records on site for the specified time will be considered by the Agency, at its discretion, sufficient basis to revoke the exclusion to the extent directed by EPA. All data must be accompanied by a signed copy of the following certification statement to attest to the truth and accuracy of the data submitted: "Under civil and criminal penalty of law for the making or submission of false or fraudulent statements or representations (pursuant to the applicable provisions of the Federal Code, which include, but may not be limited to, 18 USC § 1001 and 42 USC § 6928), I certify that the information contained in or accompanying this document is true, accurate and complete. "As to the (those) identified section(s) of this document for which I cannot personally verify its (their) truth and accuracy, I certify as the company official having supervisory responsibility for the persons who, acting under my direct instructions, made the verification that this information is true, accurate and complete. "In the event that any of this information is determined by EPA in its sole discretion to be *false, inaccurate or incomplete*, and upon conveyance of this fact to the company, I recognize and agree that this exclusion of wastes will be void as if it never had effect or to the extent directed by EPA and that the company will be liable for any actions taken in contravention of the company's RCRA and CERCLA obligations premised upon the *company's reliance on the void exclusion*."

TABLE 2—WASTES EXCLUDED FROM SPECIFIC SOURCES—Continued

Facility	Address	Waste description
Roanoke Electric Steel Corp.	Roanoke, VA	Fully-cured chemically stabilized electric arc furnace dust/sludge (CSEAFD) treatment residue (EPA Hazardous Waste No. K061) generated from the primary production of steel after March 22, 1989. This exclusion is conditioned upon the data obtained from Roanoke's full-scale CSEAFD treatment facility because Roanoke's original data were obtained from a laboratory-scale CSEAFD treatment process. To ensure that hazardous constituents are not present in the waste at levels of regulatory concern once the full-scale treatment facility is in operation, Roanoke must implement a testing program for the petitioned waste. This testing program must meet the following conditions for the exclusion to be valid: (1) *Testing:* (A) *Initial testing:* During the first four weeks of operation of the full-scale treatment system, Roanoke must collect representative grab samples of each treated batch of the CSEAFD and composite the grab samples daily. The daily composites, prior to disposal, must be analyzed for the EP leachate concentrations of all the EP toxic metals, nickel and cyanide (using distilled water in the cyanide extractions), and the total constituent concentrations of reactive sulfide and reactive cyanide. Analyses must be performed according to SW-846 methodologies. Roanoke must report the analytical test data obtained during this initial period no later than 90 days after the treatment of the first full-scale batch. *(B) Subsequent testing: Roanoke must collect representative grab samples from every treated batch of CSEAFD generated daily and composite all of the grab samples to produce a weekly composite sample. Roanoke then must analyze each weekly composite sample for all of the EP toxic metals and nickel. Analyses must be performed according to SW-846 methodologies. The analytical data, including all quality control information, must be compiled and maintained on site for a minimum of three years. These data must be furnished upon request and made available for inspection by any employee or representative of EPA or the State of Virginia.* (2) *Delisting levels:* If the EP extract concentrations for chromium, lead, arsenic, or silver exceed 0.315 mg/l; for barium exceeds 6.3 mg/l; for cadmium or selenium exceed 0.063 mg/l; for mercury exceeds 0.0126 mg/l; for nickel exceeds 3.15 mg/l; or for cyanide exceeds 1.26 mg/l, or total reactive cyanide or total reactive sulfide levels exceed 250 mg/kg and 500 mg/kg, respectively, the waste must either be re-treated or managed and disposed in accordance with Subtitle C of RCRA. *(3) Data submittals: Within one week of system start-up, Roanoke must notify the Section Chief, Variances Section (see address below) when their full-scale stabilization system in on-line and waste treatment has begun. All data obtained through the initial testing condition (1)(A), must be submitted to the Section Chief, Variances Section, PSPD/OSW, (OS-343), U.S. EPA, 401 M Street, SW., Washington, DC 20460 within the time period specified in condition (1)(A). Failure to submit the required data or keep the required records will be considered by the Agency, at its discretion, sufficient basis to revoke Roanoke's exclusion.* All data must be accompanied by the following certification statement: "Under civil and criminal penalty of law for the making or submission of false or fraudulent statements or representations (pursuant to the applicable provisions of the Federal Code which include, but may not be limited to, 18 USC 6928), I certify that the information contained in or accompanying this document is true, accurate and complete. As to the (those) identified section(s) of this document for which I cannot personally verify its (their) truth and accuracy, I certify as the company official having supervisory responsibility for the persons who, acting under my direct instructions, made the verification that this information is true, accurate and complete. In the event that any of this information is determined by EPA in its sole discretion to be false, inaccurate or incomplete, and upon conveyance of this fact to the company, I recognize and agree that this exclusion of wastes will be void as if it never had effect or to the extent directed by EPA and that the company will be liable for any actions taken in contravention of the company's RCRA and CERCLA obligations premised upon the company's reliance on the void exclusion."
Tricil Environmental Systems, Inc.	Hilliard, Ohio	Spent pickle liquor (EPA Hazardous Waste No. K062) generated by steel finishing operations of facilities within the iron and steel industry (SIC Codes 331 and 332) after November 17, 1986. To ensure that hazardous constituents are not present in the waste at levels of regulatory concern, the facility must implement a contingency testing program for the petitioned wastes. This testing program must meet the following conditions for the exclusions to be valid: (1) Each batch of treatment residue must be representatively sampled and tested using the total oil and grease test and the EP Toxicity test (or the Oily Waste EP test, if the oil and grease content of the waste exceeds one percent) for arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver and nickel. If the extract concentrations for chromium, lead, arsenic, barium, and silver exceed 6.3 ppm; cadmium and selenium exceed 0.063 ppm; mercury levels exceed 0.013 ppm; or nickel levels exceed 2.2 ppm, the waste will be retreated or managed and disposed as a hazardous waste under 40 CFR parts 262 to 265 and the permitting standards of 40 CFR 270.

TABLE 2—WASTES EXCLUDED FROM SPECIFIC SOURCES—Continued

Facility	Address	Waste description
		(2) Each batch of treatment residue must be tested for reactive and leachable cyanide. If the reactive cyanide levels exceed 250 ppm; or leachable cyanide levels (using ther EP Toxicity test without acetic acid adjustment) exceed 1.26 ppm, the waste must be retreated or managed and disposed as hazardous waste under 40 CFR parts 262 to 265 and the permitting standards of 40 CFR Part 270.
		(3) Each batch of waste must be tested for the total content of the following organic toxicants. If the total content of any of the constituents exceeds the maximum levels shown, the waste must be managed and disposed as a hazardous waste under 40 CFR parts 262 and 265 and the permitting standards of 40 CFR Part 270.
		Compound and Maximum Acceptable Levels (ppm)
		Acrolein, 56.8 Anthracene, 76.8 Benzene, 0.106 p-Chloro-m-cresol, 133 1,1-Dichloroethane, 0.01 Fluorene, 10.4 Methylenechloride, 8.2 Methyl ethyl ketone, 326 n-Nitrosodiphenylamine, 11.9 Phenanthrene, 14 Tetrachloroethylene, 0.188 Trichloroethylene, 0.59 Chloroform, 0.013 1,2-Dichloroethane, 0.0083 1,2-trans-Dichloroethylene, 231 2,4-Dimethylphenol, 12.5 Vinyl chloride, 0.18 1,2-Diphenyl hydrazine, 0.001
		(4) A grab sample must be collected from each batch to form one monthly composite sample, which must be tested using GC/MS analysis for the organic compounds shown above, as well as the remaining organics on the priority pollutant list (see 47 FR 52309, November 19, 1982, Appendix A-126 Priority Pollutants).
		(5) The test data from conditions 1–4 must be kept on file at the facility for inspection purposes and must be compiled, summarized, and submitted to the Administrator by certified mail on a semiannual basis. The Agency will review this information and if needed, will propose to modify or withdraw the exclusion. The organics testing described in conditions 3 and 4 above is not required until May 18, 1987. The Agency's decision to conditionally exclude the treatment residue generated from the wastewater treatment system at this facility applies only to the wastewater treatment residue described in this petition.
Tricil Environmental System, Inc.	Muskegon, Michigan.	Spent pickle liquor (EPA Hazardous Waste No. K062) generated by steel finishing operations of facilities within the iron and steel industry (SIC Codes 331 and 332); after November 17, 1986. To ensure that hazardous constituents are not present in the waste at levels of regulatory concern, the facility must implement a contingency testing program for the petitioned wastes. This testing program must meet the following conditions for the exclusion to be valid:
		(1) Each batch of treatment residue must be representatively sampled and tested using the total oil and grease test and the EP Toxicity test (or the Oily Waste EP test, if the oil and grease content of the waste exceeds one percent) for arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver and nickel. If the extract concentrations for chromium, lead, arsenic, barium, and silver exceed 6.3 ppm, cadmium and selenium exceed 0.063 ppm; mercury levels exceed 0.013 ppm; or nickel levels exceed 2.2 ppm, the waste will be retreated or managed and disposed as a hazardous waste under 40 CFR parts 262 to 265 and the permitting standards of 40 CFR 270.
		(2) Each batch of treatment residue must be tested for reactive and leachable cyanide. If the reactive cyanide levels exceed 250 ppm; or leachable cyanide levels (using the EP Toxicity test without acetic acid adjustment) exceed 1.26 ppm, the waste must be retreated or managed and disposed as hazardous waste under 40 CFR parts 262 to 265 and the permitting standards of 40 CFR Part 270.
		(3) Each batch of waste must be tested for the total content of the following organic toxicants. If the total content of any of the constituents exceeds the maximum levels shown, the waste must be managed and disposed as a hazardous waste under 40 CFR parts 262 and 265 and the permitting standards of 40 CFR Part 270:
		Compound and Maximum Acceptable Levels (ppm)
		Acrolein, 56.8 Anthracene, 76.8 Benzene, 0.106 p-Chloro-m-cresol, 133 1,1-Dichloroethane, 0.01

TABLE 2—WASTES EXCLUDED FROM SPECIFIC SOURCES—Continued

Facility	Address	Waste description
		Fluorene, 10.4 Methylenechloride, 8.2 Methyl ethyl ketone, 326 n-Nitrosodiphenylamine, 11.9 Phenanthrene, 14 Tetrachloroethylene, 0.188 Trichloroethylene, 0.59 Chloroform, 0.013 1,2-Dichloroethane, 0.0083 1,2-trans-Dichloroethylene, 231 2,4-Dimethylphenol, 12.5 Vinyl chloride, 0.18 1,2-Diphenyl hydrazine, 0.001 (4) A grab sample must be collected from each batch to form one monthly composite sample, which must be tested using GC/MS analysis for the organic compounds shown above, as well as the remaining organics on the priority pollutant list (see 47 FR 52309, November 19, 1982, Appendix A-126 Priority Pollutants). (5) The test data from conditions 1–4 must be kept on file at the facility for inspection purposes and must be compiled, summarized, and submitted to the Administrator by certified mail on a semiannual basis. The Agency will review this information and if needed, will propose to modify or withdraw the exclusion. The organics testing described in conditions 3 and 4 above is not required until May 18, 1987. The Agency's decision to conditionally exclude the treatment residue generated from the wastewater treatment system at this facility applies only to the wastewater treatment residue described in this petition.
USX Steel Corporation, USS Division, Southworks Plant, Gary Works.	Chicago, Illinois.	Fully-cured chemically stabilized electric arc furnace dust/sludge (CSEAFD) treatment residue (EPA Hazardous Waste No. K061) generated from the primary production of steel after April 29, 1991. This exclusion (for 35,000 tons of CSEAFD per year) is conditioned upon the data obtained from USX's full-scale CSEAFD treatment facility. To ensure that hazardous constituents are not present in the waste at levels of regulatory concern once the full-scale treatment facility is in operation, USX must implement a testing program for the petitioned waste. This testing program must meet the following conditions for the exclusion to be valid: (1) *Testing:* Sample collection and analyses (including quality control (QC) procedures) must be performed according to SW-846 methodologies. (A) *Initial Testing:* During the first four weeks of operation of the full-scale treatment system, USX must collect representative grab samples of each treated batch of the CSEAFD and composite the grab samples daily. The daily composites, prior to disposal, must be analyzed for the EP leachate concentrations of all the EP toxic metals, nickel, and cyanide (using distilled water in the cyanide extractions), and the total concentrations of reactive sulfide and reactive cyanide. USX must report the analytical test data, including quality control information, obtained during this initial period no later than 90 days after the treatment of the first full-scale batch. (B) *Subsequent Testing:* USX must collect representative grab samples from every treated batch of CSEAFD generated daily and composite all of the grab samples to produce a weekly composite sample. USX then must analyze each weekly composite sample for all of the EP toxic metals, and nickel. The analytical data, including quality control information, must be compiled and maintained on site for a minimum of three years. These data must be furnished upon request and made available for inspection by any employee or representative of EPA or the State of Illinois. (2) *Delisting levels:* If the EP extract concentrations for chromium, lead, arsenic, or silver exceed 0.315 mg/l; for barium exceeds 6.3 mg/l; for cadmium or selenium exceed 0.063 mg/l; for mercury exceeds 0.0126 mg/l; for nickel exceeds 3.15 mg/l; or for cyanide exceeds 4.42 mg/l, total reactive cyanide or total reactive sulfide levels exceed 250 mg/kg and 500 mg/kg, respectively, the waste must either be re-treated until it meets these levels or managed and disposed of in accordance with Subtitle C of RCRA.

TABLE 2—WASTES EXCLUDED FROM SPECIFIC SOURCES—Continued

Facility	Address	Waste description
		(3) *Data submittals:* Within one week of system start-up USX must notify the Section Chief, Delisting Section (see address below) when their full-scale stabilization system is on-line and waste treatment has begun. The data obtained through condition (1)(A) must be submitted to the Section Chief, Delisting Section, CAD/OSW (OS-333), U.S. EPA, 401 M Street, S.W., Washington, DC 20460 within the time period specified. At the Section Chief's request, USX must submit any other analytical data obtained through conditions (1)(A) or (1)(B) within the time period specified by the Section Chief. Failure to submit the required data obtained from conditions (1)(A) or (1)(B) within the specified time period or maintain the required records for the specified time will be considered by the Agency, at its discretion, sufficient basis to revoke USX's exclusion to the extent directed by EPA. All data must be accompanied by the following certification statement: "Under civil and criminal penalty of law for the making or submission of false or fraudulent statements or representations (pursuant to the applicable provisions of the Federal Code which include, but may not be limited to, 18 U.S.C. § 6928), I certify that the information contained in or accompanying this document is true, accurate and complete. As to the (those) identified section(s) of this document for which I cannot personally verify its (their) truth and accuracy, I certify as the company official having supervisory responsibility for the persons who, acting under my direct instructions, made the verification that this information is true, accurate and complete. In the event that any of this information is determined by EPA in its sole discretion to be false, inaccurate or incomplete, and upon conveyance of this fact to the company, I recognize and agree that this exclusion of wastes will be void as if it never had effect or to the extent directed by EPA and that the company will be liable for any actions taken in contravention of the company's RCRA and CERCLA obligations premised upon the company's reliance on the void exclusion."
Vulcan Materials Company.	Port Edwards, WI.	Brine purification muds (EPA Hazardous Waste No. K071) generated from the mercury cell process in chlorine production, where separately prepurified brine is not used after November 17, 1986. To assure that mercury levels in this waste are maintained at acceptable levels, the following conditions apply to this exclusion: Each batch of treated brine clarifier muds and saturator insolubles must be tested (by the extraction procedure) prior to disposal and the leachate concentration of mercury must be less than or equal to 0.0129 ppm. If the waste does not meet this requirement, then it must be re-treated or disposed of as hazardous. This exclusion does not apply to wastes for which either of these conditions is not satisfied.

TABLE 3—WASTES EXCLUDED FROM COMMERCIAL CHEMICAL PRODUCTS, OFF-SPECIFICATION SPECIES, CONTAINER RESIDUES, AND SOIL RESIDUES THEREOF

Facility	Address	Waste description
Union Carbide Corp.	Taft, LA............	Contaminated soil (approximately 11,000 cubic yards), which contains acrolein in concentrations of less than 9 ppm.

[49 FR 37070, Sept. 21, 1984]

EDITORIAL NOTE: For FEDERAL REGISTER citations affecting appendix IX of part 261, see the List of CFR Sections Affected in the Finding Aids section of this volume.

APPENDIX X TO PART 261—METHOD OF ANALYSIS FOR CHLORINATED DIBENZO-P-DIOXINS AND -DIBENZOFURANS [1, 2, 3, 4]

Method 8280

1. *Scope and Application*

---

[1] This method is appropriate for the analysis of tetra-, penta-, and hexachlorinated dibenzo-*p*-dioxins and -dibenzofurans.

[2] Analytical protocol for determination of TCDDs in phenolic chemical wastes and soil samples obtained from the proximity of chemical dumps. T.O. Tiernan and M. Taylor. Brehm Laboratory, Wright State University, Dayton, OH 45435.

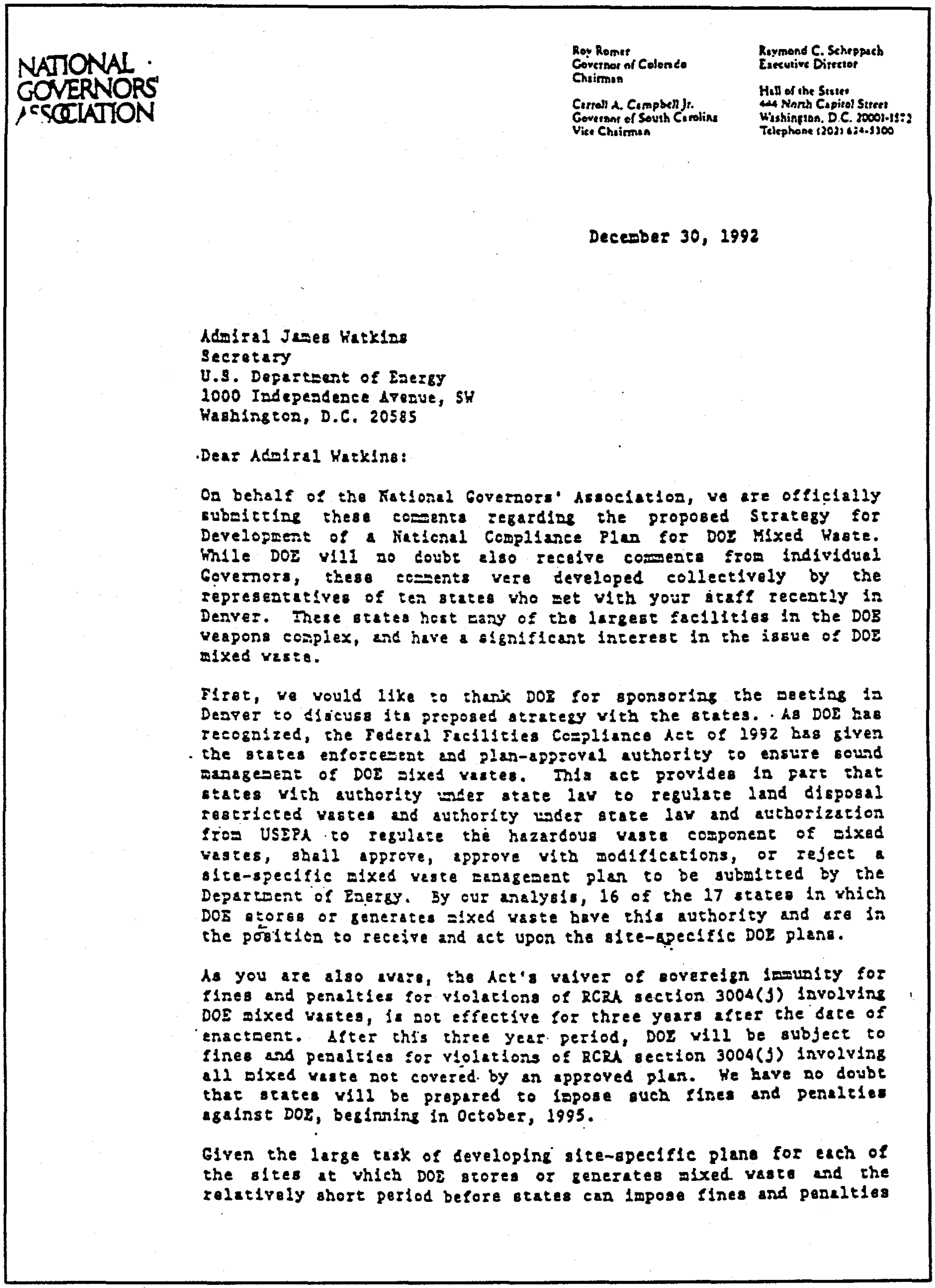
[3] Analytical protocol for determination of chlorinated dibenzo-*p*-dioxins and chlorinated dibenzofurans in river water. T.O. Tiernan and M. Taylor. Brehm Laboratory, Wright State University, Dayton, OH 45435.

[4] In general, the techniques that should be used to handle these materials are those which are followed for radioactive or infectious laboratory materials. Assistance in evaluating laboratory practices may be ob-

Continued

Appendix D

Letter From
National Governors' Association to
Admiral Watkins, Secretary, U.S. Department of Energy,
December 30, 1992



NATIONAL GOVERNORS' ASSOCIATION

Roy Romer
Governor of Colorado
Chairman

Carroll A. Campbell Jr.
Governor of South Carolina
Vice Chairman

Raymond C. Scheppach
Executive Director

Hall of the States
444 North Capitol Street
Washington, D.C. 20001-1572
Telephone (202) 624-5300

December 30, 1992

Admiral James Watkins
Secretary
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, D.C. 20585

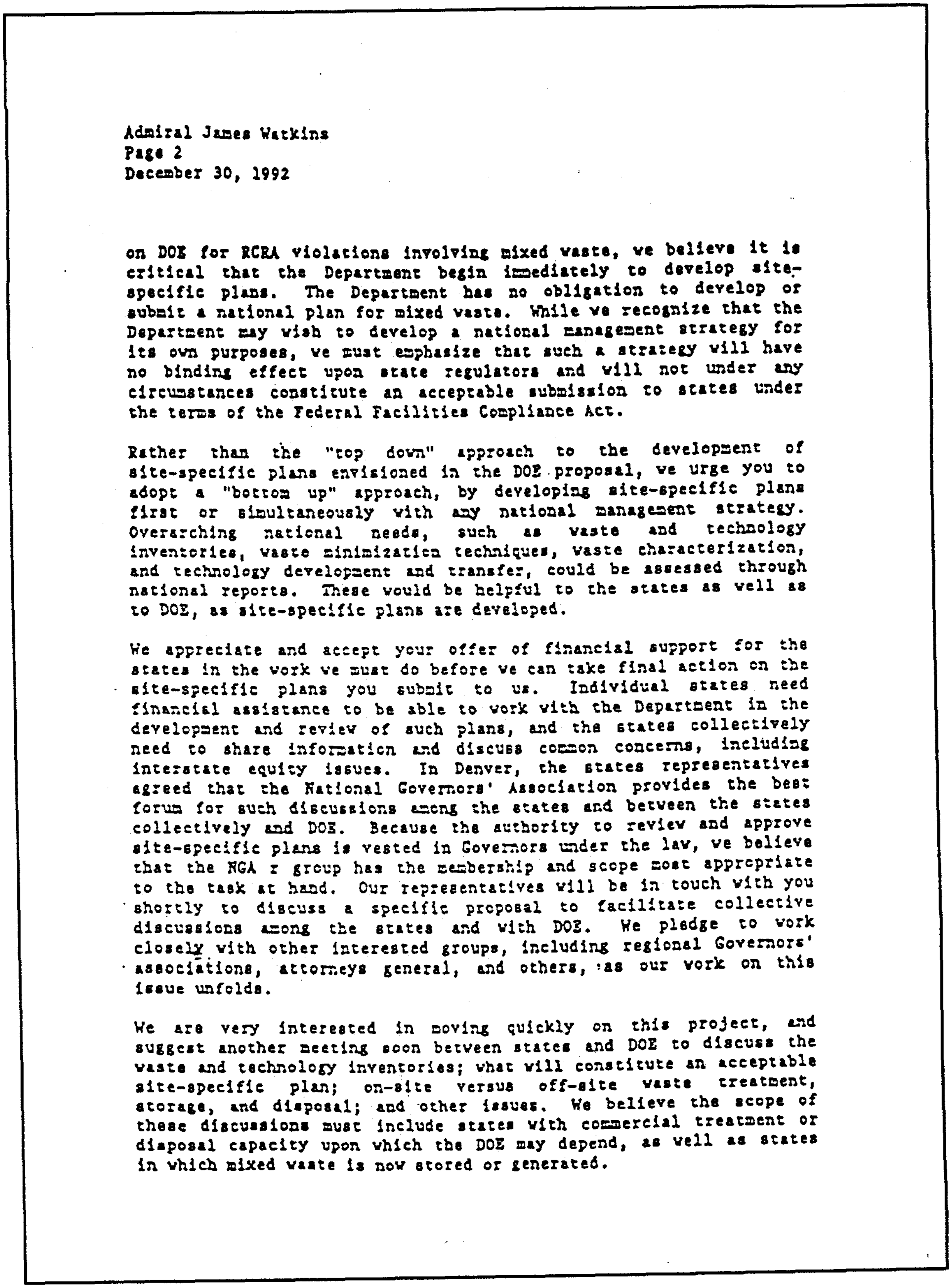
Dear Admiral Watkins:

On behalf of the National Governors' Association, we are officially submitting these comments regarding the proposed Strategy for Development of a National Compliance Plan for DOE Mixed Waste. While DOE will no doubt also receive comments from individual Governors, these comments were developed collectively by the representatives of ten states who met with your staff recently in Denver. These states host many of the largest facilities in the DOE weapons complex, and have a significant interest in the issue of DOE mixed waste.

First, we would like to thank DOE for sponsoring the meeting in Denver to discuss its proposed strategy with the states. As DOE has recognized, the Federal Facilities Compliance Act of 1992 has given the states enforcement and plan-approval authority to ensure sound management of DOE mixed wastes. This act provides in part that states with authority under state law to regulate land disposal restricted wastes and authority under state law and authorization from USEPA to regulate the hazardous waste component of mixed wastes, shall approve, approve with modifications, or reject a site-specific mixed waste management plan to be submitted by the Department of Energy. By our analysis, 16 of the 17 states in which DOE stores or generates mixed waste have this authority and are in the position to receive and act upon the site-specific DOE plans.

As you are also aware, the Act's waiver of sovereign immunity for fines and penalties for violations of RCRA section 3004(j) involving DOE mixed wastes, is not effective for three years after the date of enactment. After this three year period, DOE will be subject to fines and penalties for violations of RCRA section 3004(j) involving all mixed waste not covered by an approved plan. We have no doubt that states will be prepared to impose such fines and penalties against DOE, beginning in October, 1995.

Given the large task of developing site-specific plans for each of the sites at which DOE stores or generates mixed waste and the relatively short period before states can impose fines and penalties

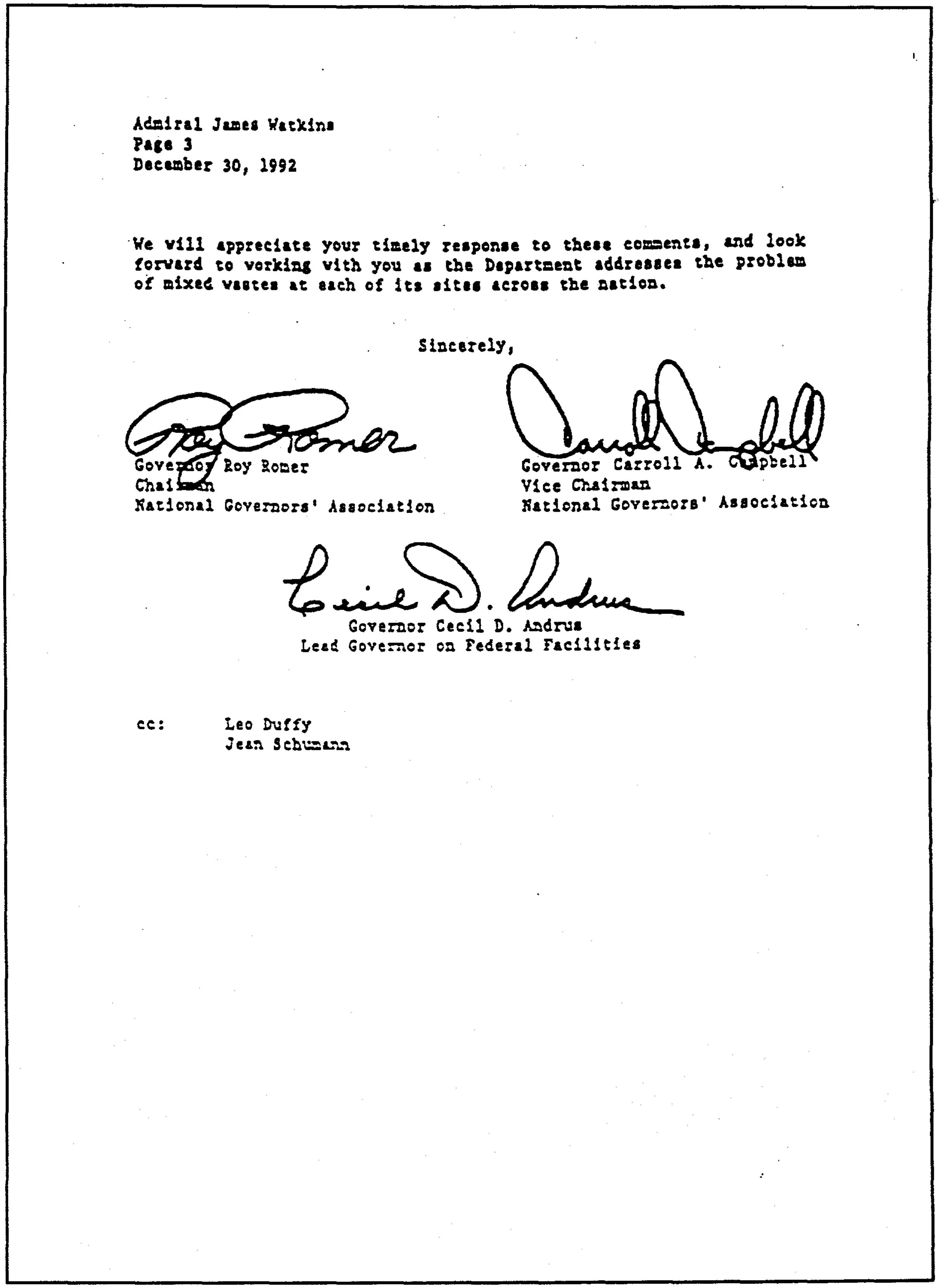


on DOE for RCRA violations involving mixed waste, we believe it is critical that the Department begin immediately to develop site-specific plans. The Department has no obligation to develop or submit a national plan for mixed waste. While we recognize that the Department may wish to develop a national management strategy for its own purposes, we must emphasize that such a strategy will have no binding effect upon state regulators and will not under any circumstances constitute an acceptable submission to states under the terms of the Federal Facilities Compliance Act.

Rather than the "top down" approach to the development of site-specific plans envisioned in the DOE proposal, we urge you to adopt a "bottom up" approach, by developing site-specific plans first or simultaneously with any national management strategy. Overarching national needs, such as waste and technology inventories, waste minimization techniques, waste characterization, and technology development and transfer, could be assessed through national reports. These would be helpful to the states as well as to DOE, as site-specific plans are developed.

We appreciate and accept your offer of financial support for the states in the work we must do before we can take final action on the site-specific plans you submit to us. Individual states need financial assistance to be able to work with the Department in the development and review of such plans, and the states collectively need to share information and discuss common concerns, including interstate equity issues. In Denver, the states representatives agreed that the National Governors' Association provides the best forum for such discussions among the states and between the states collectively and DOE. Because the authority to review and approve site-specific plans is vested in Governors under the law, we believe that the NGA r group has the membership and scope most appropriate to the task at hand. Our representatives will be in touch with you shortly to discuss a specific proposal to facilitate collective discussions among the states and with DOE. We pledge to work closely with other interested groups, including regional Governors' associations, attorneys general, and others, as our work on this issue unfolds.

We are very interested in moving quickly on this project, and suggest another meeting soon between states and DOE to discuss the waste and technology inventories; what will constitute an acceptable site-specific plan; on-site versus off-site waste treatment, storage, and disposal; and other issues. We believe the scope of these discussions must include states with commercial treatment or disposal capacity upon which the DOE may depend, as well as states in which mixed waste is now stored or generated.



Admiral James Watkins
Page 3
December 30, 1992

We will appreciate your timely response to these comments, and look forward to working with you as the Department addresses the problem of mixed wastes at each of its sites across the nation.

Sincerely,

Roy Romer
Governor Roy Romer
Chairman
National Governors' Association

Carroll Campbell
Governor Carroll A. Campbell
Vice Chairman
National Governors' Association

Cecil D. Andrus
Governor Cecil D. Andrus
Lead Governor on Federal Facilities

cc: Leo Duffy
Jean Schumann

Appendix E

New EPA Strategy for Hazardous Waste Reduction and Combustion

May 18, 1993

United States
Environmental Protection
Agency

Communications, Education,
And Public Affairs
(A-107)

EPA

Environmental News

FOR RELEASE: TUESDAY, MAY 18, 1993

EPA ADMINISTRATOR BROWNER ANNOUNCES NEW HAZARDOUS WASTE REDUCTION AND COMBUSTION STRATEGY

Robin Woods 202-260-4377

U.S. Environmental Protection Agency Administrator Carol M. Browner today announced new steps to protect public health and the environment by reducing the amount of hazardous waste produced in this country and strengthening federal controls governing hazardous waste incinerators and industrial furnaces.

"Beginning today," said Browner, "we are changing our approach to hazardous waste management in this country, to ensure maximum protection to the public. I am directing EPA's regional offices to immediately give their highest priority over the next 18 months to bringing existing facilities under rigorous permit controls. This will have the general effect of a temporary capacity freeze as we reexamine our national waste strategy."

Administrator Browner said she is also taking a series of immediate additional actions to permanently enhance the hazardous waste prevention and combustion programs:

-- conducting a major overhaul of federal rules governing waste combustion;

-- starting today, requiring full risk assessments, including those for indirect exposure, in all new permits to ensure that they are based on the best scientific evidence;

-- immediately requiring new permits to include an appropriate dioxin emission standard;

-- immediately requiring new permits to include an appropriate, more stringent control for metals;

-- calling for hazardous waste producers to commit to waste reduction programs;

R-114

(more)

-- calling for a national review of the relative roles of waste combustion and waste reduction in hazardous waste management; and,

-- calling for greater public involvement opportunities.

"I believe today's actions are a significant step toward enhancing the safety of disposal operations for industrial wastes, but even more importantly, they move us closer to my goal of reducing hazardous waste," said Browner. "The Clinton Administration is committed to using every tool available under the law to make changes that will result in the safety of hazardous waste disposal.

"My highest priority is the prevention of pollution at its source, before it is ever created," said Browner. "Hazardous waste reduction represents the future of waste control in this country as well as the future in safeguarding the health of our citizens.

Hazardous waste producers must commit to waste reduction programs using guidelines issued today. These guidelines specify necessary elements for these programs and are the first-ever hazardous waste reduction guidelines EPA has ever published. Under the federal hazardous waste law, the Resource Conservation and Recovery Act (RCRA), hazardous waste producers have been required since 1984 to have waste reduction programs in place, but no specific guidance has been issued to define those programs until today.

Nearly five million tons of hazardous wastes, equal to the amount which could be carried in enough 6,000 gallon tank trucks to cover 2400 miles, end-to-end, from Washington, D.C. to Los Angeles, are burned each year in 184 incinerators and 171 industrial furnaces, including 34 cement kilns. About half of the five million tons are burned each year at 15 large commercial incinerators and the 34 cement kilns, which also take commercial wastes. The remaining incinerators and industrial furnaces are "on-site" facilities, permitted for non-commercial use only.

"It has been 12 years since the federal rules governing the safety of hazardous waste incinerators have been reviewed or strengthened," said Browner. "Today we are taking significant interim steps to vastly improve permits, as well as conducting a complete review of the incinerator standards and the more recent industrial furnace rules to reflect changes in advanced pollution control technologies."

R-114 (more)

Until new rules are published, EPA will continue to use its general "omnibus" permitting authority to require new controls and risk assessments in each new permit when necessary to protect the public or the environment.

Browner emphasized the important role of the public in the permitting process: "I will provide for increased public participation opportunities in the permitting process, such as during test burns, to help local citizens assure themselves that facilities in their neighborhoods are operated safely."

Browner also will convene a task force of EPA and state officials to undertake a broad evaluation of the role of hazardous waste combustion in the nation's management of hazardous waste, specifically to include waste reduction.

Currently, federal rules do not routinely require full risk assessments or the new emission controls. For dioxin, federal rules now generally only require that hazardous waste be burned to a percentage destruction of dioxin. The use of risk assessments, including those on indirect exposure, along with the addition of an appropriate emission limit for dioxin in new permits, will provide a greater measure of certainty that dioxin does not present an unacceptable risk.

Browner also today tightened the controls for particulate matter (pm) in new permits, used to control metals emissions. The new, more stringent, standard is based on the availability of advanced technology.

Over the next 18 months, as a result of Browner's new directive, EPA's regional offices will work with the states to begin bringing incinerators and industrial furnaces under full permit controls. This will include all of the 171 industrial furnaces, including over 30 cement kilns.

Browner's directive to fully permit existing capacity prior to considering additional capacity is based on EPA data indicating that, at this time, there is approximately 2.7 million tons of commercial combustion capacity available. Of this, approximately 55 percent of the liquids combustion capacity is being utilized while nearly 90 percent of the solids combustion capacity is being utilized.

R-114

# # #

United States
Environmental Protection
Agency

Solid Waste and
Emergency Response
(OS-305)

EPA/530-F-93-009
May 1993

Office of Solid Waste

EPA

Environmental Fact Sheet

Hazardous Waste Minimization: Interim Final Guidance for Generators

The concept of waste minimization enjoys widespread support and achieves one of the Environmental Protection Agency's (EPA's) primary goals of preventing or minimizing the generation of hazardous waste. To this end, the Agency is developing guidance to help hazardous waste management organizations and facilities design satisfactory programs that fulfill the provisions of the Resource Conservation and Recovery Act (RCRA), and that meet their specific waste management and economic needs.

Background

RCRA sets national policy that emphasizes the importance of reducing or preventing the generation of hazardous waste. It also contains provisions to promote implementation of waste minimization programs at hazardous waste management facilities. Under those provisions, hazardous waste generators must certify that they have a waste minimization program in-place to reduce the volume or quantity and toxicity of their waste to the degree they determine to be economically practicable. Owners and operators of facilities that receive a permit for the treatment, storage, or disposal of hazardous waste that they generate on the premises also are required to make the same certification at least once a year.

Action

EPA is issuing interim final guidance that describes the basic elements of a hazardous waste minimization program and defines the term *waste minimization*. The term waste minimization includes source reduction, or preventing waste from being generated in the first place (using the legal definition of source reduction that is found in the Pollution Prevention Act) and certain forms of recycling. (Those forms of recycling that closely resemble conventional waste management practices are not included in the definition.)

By describing the basic elements of a hazardous waste minimization program, hazardous waste generators may be able to properly certify programs that are more suited to their individual needs. EPA believes that a "program-in-place" includes:

- top management support;
- characterization of waste generation and waste management costs;
- periodic waste minimization assessments;
- appropriate cost allocation;
- encouragement of technology transfer; and
- program implementation and evaluation.

The public is encouraged to submit comments on this interim final guidance. The Agency is committed to establishing a strong partnership with the states to develop a network of pollution prevention programs. While this interim guidance is designed to encourage generators of hazardous waste to reduce the amount and toxicity of their waste, the states play a key role in assisting all industries in implementing pollution prevention measures.

Contact

For additional information or to order a copy of the *Federal Register* notice, contact the RCRA Hotline, Monday-Friday, 8:30 a.m. to 7:30 p.m. EST. The national, toll-free number is (800) 424-9346; TDD (800) 553-7672 (hearing impaired); in Washington, D.C., the number is (703) 412-9810, TDD (703) 412-3323.

Copies of the *Federal Register* notice or other documents pertaining to hazardous waste minization may be obtained by writing: RCRA Information Center (RIC), U.S. Environmental Protection Agency, Office of Solid Waste (OS-305), 401 M Street SW, Washington, D.C. 20460.

EPA/530–F–93–010

Environmental Fact Sheet

Source Reduction and Combustion of Hazardous Waste

The Environmental Protection Agency (EPA) is issuing a directive to its Regional Offices outlining the importance of source reduction and a series of protective actions to be taken during the permitting of hazardous waste incinerators and boilers and industrial furnaces (BIFs). In addition, EPA is issuing guidance on the elements that should be included in a generator's waste minimization program in order to properly certify that the generator has a waste minimization program in place. Finally, EPA is issuing a draft strategy as the starting point for a broad and open evaluation of how source reduction and waste combustion must be integrated in the nation's hazardous waste management strategy.

Overview of the Combustion Debate

The role that combustion plays in hazardous waste management has changed dramatically over the last decade and a half. Early on, disposal of hazardous waste primarily involved putting wastes into landfills and surface impoundments. As we reached the mid-1980's, there arose a widespread recognition that land-based disposal practices were continuing to present long term pollution problems, particularly with respect to contamination of the nation's ground water.

In 1984, the Resource Conservation and Recovery Act (RCRA) was substantially amended by the Hazardous and Solid Waste Amendments (HSWA). These Amendments charted a new course for hazardous waste management -- away from historic land disposal practices and towards much greater use of treatment technologies prior to disposal. HSWA also further articulated the national policy to emphasize pollution prevention as the first and primary goal for the waste management program.

As a result of this change, combustion of hazardous waste in incinerators and boilers and industrial furnaces (BIFs) began to increase substantially. Concurrent with increased use of combustion as a form of waste management, public concerns began to be voiced about the safety and reliability of combustion facilities. In addition, citizens began to ask whether an overabundance of combustion capacity serves to undercut reduction of waste generated at industrial facilities.

At this juncture, EPA has decided to initiate a fresh look at how to achieve a fully integrated waste management program in which source reduction is given its proper emphasis and in which the role of combustion is carefully considered. As detailed below, this involves the establishment of a broad dialogue on these national policy questions under the joint leadership of EPA and the states. At the same time, EPA will take a series of interim actions designed to further ensure the safety and reliability of hazardous waste combustion in incinerators and BIFs while longer-range scientific research is being conducted and while technical amendments to the regulations are being evaluated. These interim actions will help to ensure that operation of combustion facilities do not present unacceptable risks to human health or the environment.

Background Facts and Figures

About 5 million tons of liquid, semi-solid, and solid hazardous waste are burned each year in hazardous waste incinerators and BIFs. In everyday terms, these 5 million tons would fill up a line of tank trucks stretching from Washington D.C. to Los Angeles, over 2400 miles. About 90% of the wastes combusted today are generated by 10 industry categories, which comprise major segments of American industry, for example, petroleum refineries, agricultural chemical manufacturers, and organic and inorganic chemical plants. Common types of wastes being combusted are spent solvents, distillation bottoms, and off-spec organic chemicals and products.

EPA's incinerator regulations were adopted under the Resource Conservation and Recovery Act (RCRA) in 1981. In 1988, EPA's Office of Solid Waste issued supplemental guidance that directed use of the RCRA "omnibus" permit authority to add controls for emissions of metals, products of incomplete combustion (PICs), and hydrochloric acid (HCl) into new incinerator permits on a case-by-case basis.

Currently, there are 184 hazardous waste incinerators, 139 of which can operate under final permits and another 15 of which are operating in interim status pending final resolution of the appeals on their permits. Another 30 incinerator units are on a permitting track, but only 4 of these are built and operating in interim status. There are 19 commercial incinerators in the United States, 15 of which are in commercial operations today.

Major types of BIFs burning hazardous waste include cement kilns, lightweight aggregate kilns, and industrial and utility boilers. Currently, there are 171 BIFs, of which some 35 are commercial facilities accepting wastes from other generators. BIFs are subject to comprehensive EPA RCRA regulations that were adopted in 1990. Among other key features, these regulations contain controls on metals, PICs, and HCl being emitted from BIF facilities. At the present time, these controls are imposed as interim status standards. No BIFs have yet received final permits although a number of permit applications have been recently filed.

EPA's Objectives

In taking these actions, EPA has articulated several goals that will guide its future actions and will provide the framework for debate on EPA's draft strategy. These goals are:

- To establish a strong preference for source reduction over waste management, and thereby reduce the long-term demand for combustion and other waste management facilities.
- To better address public participation in setting a national source reduction agenda, in evaluating technical combustion issues, and in reaching site-specific decisions during the waste combustion permitting process.
- To develop and impose implementable and rigorous state-of-the-art safety controls on hazardous waste combustion facilities by using the best available technologies and the most current science.
- To ensure that combustion facilities do not pose an unacceptable risk, and use the full extent of legal authorities in permitting and enforcement.
- To continue to advance scientific understanding with regard to waste combustion issues.

The Process for Pursuing a National Strategy

Under RCRA, EPA and the States are partners and co-regulators of the generation, transportation, treatment, storage, and disposal of hazardous waste. EPA is firmly committed to the view that any evaluation of the role of hazardous waste combustion in the hazardous waste management system must be undertaken as a joint federal and state effort. To that end, an EPA-State Committee is being formed to further develop the national strategy. The initial charge to this Committee includes focusing on aggressive source reduction measures, improvements to technical and permitting standards, facilitation of alternative treatment technologies, and developing a better scientific foundation for decision making.

Furthermore, EPA intends to involve all stakeholders in this dialogue. EPA is issuing a draft combustion strategy as a starting point for debate on needed source reduction actions and regulatory changes that must be pursued, and will engage the widest range of interested parties in this debate. In particular, EPA is emphasizing aggressive use of source reduction as the first and primary goal to be pursued with respect to the generation of combustible wastes. However, EPA will immediately pursue a number of actions to ensure that existing combustion facilities are operated safely and without unacceptable risks to human health and the environment while the discussions on the source reduction and the national waste management strategy are taking place.

Actions Being Taken

While the national dialogue on source reduction and hazardous waste combustion is taking place, EPA has issued a directive to its Regional Offices that, effective immediately, calls for a series of actions to be taken in connection with making permit decisions on incinerators and BIFs. These actions include:

- aggressive use of waste minimization measures as part of permitting and enforcement efforts involving generators of combustible waste as well as incinerators and BIFs,
- ensuring that a comprehensive risk assessment, including indirect exposures, is conducted at each facility site,
- use of omnibus permit authority to include dioxin/furan emission limits and a stringent particulate matter standard in new permits where necessary to protect human health and the environment,
- providing for earlier and more effective public participation, and
- giving low management priority to permitting any new incinerator and BIF capacity over the next 18 months unless the new facilities would replace and be a significant improvement over existing capacity.

In addition, the directive targets incinerators and BIFs for enhanced inspection and enforcement efforts regarding compliance with EPA's regulations and with individual facility permit conditions. These enhanced inspection and enforcement activities will also include use of waste minimization requirements as part of compliance actions.

With respect to source reduction, EPA is also issuing interim final guidelines on the elements of a sound waste minimization program. These elements, which span administrative, financial, and technical areas, should be contained in a generator's waste minimization program in order for that generator to make a proper certification under RCRA. The RCRA statute requires that each generator of hazardous waste make such a certification.

On a broader scale, the Administrator is convening a task force of EPA and state officials to undertake a broad evaluation of source reduction and waste combustion as integral components of the national waste management strategy. Concurrently, EPA is issuing a draft combustion strategy as a starting point for discussion on source reduction and waste combustion.

EPA is committed to ensure that all waste management technologies are fully protective of human health and the environment. EPA will not tolerate operation of waste management facilities that present unacceptable risks to human health and the environment. The series of short and longer-term actions set forth in the Administrator's directive to the Regions and proposed for discussion in the draft combustion strategy are designed to achieve this end. These actions will ensure that EPA doing what it can to pursue aggressive source reduction, to enhance controls on existing combustion facilities, and to promote public participation in permitting and source reduction efforts.

# # #

EPA/530-D-93-001

****

DRAFT STRATEGY
FOR COMBUSTION OF HAZARDOUS WASTE

****

U.S. ENVIRONMENTAL PROTECTION AGENCY

MAY 1993

DRAFT STRATEGY FOR COMBUSTION OF HAZARDOUS WASTE IN INCINERATORS AND BOILERS AND FURNACES

I. INTRODUCTION

During the last decade, a dramatic transition in hazardous waste management has occurred. Untreated hazardous waste ceased to be placed on the land, and widespread use of waste treatment technologies, including combustion, ensued. We also began to understand that even vigorously regulated and enforced hazardous waste management requirements cannot totally solve our long-term waste problems. Rather, our long-term national waste management strategy must have reduction of waste as its first and primary goal.

EPA, the States, industry, and the public have learned much about the concept of waste reduction over the last decade. Our challenge for the next decade is to take these lessons and develop a strategy to accomplish our goal of source reduction.

Source reduction is and will continue to be at the top of our waste management hierarchy and must be more aggressively pursued to reduce the long-term demand for waste management facilities. EPA intends to take a fresh look at hazardous waste management issues as part of moving towards the promise of pollution prevention and source reduction. Specifically, in this effort, EPA's goal is to develop an integrated and balanced program for source reduction and waste management. EPA will examine the appropriate roles of source reduction and waste treatment in the nation's hazardous waste management system. EPA also intends to reexamine its existing regulations and policies on waste combustion.

This evaluation will be led by a committee of EPA and State officials. This EPA-State Committee will first be asked to address the relationship between hazardous waste combustion facilities and source reduction of hazardous waste, and to make recommendations on additional source reduction opportunities that should be pursued. The Committee's second charge will be to address how EPA could improve its technical and permitting rules for hazardous waste combustion facilities to ensure that such facilities reflect the state-of-the-art as well as continued technological innovation. The Committee will also be asked to explore the development of alternative waste treatment technologies, as well as the need for better science in evaluating combustion technologies and monitoring emissions from combustion facilities.

As a starting point for this effort, EPA is issuing this Draft Combustion Strategy. This document will serve as a catalyst for discussion with and input from all interested parties on how best to integrate source reduction and waste combustion and on ways by which we can better assure the public of safe operation of hazardous waste combustion facilities.

This draft combustion strategy consists of a discussion of the goals and objectives for this project and a series of short and longer-term actions that can be taken to achieve our goals. These actions are intended as the starting point for discussions with the public and industry. The list of actions in this document are presented for debate and additional ideas. However, while that discussion is taking place, EPA intends to aggressively pursue several of the interim activities.

II. EPA'S STRATEGIC GOALS

A. Background for the Goals

Combustion is currently a large component of hazardous waste management in the United States. It has become a large component as the nation moved away from land disposal in the 1980's and into treatment to reduce the volume and toxicity of hazardous waste. As this shift occurred in the 1980's, citizens in areas where incinerators or boilers and industrial furnaces (BIFs) are located have increasingly challenged the need for these hazardous waste combustion facilities. Citizens evidence concern that waste combustion is too frequently used where source reduction may be the preferred alternative. Citizens also raise concerns regarding facility siting and potential health risks posed by waste management facilities.

Hazardous wastes being burned today are generated by major segments of American industry, and represent a spectrum of commonly-encountered wastes, including spent solvents, sludges and distillation bottoms, and off-spec organic chemicals and products. About 5 million tons of these highly organic wastes are being combusted each year -- some 40% in incinerators and 60% in BIFs. Based on our most recent data, it appears that substantial excess capacity exists for combustion of hazardous waste, particularly liquid wastes. It should also be recognized that although some additional wastes are untreated today, these wastes will soon be subject to treatment requirements mandated under the Hazardous and Solid Waste Amendments of 1984 (HSWA). These treatment requirements could use up much of today's surplus capacity over the next several years.

Incinerators and BIFs burning hazardous waste are regulated by EPA and authorized states under the Resource Conservation and Recovery Act (RCRA). EPA's incinerator permit regulations, first promulgated in 1981, control emissions of principal organic hazardous constituents (POHCs), hydrochloric acid (HCl), and particulate matter at incinerators. For interim status incinerators, only general facility regulations are in place. In 1988, the Office of Solid Waste (OSW) issued guidance to the EPA Regional Offices directing that, on a case-by-case basis under the omnibus provision in RCRA section 3005(c), incinerator permits should be issued with major substantive improvements including controls on metals and products of incomplete combustion (PICs) and improved controls on HCl and acid gases.

BIF facilities burning hazardous waste are all currently in interim status. These facilities -- such as cement and lightweight aggregate kilns -- are subject to EPA regulations adopted in 1991. These regulations, among other things, impose emission controls for metals, PICs, and HCl and acid gases that remain in effect until final permits are issued for these facilities. Currently, there are about 160 interim status BIFs, which are pending final determinations on their permits.

Waste combustion has been viewed as a means to detoxify many hazardous wastes, particularly those containing high levels of organics. EPA's position has been that, if conducted in compliance with regulatory standards and guidance, combustion can be a safe and effective means of disposing of hazardous waste. As new information has come to light, improvements to the regulations governing BIFs and incinerators have been and will continue to be pursued.

EPA believes that our task now is to better integrate source reduction with the regulatory approach to combustion of hazardous waste, and further ensure that national rules reflect the best combustion controls possible. For example, we should broaden our approach to include consideration of how an aggressive source reduction program should factor into national policy on the permitting of hazardous waste combustion facilities. Of course, remediation wates present a different circumstance than newly-generated wastes and, given the finite set of options for dealing with historic cleanup sites, combustion may be the most appropriate remedy. In addition, waste minimization opportunities at cleanup sites are usually severely limited. The EPA-State Committee will focus on these and other similar issues as part of the national dialogue on integration of source reduction and waste management.

B. EPA's Goals

The foundation of this draft strategy are the following five goals:

- To establish a strong preference for source reduction over waste management, and thereby reduce the long-term demand for combustion and other waste management facilities.

- To better address public participation in setting a national source reduction agenda, in evaluating technical combustion issues, and in reaching site-specific decisions during the waste combustion permitting process.
- To develop and impose implementable and rigorous state-of-the-art safety controls on hazardous waste combustion facilities by using the best available technologies and the most current science.
- To ensure that combustion facilities do not pose an unacceptable risk, and use the full extent of legal authorities in permitting and enforcement.
- To continue to advance scientific understanding with regard to waste combustion issues.

These goals address the major issues surrounding hazardous waste combustion today and provide an appropriate framework for a broad assessment of how source reduction and combustion of hazardous waste can be integrated into a national waste management program. This assessment will be comprised of many different activities, many of which will be led by the EPA-State Committee. The Committee and other interested parties are encouraged to examine these goals critically and to consider whether and how they can be improved.

III. THE PROCESS FOR PURSUING A NATIONAL STRATEGY

Under RCRA, EPA and the States are partners and co-regulators of the generation, transportation, treatment, storage, and disposal of hazardous waste. EPA therefore is firmly committed to the view that any evaluation of the role of hazardous waste combustion in our hazardous waste management strategy must be undertaken as a joint federal and state effort. To that end, an EPA-State Committee will be formed under the aegis of the EPA-State Operations Committee. As mentioned earlier, the initial charge to this Committee includes components dealing with aggressive source reduction, improvements to technical and permitting standards, alternative treatment technologies, and a better scientific foundation for decision making.

In each of these areas, this draft strategy lays out a series of short and longer-term actions for public discussion. EPA intends to involve all stakeholders in this dialogue. EPA is providing these ideas as a starting point for discussion on needed source reduction actions and regulatory changes that must be pursued, and encourages all interested parties to comment upon and contribute additional ideas. In addition, however, EPA believes that we must immediately pursue a number of actions to ensure that existing combustion facilities are operated safely and without unacceptable risks to human health and the environment. Accordingly, while we implement the elements of this strategy, EPA is directing its Regions to immediately take actions to pursue aggressive source reduction programs at hazardous waste facilities, and to ensure that waste combustion is closely controlled through permitting and aggressive enforcement.

Both EPA and the EPA-State Committee will seek to engage the widest range of interested parties in our evaluation of source reduction and waste combustion. This will include federal, state, and local officials, waste generators and treaters, the waste combustion industry, environmental and citizen groups, and members of the public at large. Meaningful participation by, and communication among, all affected parties is a cornerstone of EPA's federal hazardous waste program. We intend to take all steps necessary to foster this participation and communication.

EPA is also keenly aware that, ultimately, we serve the public. Our mission under RCRA, and that of the authorized states, is explicit -- we must ensure adequate protection of human health and the environment. EPA fulfills this responsibility in the light of full public scrutiny. We will continue to do so during this reevaluation of the role of combustion in our national waste management strategy.

IV. <u>ACTIONS TO IMPLEMENT STRATEGIC GOALS</u>

All waste management technologies must assure full protection of human health and the environment. EPA will not tolerate operation of waste management facilities that present unacceptable risks to human health and the environment. Accordingly, EPA will engage in a series of short and longer-term actions designed to pursue aggressive source reduction, to enhance controls on existing combustion facilities, and to promote public participation in permitting and source reduction efforts.

The short term actions include:

- An aggressive source reduction program that integrates waste combustion with waste management decision making
- Direction to EPA Regions and states to:

- -- Perform site-specific risk assessments, including indirect exposure, at incinerator and BIF facilities in the permitting process
- -- Use omnibus permit authority in new permits at incinerator and BIF facilities as necessary to protect human health to impose upgraded particulate matter standards and if necessary additional metal emission controls, and to impose limits on dioxin/furan emissions
- -- Establish a priority for reaching final permit decisions for incinerators and BIF facilities
- -- Enhance public participation in permitting of incinerators and BIFs
- -- Enhance inspection and enforcement for incinerators and BIFs.

The longer-term actions include:

- o Continued efforts to build an aggressive source reduction program, including exploration of the usefulness and feasibility of setting a national capacity reduction goal for generation of combustible waste
- o Investigation of feasibility and risks associated with alternative waste treatment technologies
- o Upgrades to EPA's rules on emission controls at combustion facilities and on continuous emission monitoring techniques
- o Upgrades to EPA's rules on the permitting and public involvement process for combustion facilities

A. Short Term Actions

1. Integration of Aggressive Source Reduction and Waste Combustion

o Use of permit priorities to stimulate source reduction

Over the next 18 months, as the national dialogue on source reduction is held, EPA will give low priority to permit-related requests for additional combustion capacity except where that capacity offsets the retirement of existing combustion capacity.

The Agency will consider such requests for additional combustion capacity only if the new capacity would provide a substantial reduction in emissions. These administrative measures will allow the Agency to focus as a priority matter on assuring the safety of currently operating facilities. Furthermore, to the extent any new capacity is considered, it will be state-of-the-art combustion units designed to achieve more efficient combustion and lower emissions. These measures will extend to new permit applications, modifications to existing permits to expand combustion capacity, and expansion of interim status combustion operations.

- **Publication of final "Waste Minimization Program in Place" guidelines.**

These guidelines identify the elements of a waste minimization program for generators and facilities to make a proper certification to EPA that they have a waste minimization program in place, as required by the RCRA statute. EPA will also pursue compliance with the enhanced certification requirements to the maximum extent permitted under RCRA authority. EPA is also considering publication of lists of non-compilers to alert the public and the waste treatment industry. Where legally appropriate, EPA may also use enforcement orders and permits to incorporate the elements of a good waste minimization program into the set of requirements that a facility must meet.

- **Work with the waste treatment industry as a means to get more aggressive action on source reduction from the generators of combustible waste.**

EPA will ask treatment companies to consider accepting wastes only from customers that have conducted source reduction audits and have an enhanced waste minimization program in place (per EPA's "Program in Place" notice). In doing so, we hope that a working partnership can be established among the regulatory agencies, the treaters, and the generators such that we can achieve, as a national priority, the maximum amount of source reduction possible. All interested parties must pursue an aggressive source reduction program. EPA will work closely with the treatment industry to identify additional opportunities for source reduction.

- **Target generating industries that produce combustible wastes both for source reduction inspections and for requiring generators to conduct waste minimization audits.**

EPA will give top priority to ensuring compliance with waste minimization requirements/guidance at those facilities that are driving the demand for waste combustion. In addition, at the same facilities, EPA will to the maximum extent possible include audit requirements in enforcement settlement agreements, permits, and as part of corrective action orders. The audits will allow these companies to investigate the maximum possible use of source reduction to the extent that they are not already doing so in partnership with EPA and the states.

- **Maximum public involvement and information regarding source reduction and its integration with waste combustion**

EPA will also establish a program to more effectively provide information to the public on the types of wastes going to combustion units and the sources of those wastes. First, EPA will compile information from the Biennial Report and will collect information from commercial combustion facilities. This information -- such as the specific types and volumes of wastes being sent for combustion as well as the generators of these wastes -- will be complied in a report and be provided to the public. This information will apprise citizens of those industries that rely on combustion of their wastes and will allow the public to better focus their attention on the appropriate generating facilities.

2. Immediate Actions in Combustion Facility Permitting

The Agency's goal is to continuously improve the regulation of hazardous waste combustion to reflect advances in scientific understanding so that adequate protection of human health and the environment is assured. During the time it takes to propose and finalize updates to national regulations, EPA will use its omnibus authority on a case-by-case basis as necessary to protect human health and the environment to include the appropriate conditions in permits being issued.

At this time, EPA believes that regions and states should use the RCRA omnibus provision and RCRA permit modification regulations to add permit conditions as necessary to protect human health and the environment whenever a combustion facility owner/operator is seeking issuance of a new permit or reissuance of an expiring permit, or, in appropriate circumstances, when existing permits are reopened for modification. The following will be addressed during the permitting process.

- **Risk Assessments**

EPA is directing that site-specific risk assessments be conducted at incinerators and BIFs during the permitting process. These should be done in accordance with EPA's draft indirect risk assessment guidance. EPA is currently developing updated, final guidance on conducting risk assessments at combustion facilities, including consideration of the risks from indirect exposures. Until this national risk assessment guidance is completed, all risk assessments at combustion facilities will be done on a site-by-site basis. EPA and State technical experts will be available to serve on risk assessment teams to assist regions and states in conducting these risk assessments (particularly with regard to indirect risks).

- **Upgraded Particulate Matter Standard and Supplemental Controls on Metal Emissions**

Hazardous waste combustion units should be required, through appropriate use of the omnibus permit authority, to meet the more stringent particulate matter standard that is now applicable to municipal waste combusters -- 0.015 mg/dscm. This technology-based standard operates to provide a major control on metals emissions from combustion unit. In addition, each combustion facility should be required to consider, as part of its facility-specific risk assessment, whether the upgraded PM standard affords adequate protection against the risks posed by metals. If additional metal controls are found to be necessary, the regions and states should impose these controls through use of the omnibus permit authority.

The upgraded PM standard will be used for BIFs unless another protective standard is applicable under state or federal law. These upgraded PM standards will continue to be used until an alternative PM standard has been promulgated for incinerators and BIFs. It may be that the upgraded PM standard is sufficient for many combustion facilities. However, some combustion units may be emitting metals above de minimis quantities, in which case additional controls may be warranted.

- **Dioxins and Furans**

Site specific risk assessments at hazardous waste combustion facilities may reveal the need for additional controls on dioxin and furan emissions. Through appropriate use of the omnibus permit authority, the regions and states should impose as an interim measure emission limits of 30 ng/dscm (based on the sum of all tetra through octa dioxin and furan congeners). This standard is the same as the New Source Performance Standard for new municipal waste combusters. Regions and states should supplement this with more stringent emission limits if the site-specific risk assessment warrants.

- **Permit Controls on Incinerators and BIFs**

EPA regions and states should bring incinerators and BIFs under permit controls as soon as possible. This will be implemented through establishment of a schedule for calling in all BIF permits for final determinations. Each region will develop a plan that provides for commercial BIF permits to be called in within the next 12 months and for all other BIF permits to be called in within the succeeding 24 months. Permits represent one of the most effective means by which EPA and the authorized states can develop and enforce conditions on the operation of incinerators and BIFs. At this point, no BIFs have had final permit decisions. Thus, permit determinations should be made as expeditiously as feasible to effectively control those operations that can be operated safely as well as deny permits at those facilities that can not be operated safely.

- **Enhanced Public Participation**

Public participation is one of the major cornerstones of EPA's environmental programs. EPA is committed to meaningful public involvement in its permitting programs. Local citizens must be given the opportunity to assure themselves that facilities in their neighborhoods will be operated safely.

EPA will immediately provide for greater public participation in the permitting of BIFs and incinerators, and will initiate amendments to its rules to reflect new avenues for public participation. Prior to these amendments being finally adopted, EPA will direct all regions and states to provide immediately for additional public participation opportunities during permitting of combustion units - particularly at earlier stages than now provided for under EPA's current permitting regulations. These should include, but are not limited to, public comment on the trial burn plan. EPA will also direct that local citizens be given the opportunity to participate during the risk assessment process at combustion facilities.

- **Enhanced Inspection and Enforcement**

EPA will continue and enhance its current enforcement efforts regarding combustion units through aggressive inspection and enforcement at both BIFs and incinerators and through use of specialized combustion inspectors. Based on our experience and the level of public concern about the compliance record of commercial combustion units, the use of aggressive enforcement and special inspectors will ensure the maximum timeliness and extent of compliance. In particular, if an event occurs that results in non-compliance, EPA or the state will be in a position to take the appropriate enforcement or permitting action, including abatement of the problem or, if necessary, shutdown of combustion operations. Whenever appropriate, Regions and States are encouraged to use permanent on-site inspectors at commercial incinerators and BIFs.

B. <u>Longer Term Actions</u>

EPA will also immediately pursue a number of longer term actions to continue the progress towards our goals of source reduction, balancing the amount of combustion capacity with the actual needs, ensuring combustion safety, and providing for greater public participation.

- **Continue to build an aggressive source reduction program**

EPA will conduct a national round table on source reduction opportunities for hazardous wastes. The national round table on source reduction will seek to highlight avenues for reducing the amount of waste being combusted, and will explore the appropriate balance between source reduction and use of combustion as a waste management tool. The round table will explore both regulatory and non-regulatory options to encourage and/or require source reduction. Generating and treatment industries will be asked to participate actively in this effort. Results will also be used by the EPA-State Committee to establish a national dialogue among the interested parties on the proper integration of source reduction and waste combustion.

- **Establishment of a Percent/Target Year Program for reduction of combustible hazardous wastes**

EPA will work with the states towards establishing a program in which industry is challenged to reduce by a selected percentage and by a target year the amount of process wastes going to combustion units. EPA will discuss with all interested parties the appropriate percentage reduction to be used as a goal and the appropriate time frame for this reduction.

- **Upgrade EPA's rules to reflect state-of-the-art advancements**

EPA will initiate a rulemaking to upgrade our combustion rules. In doing so, EPA will explore the feasibility of a technology-based approach, particularly with respect to setting emission controls on metals, dioxins and furans, acid gases, particulate matter, and products of incomplete combustion. In addition, EPA will continue to refine its risk assessment guidelines to ensure that all risks are effectively addressed by national regulations or site-specific permit conditions.

- **Upgrade EPA's rules on permit process for combustion units**

While EPA is directing regions and states to immediately afford greater public participation on a permit-by-permit basis, we will seek to modify our rules to reflect expanded public participation. EPA will initiate a rulemaking to codify our goal of increased public participation at earlier stages in the permitting process for incinerators and BIFs. In particular, EPA will address the trial burn process and the public's role in that process.

EPA also believes there is a need to explore a rulemaking to reform the permit appeal process for combustion units whose permit applications have been denied by the Regional Administrator or State Director. In particular, where the unit has been burning waste under interim status, EPA will seek to establish rules that prevent the continued burning of waste during administrative appeals of a permit denial decision. EPA will also explore additional guidance or a rulemaking to clarify the number of permissible trial burns allowed before permit denial.

- **Use and Feasibility of a Long-Term National Capacity Reduction Goal**

EPA will explore the usefulness of developing a long-term reduction goal (e.g., a 25% reduction in combustion capacity over the next 10 years) to reduce combustion capacity beyond that which can be achieved through source reduction efforts. The purpose of such a goal would be to give more concrete national guidance on how best to mesh combustion demand with capacity.

- **Conduct research on continuous monitoring for organics, including dioxins and metals.**

EPA will use its research resources to continue and enhance scientific inquiry on ways to better determine what constituents are in emissions from combustion units and to develop the technology needed to monitor these emissions on a continuous basis. EPA will work cooperatively with the waste combustion industry to address these research areas.

- **Investigate innovative waste treatment technologies that provide protection to human health and the environment.**

EPA will continue and enhance its efforts to foster the development of innovative technologies for the safe and effective treatment of hazardous waste. Such actions are essential to our national waste management system and to our global competitiveness.

V. CONCLUSION

EPA is committed to evaluating the role that source reduction and combustion of hazardous waste should play in our national waste management program. EPA will work in full partnership with the States in this effort. EPA and the States will embark upon a full and open discussion with all stakeholders, including affected citizens and industries, on the issues and actions detailed in this Draft Combustion Strategy.

Appendix F

DOE Office of Waste Management—List of Waste Streams That May Be Appropriate for Treatment by Incineration and/or MSO

Table F-1. Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
AMES	Combustible dry waste	2	10		✓	✓	
AMES	Contaminated vacuum pump oil	.02	U	✓		✓	
ANL-W	Combustible LLW	3	U		✓	✓	
ANL-W	Contaminated HG-1BC Cask Main D009	.01	.0189		✓	✓	
ANL-W	Ethanol-vermiculite ignitable solution	.0	.42		✓	✓	
ANL-W	Non processable waste (inc. wood)	60	U		✓		✓
ANL-W	Out of cell LLW incinerable waste	28	U		✓	✓	
ANL-W	Paint stripping waste	.1	.0710		✓	✓	
ANL-W	Potassium chromate on blotter paper D007	0	.23		✓	✓	
ANL-W	Radioactive cadmium	.02	U		✓	✓	
ANL-W	Radioactive Mercury	.02	U		✓	✓	
ANL-W	Radioactive oil	.02	U	✓		✓	
ANL-W	Radioactive paint strippings D007, D008, F002, F003	.0135	U		✓	✓	
ANL-W	RH LLW waste	.8	U		✓		✓
ANL-W	Solvent decon solution F003, F005	0	.02	✓		✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
ANL-W	Xylene decon waste F003	0	.2		✓	✓	
ANL-W	ZPPR combustible	3	U		✓		✓
ANL-W	ZPPR non compactible	3	U		✓		✓
BCL	BCL DP D&D waste	200	3650 55 gal drum		✓		✓
BCL	Sump sludge D040	0	1.24		✓		✓
BCL	Sump sludge	0	1.56		✓		✓
BCL	Sump sludge	0	1.59		✓		✓
BCL	Sump sludge	0	2.25		✓		✓
BNL	Chlorinated solvents F001, F002, V044, U226	.05	.43	✓		✓	
BNL	Contaminated Oil	.08	13.4	✓		✓	
BNL	Ignitable liquid D001, F003, U002, U159	.057	.3	✓		✓	
BNL	Ignitable liquids D001	2.4	U	✓		✓	
BNL	Lab pack chemicals	10.1	U		✓	✓	
BNL	Mixed flammable solvent D001, F003	.64	U	✓		✓	
BNL	PCB Capacitors	3.0	U	✓		✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
BNL	PCB contaminated debris	.0275	U		✓	✓	
BNL	PCB transformer	.09	U	✓		✓	
BNL	Scintillation Cocktail	.175	U		✓		✓
BNL	Scintillation Fluid D001, V220, V239	.28	U	✓		✓	
BNL	Scintillation Fluid, TCE F001, F002, V226	.04	12.5	✓		✓	
BNL	1.1.1 - TCE F001	1.04	U	✓		✓	
BNL	1.1.1 - TCE F001	1.25	U	✓		✓	
BNL	Waste degreasing solvent	2.1	U	✓		✓	
BETTIS	Compacted solvent waste D001, F002, F003, F005	0	U		✓	✓	
BETTIS	Exhaust System Charcoal F001, F003	0	30 55 gal drums		✓	✓	
BETTIS	Hydraulic oil with heavy metals D006, D008, D009, D010	0	36 gal	✓		✓	
BETTIS	Irrad. waste fission prod	261	U		✓		✓
BETTIS	Pb & Cr based paint chips D007, D008	0	20.7		✓		✓
BETTIS	Oil containing heavy metals D010	0	.057	✓		✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
BETTIS	Oil D007, D009, D011	0	1.7	✓		✓	
BETTIS	PCB Oil	0	U	✓		✓	
BETTIS	Spent M-192 Solvent Rags F003, F005	.017	U		✓	✓	
BETTIS	Spent M192 solvent D001, F003, F005	.02	U	✓		✓	
BETTIS	Unirradiated alpha-cont. waste	140	U		✓		✓
Colonie	PCB capacitor filled with oil	0	500 kg		✓		✓
Colonie	PCB oil	0	500 kg	✓		✓	
Colonie	D007/D040 (#445)	0	.02		✓		✓
Colonie	Waste Oil D039/D040	0	.42		✓		✓
Colonie	Hydroseal and Dye D039	0	.42	✓		✓	
Colonie	Liquid waste - ignitable D001, D039	0	.21	✓		✓	
Colonie	Liquid Waste - ignitable D001, D023	0	.15	✓		✓	
Colonie	Mighty Strip D018	0	.13	✓		✓	
Colonie	Oils	0	3.15		✓		✓
Colonie	Phenols/Benzenes D001, D018, D023, D024, D025	0	.21	✓		✓	

U = Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
Colonie	Press sump D001	0	.62	✓		✓	
Colonie	Spent solvents	0	.02	✓		✓	
Colonie	Unknown liquid D008	0	.01		✓		✓
Colonie	Waste oil F001 0	0	.42	✓		✓	
Colonie	Waste Oil D001, D006, D008, D009, D028, D039	0	.21	✓		✓	
Colonie	Waste oil D006	0	.42		✓		✓
Colonie	Waste Oil D006, D039	0	.21	✓		✓	
Colonie	Waste oil D008, D039, D040	0	209.3	✓		✓	
Colonie	Waste oil D039	0	.21	✓		✓	
ETEC	Oils (Hydraulic, gear & misc.)	0	0.3	✓		✓	
FEMP	1.1.1-TCE still bottoms D001, F001	0	13.45	✓		✓	
FEMP	1.1.2 TCE U27	0	U	✓		✓	
FEMP	Acetonitrile in water D001	0	.096		✓		✓
FEMP	Aniline Nitrobenizene lab packs U012, U169	U	U				✓
FEMP	Barium sulfate filter cake D001, D005, D007	0	9.0		✓		✓

U=Unknown, not listed in the available data.

Table F-1 (continued). *Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies*

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
FEMP	Batteries, flashlight/beepers D002, D006, D009	U	U				✓
FEMP	CCl_4, TCE lab packs U211, *227	U	U	✓		✓	
FEMP	Chemical lab packs V021, V165, V201, V219, V328	U	U		✓		✓
FEMP	Cleanout sludges D001	0	13.93		✓	✓	
FEMP	Cobalt Trifluoride D001, D003	0	U		✓		✓
FEMP	Contaminated protective clothing F001, F005	0	U		✓	✓	
FEMP	Contaminated solvents F002	0	.13	✓		✓	
FEMP	Contaminated solvents D001, D007, F003	0	55 gal	✓		✓	
FEMP	Contaminated spent solvents D018, F001, F002	0	1.7	✓		✓	
FEMP	Contaminated spent solvents F002	0	U	✓		✓	
FEMP	Contaminated trash D005, D006, D007, D008, F003	0	U		✓	✓	
FEMP	Discard maintenance prod. D001, D018	0	U		✓		✓
FEMP	Discard maintenance prod. D001	0	U		✓		✓

U=Unknown, not listed in the available data.

Table F–1 (continued). Summary of DOE EM–30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
FEMP	Discard maintenance prod. D001	0	U		✓	✓	
FEMP	Discard maintenance prod. D018	0	U		✓		✓
FEMP	Discard process residue D039, D040, D043, F002	0	144.56		✓		✓
FEMP	Discard process residues F001	0	.6		✓	✓	
FEMP	Discard process residues D010	0	16 55 gal drums		✓	✓	
FEMP	Dust collector bags D006	0	1.5		✓	✓	
FEMP	Gasoline D001, D018	0	.267	✓		✓	
FEMP	Ignitagle lab packs	U	U		✓	✓	
FEMP	Ingitable lab packs D001	U	U		✓	✓	
FEMP	Ingitable lab packs D001	U	U		✓	✓	
FEMP	Ignitable lab packs D001	U	U		✓	✓	
FEMP	Ignitable lab packs D001	U	U		✓	✓	
FEMP	Kerosene D018	U	1.9	✓		✓	
FEMP	Leaded gasoline D001, D008, D018	0	3.7	✓		✓	
FEMP	Liquid and solid samples D004-D008, D010, D018, F002	0	.06		✓	✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
FEMP	Methanol/Cyclohexane D001, F003	0	U		✓		✓
FEMP	MEK and water U159	0	U		✓		✓
FEMP	Non oily sludge F002	5	5		✓	✓	
FEMP	Non oily sludge D018, F002	17	17		✓	✓	
FEMP	Non oily sump/filter cake D001, F002, F003, F005	0	5 55 gal drums		✓	✓	
FEMP	Non recoverable trash D008. F001, F002	0	8.75		✓	✓	
FEMP	Non recoverable trash F002, D007, D010	0	.368		✓	✓	
FEMP	Non recoverable trash (oil & water) F002, F005)	0	.208		✓		✓
FEMP	Non recoverable trash D019, F002	0	5 55 gal drums				✓
FEMP	Oil and solvents D001, D007, D008, D010, D018, F002	0	.05	✓		✓	
FEMP	Oily rags D010, D018, F001, F002	0	1.01		✓	✓	
FEMP	Oily rags D010, D018, F002	0	.34		✓	✓	
FEMP	Oily rags D018, F002	0	.32		✓	✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
FEMP	Oil rags, cleanup materials D018, F002	0	.07		✓	✓	
FEMP	Oil soaked dirt D008, F001	3	U			✓	
FEMP	Oily cleanup material D018	0	3.4		✓	✓	
FEMP	Oily Hilco filter cake	1.0	U		✓	✓	
FEMP	Oily Hilco filter cake & merco dry D001	5.0	5		✓	✓	
FEMP	Oily semi solid D001, F001	0	55 gal		✓	✓	
FEMP	Oily semi solids	0	2.2		✓	✓	
FEMP	Oily semi solids F002	0	153.7		✓	✓	
FEMP	Oily semi solids for oxidation	0	55 gal		✓	✓	
FEMP	Oily sludge D001, F002	74	74		✓	✓	
FEMP	Oily sludge D005, D008	3	3		✓	✓	
FEMP	Oily sludge D018, F002	1	1		✓	✓	
FEMP	Oily sludge D008, F002	16	1.9		✓	✓	
FEMP	Oily sludeges for oxidation F002	0	7.788				✓
FEMP	Oily sludges for oxidation D001, D010	0	.208				✓
FEMP	Paint thinner D001	0	.4		✓	✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). *Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies*

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
FEMP	Paint thinner D001, F002	3.0	13.28	✓		✓	
FEMP	Paint thinners D001, F002, F003, F005	0	1.14	✓		✓	
FEMP	Phenol U188	0	U	✓		✓	
FEMP	Pressure treated wood D006	0	.44		✓	✓	
FEMP	Rags F002, F003, F005	0	.045		✓	✓	
FEMP	Rags w/1,1,1-TCA D008, D018, F001, F002	0	U		✓	✓	
FEMP	Salt sludge for plant 8 D004, D019, D039, F002	0	4 55 gal drums				✓
FEMP	Rags, gloves, protective clothing D007	0	U		✓	✓	
FEMP	Scrap salts D008	0	521.6			✓	
FEMP	Soil borings - solvents D039, D040, F002	0	U				✓
FEMP	Soil contaminated with oil and water D018	0	U				✓
FEMP	Solids contaminated by lab samples D004-D008, D022, F002, F003	0	U		✓		✓

U=Unknown, not listed in the available data.

Table F–1 (continued). Summary of DOE EM–30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
FEMP	Solvent contaminated rags D018, F001, F002	0	.093		✓	✓	
FEMP	Solvent contaminated wood pallets F002	0	2.8		✓	✓	
FEMP	Solvent sludges D001, F002	1.0	1.0		✓	✓	
FEMP	Solvent sludges D001, D007	0	55 gal		✓	✓	
FEMP	Spent 1,1,1-TCA D008, D018, F001, F002	10	.092	✓		✓	
FEMP	Spent 1,1,1-TCA F001	0	0.3	✓		✓	
FEMP	Spent acetone D001, F003	0	.5	✓		✓	
FEMP	Spent chloroform D022	0	U	✓		✓	
FEMP	Spent enamel D001	1.0	1	✓		✓	
FEMP	Spent methanol D001, F003	0	.21	✓		✓	
FEMP	Spent methylene chloride F002	0	U	✓		✓	
FEMP	Spent methylene choride and perc D018, F002	0	.3	✓		✓	
FEMP	Spent 7BP, derosene D001, D002, D007	3.0	3	✓		✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
FEMP	Spent PCE D007, D008, D018, D019, D021, D039, D040, F001, F002	0	.003	✓		✓	
FEMP	Spent xylene D001, F003	0	.02	✓		✓	
FEMP	Spill PCE U210	0	.31		✓	✓	
FEMP	Sump water & hydraulic oil D001, D008, D019, D039, D040, F002, F003, F005	0	.624		✓		✓
FEMP	TBP/kerosene semi solid D001, D002, D007	0	2.9		✓	✓	
FEMP	TBP/Kerosene semi solid D018	0	2.9		✓	✓	
FEMP	Unfired reduction charges D001	0	.025			✓	
FEMP	Used oil D005, D008	0	2.29	✓		✓	
FEMP	Used oil D008, D018, F001, F003	0	1.06	✓		✓	
FEMP	Used oil F002	30	3.65	✓		✓	
FEMP	Used oil (+rain water) D005, D008, D018, F002	0	.34		✓		✓
FEMP	Used oil D008, D018, F002	0	.91	✓		✓	
FEMP	Used oil D008, F002	14	3.7	✓		✓	
FEMP	Used oil D010, D018, F002	18	17.9	✓		✓	

U=Unknown, not listed in the available data.

Table F-1 *(continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies*

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
FEMP	Used oil D001, F001	15	14.4	✓		✓	
FEMP	Used oil D008, F001	0	62	✓		✓	
FEMP	Used paint thinner D001, D008, F002	0	U	✓		✓	
FEMP	Waste benzene D001, D018	0	0.204	✓		✓	
FEMP	Waste ethyl ether D003, F003	0	.08	✓		✓	
FEMP	Waste lab solid D005, D006, D007, D008	0	U		✓	✓	
FEMP	Waste rags, paper, etc D004, D005, F002, F003	0	U		✓	✓	
FEMP	Waste solvents, mixed D007, D008, D018, D019, D021, D029, D039, D040, F001	0	6.38	✓		✓	
FEMP	Water/gas mixture D001, D018	0	7.27		✓		✓
FEMP	Water/gas mixture D001, D008, D018	0	3.7		✓		✓
FEMP	Water/gas mixture D008, D018	0	2.25		✓		✓
FEMP	Wet sumpcake D002, D006, D010	0	940		✓	✓	
FEMP	Contaminated graphite F001, F002	0	.416	✓			✓

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
FEMP	Contaminated graphite D001, D003	0	35.152	✓			✓
FERMI	1,1,1 TCA F001	.02	.01	✓		✓	
FERMI	Acetone soaked rags F003	U	U		✓	✓	
FERMI	Chlorinated solvent soaked rags F001	.15	.04		✓	✓	
FERMI	Compacted dry solids	4.79	4.79		✓	✓	
FERMI	Compactible dry solids	28.5	28.5		✓	✓	
FERMI	Corrosive acids D002	.08	.41	✓			✓
FERMI	Corrosive alkalines D002	.06	.02	✓			✓
FERMI	Flammable aerosols D001	.16	.15	✓		✓	
FERMI	Flammable liquids D001, F003	7.83	.71	✓		✓	
FERMI	Flammable liquids D001	.38	.06	✓		✓	
FERMI	Flammable solvent soaked rags F003	.36	.84		✓	✓	
FERMI	Freon TF F001	2.95	3.2	✓		✓	
FERMI	Freon soaked rags F001	U	U		✓	✓	
FERMI	Lead contaminated solids D008	3.86	.17		✓	✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). *Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies*

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
FERMI	Misc accelerator components	70	90 55 gal dr, 15 boxes		✓		✓
FERMI	PCB Contaminated oil	45.9	U	✓		✓	
FERMI	PCB Contaminated solids	8.45	.34		✓		✓
FERMI	Petroleum based paint D001	.38	.13	✓		✓	
FERMI	Safety Kleen solvent D001	4.62	U	✓		✓	
FERMI	Spent ethyl alcohol D001	.02	U	✓		✓	
FERMI	Vacuum pump oils	1.6	1.6	✓		✓	
GJPO	Alcohol (isopropanol & butanol) D001	.022	.022	✓		✓	
GJPO	Combustible solvents D001, F003	.02	.02	✓		✓	
GJPO	Cyclohexanel TOPO D001	.05	.04	✓		✓	
GJPO	Index of refraction oils D004	0	.001	✓		✓	
GJPO	Liquid excess chemicals U328, U359	0	.001		✓		✓
GJPO	Liquid scintillation cocktails D001, D008, F003	.02	.025	✓		✓	
GJPO	Naptha D001	.160	.0690	✓		✓	
GJPO	PCB calibration standards D001, F003	.020	.0014	✓		✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
GJPO	PCB extractant and sample wastes D001, F002, F003	.06	.045	✓		✓	
GJPO	Spent solvent D001, F003, F005	.18	.181	✓		✓	
GJPO	Waste solvents from laboratory D001, F002, F003	0	.06	✓		✓	
INEL	1,1,1-TCA and alcohol lab waste D001, F001	.2000	236.0	✓		✓	
INEL	1,1,2 Trichloro-1.2.2-trifluoroethane F002	.21	.21	✓			✓
INEL	Activated carbon LLW D002-D043	.42	.21	✓			✓
INEL	ARA IV sump sludge F002	0	.64		✓	✓	
INEL	Benelex, plexiglass - LLW D008, D019, D040, F001	U	67.0		✓	✓	
INEL	Blankrola solvent D039, F002	.04	U	✓		✓	
INEL	Carburetor grease F003	.0021	.0021	✓		✓	
INEL	Cemented LLW sludges D005, D007, D008, D019, D040, F001, F002, F003	U	286				✓
INEL	Cemented TRV sludges D006, D007, D008, D019, D040, F001-003	U	295				✓

U=Unknown, not listed in the available data.

Table F-1 (continued). *Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies*

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
INEL	Chromium sandblast grit D007	U	U			✓	
INEL	Chromium trioxide wastes D007	.02	.012			✓	
INEL	Chromium/cadmium contaminated solids D006, D007	3.0	U				✓
INEL	Combustibles (LLW) D001, D002, D008, D009, D019, D040, F001-003	U	7245			✓	
INEL	Discarded petroleum product D001, F001, F003, F005	U	U	✓		✓	
INEL	Electronic board & misc parts D006, D007, D008, D011	.02	U				✓
INEL	F002 contaminated solids F002	.16	.06		✓	✓	
INEL	Freon decon waste D008, D011, F002	.07	.07		✓	✓	
INEL	Excess chemicals D001	U	U	✓		✓	
INEL	Heavy metal, radioactive oil D007, D008	12.57	12.57	✓		✓	
INEL	HTRE -3 spill cleanup material D009	0	1.04		✓	✓	
INEL	ICPP low level radioactive solid waste	2172	U		✓	✓	

U=Unknown, not listed in the available data.

Table F–1 (continued). Summary of DOE EM–30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
INEL	Ignitable liquid	.0005	.0005	✓		✓	
INEL	Lab debris D001, F002, F003, F005	.36	U		✓	✓	
INEL	Lab packs D000, U000	7.6	U		✓		✓
INEL	Lab waste D006, D022	.02	.42	✓		✓	
INEL	Lead contaminated debris D008	U	.62		✓	✓	
INEL	Mercury contaminated debris and asbestos	.62	.62		✓	✓	
INEL	Mercury contaminated solids D008, D009	17.0	5.04		✓	✓	
INEL	Miscellaneous lab wastes D001-D043)	.02	.02		✓		✓
INEL	Miscellaneous LLW D001, D002, D008, F002, F003, U117	U	131.5		✓		✓
INEL	Mixed solvents and debris D001, F003, F005	2.18	U		✓	✓	
INEL	Nonmetal molds and crucibles - LLW D009, F001, F002	0	23	✓			✓
INEL	NRF oil D007	0	1.6	✓		✓	
INEL	Oil sludge D008, D018, D040	.38	U	✓		✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
INEL	Paint and thinners D001, D005-D009, D026, D035, D043, F002-005	.72	U	✓		✓	
INEL	Paint contaminated rags D006, D007, D008, F005	2.18	U		✓	✓	
INEL	Paint related material liquids, waste D001, F003, F005	.84	U	✓		✓	
INEL	Paint related material, solids waste F003, F005	4.0	U		✓	✓	
INEL	Paint soiled rags D001, D040	U	U		✓	✓	
INEL	Paint stripper D007, D008, F002, F003	.21	.21		✓	✓	
INEL	PCB contaminated soil	456	U			✓	
INEL	PCB contaminated soil and debris	3.8	U			✓	
INEL	PCB small capacitors	.44	U				✓
INEL	Rad and lead contaminated debris D008	0	.37				✓
INEL	Radioactive PCB oil	0	.55	✓		✓	
INEL	Radioactive sources - LLW D008	0	4.5				✓
INEL	Resins (LLW) D001, D008, D019, D040, F001, F002	0	2.5		✓		✓

U=Unknown, not listed in the available data.

Table F–1 (continued). Summary of DOE EM–30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
INEL	Scintillation cocktails w/cadmium D006, D022	0	.2690		✓		✓
INEL	Solvent contaminated rags	.36	U		✓	✓	
INEL	Spent 1,1,1-TCE degreaser solvent F001	.4	1.0	✓		✓	
INEL	Spent GM 141 SAPC solvent	2.0	.88	✓		✓	
INEL	Spent stoddard solvent D001, D006, D007, D008	.22	.22	✓		✓	
INEL	Stoddard solvent D001	3.8	U	✓		✓	
INEL	TAN decon solvents wastes D002, D004, D006, F007-0010, F001, F002, F005	0	5.82	✓		✓	
INEL	TAN TCLP sludge D039, D040	0	3.74				✓
INEL	TCA waste	.20	.4	✓		✓	
INEL	TCA waste with water F001	0	.4		✓		✓
INEL	TRA lab scintillation cocktail D001, F005	.24	.234	✓		✓	
INEL	TSF 91 combustible waste	2.7	2.7		✓	✓	
INEL	TVRCO decon solution D040	0	.11	✓		✓	
INEL	TVRCO decon solvents D040	0	.11	✓		✓	

U=Unknown, not listed in the available data.

Table F–1 (continued). Summary of DOE EM–30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
INEL	V-80 toner D001	.38	U	✓		✓	
INEL	Waste gasoline D001, D008, D019	U	U	✓		✓	
INEL	Water soluable coolant D008	.73	U		✓		✓
INEL	WERF HEPA filters and baghouse bags D006, D008	.9	5.81		✓		✓
INEL	WERF HEPA filters and lead D006, D008	2.72	5.81		✓		✓
INEL	WERF incinerable LLW	1472	1428.57		✓	✓	
ITRI	Actinide liquid scintillations vials LSC D001, D002, F003, F005	.6	.6	✓		✓	
ITRI	ALV1-80 SLDLL01	34	100		✓		✓
ITRI	N1-63 LSC vial waste	.9	.6	✓		✓	
K-25	Aerosol cans waste D001, D018	1.1	U	✓		✓	
K-25	Bioreactor effluent F001, F002, F003, F005	11.6	U		✓		✓
K-25	Building trash	137	U		✓	✓	
K-25	Centrifuge epoxies/resins D001	0	.12		✓	✓	
K-25	CNF sludge F001, F002, F003, F006	89	U		✓	✓	

U=Unknown, not listed in the available data.

Table F–1 (continued). Summary of DOE EM–30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
K-25	Combustible liquid	1	U	✓		✓	
K-25	Combustible liquid	4	U	✓		✓	
K-25	Corrosive liquid D002, D007, D008, D009, D010, D011	9	U		✓		✓
K-25	Corrosive oxidizing liquid waste D001, D002	.02	U	✓		✓	
K-25	Dioctyl hthalate V107	.4	U	✓		✓	
K-25	Electroless nickel solution D002, D007, D009, F006	0	.8		✓		✓
K-25	Fernald treatment residues D008, F002	0	63.6		✓	✓	
K-25	Flam corrosive liquid lab pack D001, D002	.02	U		✓		✓
K-25	Flammable corrosive solids lab pack D001, D002	0	U		✓		✓
K-25	Flammable bulk solids D001	.06	U		✓	✓	
K-25	Flammable gas waste D001, U043, V115	.05	U		✓		✓
K-25	Flammable liquid lab packs	.472	U	✓		✓	
K-25	Flammable liquids	12	U	✓		✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). *Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies*

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
K-25	Flammable solids D001	0	U		✓		✓
K-25	Flammable solids D001, D035	.02	U		✓		✓
K-25	Haz. waste liquid lab packs	.05	U		✓	✓	
K-25	Haz. waste liquid	44.75	U	✓		✓	
K-25	Haz. waste solid bulk	19.6	U		✓		✓
K-25	Hydrogen peroxide waste D001	.2	U		✓		✓
K-25	K-1420 nitric acid D002	0	6.5		✓		✓
K-25	Laboratory acids D001, D002, D006-D010	38	U		✓		✓
K-25	Laboratory organics	13.5	U	✓		✓	
K-25	Laboratory trash F001, F002, F003, F005	10	U		✓	✓	
K-25	Laundry lint	29	U		✓	✓	
K-25	LLW solid	157	460				✓
K-25	Oily rags and solids	19	U		✓	✓	
K-25	Organic peroxides waste D001, D003	.02	U	✓		✓	
K-25	Oxidizing corr. liquids D001, D002	1.6	U		✓		✓
K-25	Oxidizing liquids D001	.16	U		✓		✓

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
K-25	Oxidizing solids D001	.05	U		✓		✓
K-25	Oxidizing solids D001, D003	.02	U		✓	✓	
K-25	Oxidizing substance lab packs D001, D003, D007, D008, D011, V160	.021	U	✓		✓	
K-25	Paint waste D001, D004, D005, D007, D008, D010, D018, F001, F002, F003, F005	10.5	U	✓		✓	
K-25	PCB liquids	1200	U	✓		✓	
K-25	PCB solids	200	U		✓		✓
K-25	Photo waste	9	U		✓		✓
K-25	Poisonous liquid lab packs D003, D004, D0MX D098,P0MX, P016, V012, V0MX,V107, V223	.02	U	✓		✓	
K-25	Poisonous solids lab packs	.02	U		✓		✓
K-25	Solvent contaminated rags D005, D007, D010, D018, F001, F002, F003, F005, F006	14	U		✓	✓	
K-25	Solvents F001, F002, F003, F005	4	U		✓		✓
K-25	TSCA feed materials D008, D009, F001, F002, F003	23	U		✓		✓

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
K-25	Waste oils	416	U	✓		✓	
KCP	Acids from plating, met fin, CB oer D002, D006-008, D011, D035	391	13				✓
KCP	Chromate contaminated debris D001, D007, D008	4.63	6.72		✓		✓
KCP	Flam. res. curing agts, adhes, rubber & paint D001, D008, D009, D028	35.3	1		✓	✓	
KCP	Hazardous waste oil D001, D019, D039, D040	26.6	8.1		✓		✓
KCP	Oil/solvent contaminated debris D007, D008, D039, D040, F001-003, F005	250	22.5		✓	✓	
KCP	PCB liquids (oil, solvents, water) Numerous D codes, F001-003, F005	16.0	1.2	✓		✓	
KCP	PM147 cleanup waste - LLW	0	.738		✓		✓
KCP	PM 147 cleanup waste - mixed D008, D035, D039, F002, F005	0	.738		✓		✓
KCP	Spent solvents Numerous D and F Codes	80	7	✓		✓	
Knolls	Lead solids D008	.08	U		✓		✓

U=Unknown, not listed in the available data.

Table F-1 (continued). *Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies*

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
Knolls	Solid debris D006, D007, D008, D009, D011	.02	0		✓		
LANL	Chemstrip paint remover F002	2.5	9.8	✓		✓	
LANL	Industrial liquid waste treatment plant F002, F003, F005	0	U		✓	✓	
LANL	Lab chemicals in lab packs D004, D005, D011, D022, D036, P079, U117, U154, UV211, U228	2	14.25				✓
LANL	Mercury contaminated pump oil D009, F002	.42	4.16		✓		✓
LANL	Scintillation vials and fluids F003, F005	.9	53.85'		✓	✓	
LANL	TA-50 treatment plant sludge - LLW D018, D019, D035, D040, F002, F003, F005	50	202.69		✓		✓
LANL	Various spent solvents D018, D019, D035, D040, F001, F005	12	26.99		✓	✓	
LBL	1.1.1 - Trichloroethane F001	.85	U	✓		✓	
LBL	Ammonium persulfate D001, D002, D007, D009	1.43	U		✓		✓
LBL	Contaminated debris D001	0	.4		✓	✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). *Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies*

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
LBL	Flammable liquids D001, F003, F005, Several U codes	.5	1.7	✓		✓	
LBL	Flammable solids D001	.02	2.2	✓		✓	
LBL	Gasoline/oil/diesel D001, D008, D018	.45	U	✓		✓	
LBL	LLW - misc. solid waste steel drum	8.39	20		✓	✓	
LBL	LLW-misc. solid waste - plywood box	5.6	7.4		✓	✓	
LBL	Machining and grinding coolant/water	6.06	U	✓		✓	
LBL	Oily dirt D001, D018	1.27	U				✓
LBL	Paint related materials D001, D006-D008	0	U		✓		✓
LBL	PCB and PCB contaminated material	U	U		✓	✓	
LBL	PCB waste	U	U		✓	✓	
LBL	Dump oil from vacuum pump	.02	.5	✓		✓	
LBL	Scintillation fluid U220, U239	.2	3.4	✓		✓	
LBL	Scintillation liquid D001, F003, F005	0	3.4	✓		✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
LBL	Shop and lab debris D018, D022, D028, D035, F001-005	10.62	U		✓		✓
LBL	Waste machine oil F002	.22	U	✓		✓	
LBL	Waste oil - Auto D001	1.8	U	✓		✓	
LBL	Waste oil sludge	U	U			✓	
LBL	Waste organic solvents D001, F003	.22	U	✓		✓	
LLNL	LLW other waste	82.6	428.6		✓		✓
LLNL	Low level mixed empty containers D001, D002, D010, F002, F005, F006	.002	.13		✓		✓
LLNL	Low level mixed inorganic Trash-1 D007	0	U		✓		✓
LLNL	Low level mixed inorganic Trash-2 D001, D002, D008, D009, F002, F003	.9	U		✓		✓
LLNL	Low level mixed inorganic Trash-3 Numerous D and F codes	4.5	23.5		✓		✓
LLNL	Low level mixed oils F002	0	2.2	✓		✓	
LLNL	Low level mixed organic fluids and glass D001, F001-003, F005	.099	.495		✓	✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
LLNL	Low level mixed PCBs and oils D006, D007, D008, F001, F002	0	.1120	✓		✓	
LLNL	Low level mixed waste oils Numerous D and F codes	.06	.58	✓		✓	
Mound	27 waste solvent #516 D001, F002, F003	3.08	U		✓		✓
Mound	28 Waste solvent #518 D001, F002, F003	3.1	U	✓		✓	
Mound	49 waste solvent #551 D001, D040, F001	.22	U	✓		✓	
Mound	B waste freon #502 F001	.88	U	✓			✓
Mound	B waste solvent #542 D001, D040, F002, F003	2.2	U	✓		✓	
Mound	E Scintillation vials non rad #505	3.52	U	✓		✓	
Mound	E waste alcohol #504 D001, F003	.33	U	✓		✓	
Mound	1 waste solvent #564 D001, F001	.22	U	✓		✓	
Mound	M waste freon #580 F001	1.3	U	✓			✓
Mound	M waste water coolant #506 F002	8.8	U		✓		✓
Mound	PM waste water coolant #552 F002	.88	U		✓		✓

U=Unknown, not listed in the available data.

Table F-1 (continued). *Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies*

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
Mound	Acetonitrile waste #547 D001	.88	U	✓		✓	
Mound	Dye waste w/metal #549 D006, D007	3.1	U		✓		✓
Mound	Ethyl alcohol #576 D001	.88	U	✓		✓	
Mound	Ethylene dichloride - LLW	0	.0049	✓		✓	
Mound	Low level laboratory waste	350	724.90		✓		✓
Mound	PCB cleanup debris #513	.88	U				✓
Mound	PCB contaminated water/oil (<50 ppm) #558	.22	U		✓		✓
Mound	PCB contaminated water/oil (<500 ppm) #559	.22	U		✓		✓
Mound	PCB contaminated water/oil (>500 ppm) #560	6.0	U		✓		✓
Mound	PCB contaminated concrete, soil #525	3.5	U				✓
Mound	Radioactive PCB waste	0	9.14		✓		✓
Mound	Scintillation coctail	0	56.0	✓		✓	
Mound	Solvent based paint waste D001, F002	1.32	U	✓		✓	
Mound	Waste acetone #577 D001, F003	1.0	U	✓		✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
Mound	Waste photo film and film pads #510 D002, D011	.66	U		✓	✓	
NRF	Chromate contaminated rags D007	0	.2		✓	✓	
NRF	Irrad waste - fission products	.1	U		✓		✓
NRF	Irrad waste - induced rad	324.6	U		✓		✓
NRF	Irrad waste - induced rad	1039.1	U		✓		✓
NV-EG&G	#140 solvent D001	483 kg	U	✓		✓	
NV-EG&G	Carburetor cleaner/forklift maint. F001, F004	384 kg	U		✓		✓
NV-EG&G	Cirotech metal cleaning solution D001	122.5 kg	U	✓		✓	
NV-EG&G	Degreasing solvent F001	987.6 kg	U	✓		✓	
NV-EG&G	DG 140 solvent D001, F001	153.3 kg	U	✓		✓	
NV-EG&G	Freon TF from degreasing F001	397.8 kg	U	✓			
NV-EG&G	Fuel JP-4 D001	612.3 kg	U	✓		✓	
NV-EG&G	Fullback metal cleaning solution D001, F001, F003	162.8 kg	U	✓		✓	
NV-EG&G	Fusing fluid	84.8 kg	U	✓		✓	
NV-EG&G	Lubricating oils D008, D010, F003	162.8 kg	U	✓		✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
NV-EG&G	Oil mixture D001, D006, D008, D010, F001, F002	322 kg	U	✓		✓	
NV-EG&G	Outdated potassium permanganate D001	23.1 kg	U		✓		✓
NV-EG&G	Outdated sodium nitrate D001, D002	34.5 kg	U		✓		✓
NV-EG&G	Oxidizer from PC board prod. D001	115.2 kg	U	✓		✓	
NV-EG&G	Paint and degreasing solvent mix 1 D001, F001, F002, F003, F005	383.3 kg	U	✓		✓	
NV-EG&G	Paint and degreasing mix 2 D001, F001, F003, F005	191.9 kg	U	✓		✓	
NV-EG&G	Paint and painting solvents D001, F001, F002, F003, F005	557 kg	U	✓		✓	
NV-EG&G	Paint from metal finishing D001, F003	166.5 kg	U	✓		✓	
NV-EG&G	Paint waste D001, D008, F003, F005	284 kg		✓	✓		
NV-EG&G	Paint solvent mixture D001, D005, D007, D008, D010, F003	61.2 kg	U		✓	✓	
NV-EG&G	Solvents from metal cleaning D001, F001, F003, U228	104.8 kg	U	✓		✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). *Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies*

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
NV-EG&G	Toner solution D001	140.2 kg	U	✓		✓	
NV-EG&G	Unused fertilizer D001	23.1 kg	U		✓		✓
NV-EG&G	Unused methyl chloroform U226	65.3 kg	U	✓		✓	
NV-EG&G	Unused paint D001	1694.6 kg	U	✓		✓	
NV-EG&G	Unused sulfonated potash D001	.454 kg	U		✓		✓
NV-EG&G	Waste oil D006, D008, D010, F001	162.8 kg	U	✓		✓	
NV-EG&G	Waste paint D008, F002	191.4	U	✓		✓	
NV-EG&G	Water soluble cutting oils D008, F002	1587.6 kg	U		✓		✓
NTS	1,1,1 TCA F001, U226	U	U	✓		✓	
NTS	Chromate lab waste D007	U	U		✓		✓
NTS	Combustible degreasing mixture D001	U	U	✓		✓	
NTS	Combustible solvents D001	U	U	✓		✓	
NTS	Corrosive lab waste - Nitric D001, D002	U	U		✓		✓
NTS	Cutting oil w/Pb, solvents D008, F001, F002, F003	U	U	✓		✓	
NTS	Excess 1,1,1-TCA U226	U	U	✓		✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). *Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies*

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
NTS	Ignit. spent mix of non cmbs. solv D001, F003	U	U	✓		✓	
NTS	Ignitable mixture - solvents D001, F003, F005, U002, U057, U140, V154, U161, U220, U239	U	U	✓		✓	
NTS	Ignitable spent solvent D001	U	U	✓		✓	
NTS	Lead and solvent contaminated trash D008, F003, F005	U	U		✓	✓	
NTS	Misc organic flammable liquids D001, D009, D011, D035, V002, V057, V080, V154, V159, V213, V220, V239	U	U	✓		✓	
NTS	Oil contaminated w/solvents F002	U	U	✓		✓	
NTS	Organic lab waste D002, U080, U123, U188	U	U	✓		✓	
NTS	Organic lab waste D001, F003	U	U		✓		✓
NTS	Paint waste - unleaded D001	U	U	✓		✓	
NTS	Paint waste containing lead D001, D008	U	U	✓		✓	
NTS	Paper, gloves, rags D007, D008	U	U		✓	✓	
NTS	Photo chemical waste D001, D011	U	U	✓		✓	

U=Unknown, not listed in the available data.

Table F–1 (continued). *Summary of DOE EM–30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies*

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
NTS	Scintillation cocktail D001, F005	U	U	✓		✓	
NTS	Soil cont. w/rad & solvents F001, F003, F005	U	U				✓
NTS	Spent acid - lab & battery D002	U	U		✓		✓
NTS	Spent methylene chloride F001	U	U		✓		✓
NTS	Spent paint and thinner D001, F003	U	U	✓		✓	
NTS	Spent paint, flammable liquid D001	U	U	✓		✓	
NTS	Waste hydrofluoric acid D002	U	U		✓		
ORAU	Decontamination debris	20	U		✓		✓
ORAU	Laboratory trash	1.5	U		✓		✓
ORAU	Liquid scintillation fluids D001, F003	.3	U		✓		✓
ORNL	Dimethyl benzanthracene V094	0	.0005	✓		✓	
ORNL	Benzene D018, D019	.01	.218	✓		✓	
ORNL	Benzene containing waste D018	750 kg	U		✓	✓	
ORNL	Biological	45.5	1977		✓		✓
ORNL	Bulk poisons DO, PO	.323	U		✓		✓

U=Unknown, not listed in the available data.

Table F–1 (continued). Summary of DOE EM–30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
ORNL	Combustible liquid F002	0	U	✓		✓	
ORNL	Corrosive liquid D002	4.766	U		✓		✓
ORNL	Corrosive solid D002	.434	U		✓		✓
ORNL	Discarded chemical U107, P015, P098, V004, V064, V080, V122, V151, V220	.07	.08		✓		✓
ORNL	Discarded chemicals P015, P098, V002, V064, V080, V107, U122, U220	.065	.07		✓		✓
ORNL	Dry active waste	771.2	U		✓		✓
ORNL	EP toxic contaminated soils D004, D006, D007, D008, D009, D010, D011	.85	.86				✓
ORNL	EP toxic liquids D004, D005, D006, D007, D008, D010, D017	1.53	1.53		✓		✓
ORNL	EP toxic/TCLP solids D00, D004	2.48	U		✓		✓
ORNL	Fissile wells	.5	.2		✓		✓
ORNL	Flammable liquid F001-F005	1.071	U	✓		✓	
ORNL	Flammable liquid	4.343	U	✓		✓	
ORNL	Flammable liquids D001, D018, D019, D021, D028, D035	2.1	48.01	✓		✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
ORNL	Flammable solid D001	.293	U		✓		✓
ORNL	Flammable solids D001	1.04	3.76		✓	✓	
ORNL	Flammable solids FO	.159	U		✓	✓	
ORNL	Flammable, EP toxic liquids D001, D009, D010, D011	.02	.02		✓		✓
ORNL	Haz substance liquid F001	.2085	U	✓		✓	
ORNL	Haz substance liquid D001	.02	U	✓		✓	
ORNL	High rand wells	7.1	353		✓		✓
ORNL	Ignitable liquids contaminated D001, D035, P015, V002, V043, V154, V159, V161, V220, V239	1.8	1.75		✓		✓
ORNL	Lab pack corrosives	.02	U		✓		✓
ORNL	Lab pack flammables D001	2.847	U		✓		✓
ORNL	Lab pack oxidizers D001	.02	U		✓		✓
ORNL	Lab pack poisons PV	.52	U		✓		✓
ORNL	Lab pack spent solvents F001-F005	1.2	U	✓		✓	
ORNL	Liquid PCB w/concentrations >50 ppm	.795	U	✓		✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
ORNL	Methanol D001, D022, D037, F027, U044, U154	.001	.0067	✓		✓	
ORNL	Oil cont. solid D043	U	U				✓
ORNL	Oxidizing material D001	.609	U	✓		✓	
ORNL	PCB liquid cont. <50 ppm	2.293	U	✓		✓	
ORNL	Perc. contam solids	.045	.09		✓	✓	
ORNL	Phenol V188	.02	.02	✓		✓	
ORNL	Plating shop waste F009	0	U		✓		✓
ORNL	Scintillation Fluids D001, V220	1.7	37.78	✓		✓	
ORNL	Solid PCB w/conc <50 ppm	.103	U		✓		✓
ORNL	Solid PCB w/conc >50 ppm	3.545	U		✓		✓
ORNL	Solvent waste D009, F001, F002-F005	0	19		✓		✓
ORNL	Spent solvents w/scintillation fluids F001-F005	4.3	10.38	✓		✓	
ORNL	Used oil	U	U	✓		✓	
ORNL	Waste oily solids D018	.642	U		✓		✓

U=Unknown, not listed in the available data.

Table F-1 (continued). *Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies*

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
Paducah	Absorbents	13.376	57.3		✓		✓
Paducah	Absorbents - PCB	30.48	69.13		✓	✓	
Paducah	Aerosol cans D001, D003	1.45	3		✓	✓	
Paducah	Aqueous cleaner mixed	.15	.9	✓		✓	
Paducah	Capacitors	.84	1.68		✓		✓
Paducah	Cr-bearing material D007, D008, D018	6.1	12.4		✓		✓
Paducah	Debris	18.19	40.07		✓		✓
Paducah	Decontamination debris	20.05	41.3		✓		✓
Paducah	Developer solution	.53	1.06	✓		✓	
Paducah	Fixer solution D011	.4	4.1		✓		✓
Paducah	Flammable liquids, misc D001	.8	1.6	✓		✓	
Paducah	Flammable solids D001	.01	.02		✓		✓
Paducah	Garage wash pit sludge D008, D018, D040, F001	.63	1.4		✓	✓	
Paducah	Liquid fuels D001, D018	4.4	8.8		✓		✓
Paducah	Mercury bearing wastes D009, V151	.43	1.95		✓		✓
Paducah	Mineral spirits D001	0	.21	✓		✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
Paducah	Misc acids D002	3.95	46.9		✓		✓
Paducah	Misc chemicals	.835	2.02		✓		✓
Paducah	Misc solids	2.03	4.42		✓		✓
Paducah	Mixed corrosive waste-filters D002, D006, D007, D008	.5	2.75		✓	✓	
Paducah	Non PCB waste oil/oily solutions	11.1	16.75	✓		✓	
Paducah	Oil contaminated solids	3.7	9.6		✓		✓
Paducah	Oily rags/sorbent spill cleanup	8.91	17.81		✓		✓
Paducah	Paint related materials D001	7.3	7.3		✓		✓
Paducah	PCB absorbents	102.7	309.1		✓	✓	
Paducah	PCB asbestos	.4	137.8				✓
Paducah	PCB capacitors	838	16.5				✓
Paducah	PCB debris	107.45	835.9		✓	✓	
Paducah	PCB flush solvent	0	.4	✓		✓	
Paducah	PCB light ballast	2.0	5.7				✓
Paducah	PCB sewer sludge	0	196.2		✓		✓
Paducah	PCB sludge	1.0	7.5		✓		✓
Paducah	PCB trash	54.8	56.1		✓		✓

U=Unknown, not listed in the available data.

Table F-1 (continued). *Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies*

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
Paducah	PCB uranium precipitate	0	.6		✓		✓
Paducah	PCB waste oil/oily solutions	17.7	49.8	✓		✓	
Paducah	PCB wastewater	32.0	62.03	✓		✓	
Paducah	PCB water	6.6	23.6		✓		✓
Paducah	PCB liquid (slurry)	0	1.3		✓		✓
Paducah	PCB/hexane samples D001	0	.8		✓	✓	
Paducah	Pentachlorphenol D037, F027	0	3.41		✓		✓
Paducah	Sewer sludge	30.02	60.03		✓		✓
Paducah	Solid radioactive debris	176.15	489.8		✓		✓
Paducah	Solvent laden rags D035, D040, F001-F005	2.4	7.3		✓	✓	
Paducah	Spent solvents D001, F003	1.1	3.35	✓		✓	
Paducah	Spent solvents D001, F001, F003	0	.21	✓		✓	
Paducah	Spent solvents D018, D040, F001	4.6	8.2	✓		✓	
Paducah	TEHP solution D001, P002	.45	.95	✓		✓	
Paducah	Trash	14.25	32.07		✓		✓
Paducah	TCE still bottoms D040, F001	.1	2.51	✓		✓	
Paducah	Ventillation dust oil D007, D008	.2	.8	✓		✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
Paducah	Waste lubricating oil	30.25	137.27	✓		✓	
Paducah	Water sludge non-PCB	0	.41		✓		✓
Paducah	Wood	.9	1.8		✓		✓
Pantex	Chromium cont amt wast #091 D007	0	U		✓	✓	
Pantex	Lead cont wst solid wst #090 D008	5.3	1.4		✓	✓	
Pantex	Liquid paint wst - wst #068 D001, D006-009	40.07	.25	✓		✓	
Pantex	Mercury cont solid wst #008 D009, U151	.030	1.7		✓		✓
Pantex	Mercury contam liquid wst #97 D009	.54	.74		✓		✓
Pantex	Metal cleaning wst - wst #071 D002, D006-009	2.0	1.24		✓		✓
Pantex	Mineral spirits waste @019 D001, F001-005	0	U	✓		✓	
Pantes	Oil and solvent sludge - wst #099 D001, F002-005	.21	U	✓		✓	
Pantex	Oily solids filt wst - wst #089 D001, D008	1.0	.62	✓		✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
Pantex	Organics-misc-wst #092 D01, numerous U codes	8.0	5.3	✓		✓	
Pantex	PCB cont solids - est #010	.32	.2		✓		✓
Pantex	Plant refuse	91.98	187.2		✓		✓
Pantex	Scintillation fluids D001, F003	0	3.954	✓		✓	
Pantex	Sodium hudox solution wst #031 D002, D005-008, D011	3.54	.2		✓		✓
Pantex	Solv cont solid wst & hmet-wst #709 Several D and F codes	4.16	.90		✓	✓	
Pantex	Solv cont solid waste #075 D001, F001-005	28.0	3.2		✓	✓	
Pantex	Solvent contaminated solids D001, D035, D040, F001-005, U226	8.0	20.4		✓	✓	
Pantex	Tritium I	53.1	U		✓		✓
Pantex	Tritium II	4.2	6.2		✓		✓
Pantex	Waste oil - wst #96 D003, F001-005	3.08	U	✓		✓	
Pinellas	Contaminated oil Numerous D codes, F002	1.67	U	✓		✓	
Pinellas	Flammable liquid Numerous D codes, F003, F005	16.0	3.03	✓		✓	

U=Unknown, not listed in the available data.

Table F–1 (continued). Summary of DOE EM–30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
Pinellas	Freon Numerous D and F Codes	.62	U		✓		
Pinellas	Methylene chloride Numerous D and F Codes	2.7	0	✓		✓	
Pinellas	Miscellaneous lab waste Numerous D, F, and U codes	108	0		✓		✓
Pinellas	Paint related materials Numerous D and F codes	.21	U	✓		✓	
Pinellas	PCB contaminated oilds	U	U	✓		✓	
Pinellas	Tritium contaminate waste	107.2	16.0		✓		✓
Portsmouth	Contaminated lab debris D006, D008, D009, F001, F003, F005	8	8		✓		✓
Portsmouth	Contaminated sampling equip F001, F003, F005	.84	1.84		✓		✓
Portsmuoth	Degreasing solvents F001	1.3	9.3		✓		✓
Portsmouth	Excess lab samples D001, D018, F001, F003	.9	3.6	✓		✓	
Portsmouth	Liquid paint wastes D001, D018, F003, F005	2.5	3.3	✓		✓	
Portsmouth	Oil/solvent mixture D006, D008, D018, F001, F003, F005	4.0	95.5	✓		✓	
Portsmouth	PCB adsorbents	500	1931		✓	✓	

U = Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
Portsmouth	PCB misc solids	350	1227		✓	✓	
Portsmouth	PCB/LLW oil	65	119	✓		✓	
Portsmouth	Rad burnables	950	95		✓	✓	
Portsmouth	Rags, plastics and misc. F001, F003	30.0	155		✓	✓	
Portsmouth	RCRA facility investigation-liquid F001	76	200		✓		✓
Portsmouth	RCRA facility investigation-solid F001	100	380				✓
Portsmouth	Solvent/oily rags and wipes D018, F001, F003, F005	10	150		✓	✓	
Portsmouth	Uranium analyzer solution D001	3	4.2	✓		✓	
Portsmouth	Uranium recovery solvents D001, D002	1.0	.8	✓		✓	
Portsmouth	Waste oil D018	620	U	✓		✓	
Portsmouth	X-615 sewage sludge	0	582		✓		✓
Portsmouth	X-6619 sewage sludge	14.0	53.7		✓	✓	
Princeton	Acid solution from lab cleanup D002, U 134	.03	U		✓		
Princeton	Acids from metal cleaning D002	.04	U		✓		✓

U=Unknown, not listed in the available data.

Table F–1 (continued). Summary of DOE EM–30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
Princeton	Alkaline/solv cleaning & degreas w. D002, D008, F001	.21	U	✓		✓	
Princeton	Ammonium persulfate D001	.02	U		✓		✓
Princeton	Combustible liquid from machine cleaning D001	.24	U	✓		✓	
Princeton	Corrosive liquid from lab cleanup D002, D007	.1	U	✓		✓	
Princeton	Cyanide compounds P029, P106	.02	U		✓		✓
Princeton	Cyclohexane D001, V056	.02	U	✓		✓	
Princeton	Debris cont. w/1.1.1-TCE F001	.08	U		✓	✓	
Princeton	Dry compactible waste	30	U		✓	✓	
Princeton	Ethanol	.1	.076	✓		✓	
Princeton	Ethanol & water from repair process	2.46	U		✓		✓
Princeton	Flammable & combustible chemicals D001	.23	U		✓		✓
Princeton	Flammable liquid w/lead & chrome D001, D007, D008	.02	U	✓		✓	
Princeton	Gasoline & diesel from US T removal	.3	U	✓		✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
Princeton	Graphite tiles	.1	U	✓			✓
Princeton	HEPA filters	0	2.0		✓		✓
Princeton	Hexane & PCB contam rags D001, F001	0	90		✓	✓	
Princeton	Hydrofluoric acid D002, U134	.02	U		✓		
Princeton	Hydrogen peroxide D001	.02	U	✓		✓	
Princeton	Lab corrosives D002	.06	U		✓		✓
Princeton	Lab acids D001, D002, D006	.04	U		✓		✓
Princeton	Lab cleanup waste D001	.03	U		✓		✓
Princeton	Lab cleanup waste D001, D008	.05	U		✓		✓
Princeton	Lab corrosives	.03	U		✓		✓
Princeton	Lab waste	.02	U		✓		✓
Princeton	Lab waste	.04	U		✓		✓
Princeton	Liquid scintillation cocktail	.2	U		✓		✓
Princeton	Lithiumnitrate D001	.03	U		✓		✓
Princeton	Hg-bearing paint D001, D009	.02	U		✓	✓	
Princeton	Hg waste D009	.02	U		✓		✓

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
Princeton	Metal bearing oxidizers D001, D008, D011	.11	U		✓		✓
Princeton	Metal bearing paint & ign liq D001, D006, D007, D008	.02	U	✓		✓	
Princeton	Methylene chloride cont rags	.02	U		✓	✓	
Princeton	Nitric acid D001, D002	.03	U		✓		✓
Princeton	Oil contam debris/spills, mach shop	2.23	U		✓	✓	
Princeton	Oils and oil cont liq from UST	40.74	U	✓		✓	
Princeton	Outdated chemicals D001	.05	U		✓		✓
Princeton	Outdated resins D001, V223	.04	U		✓		✓
Princeton	Paint D001	.04	U	✓		✓	
Princeton	PCB contaminated debris	0	U		✓	✓	
Princeton	PCBs	114.28	U	✓		✓	
Princeton	Potassium permanganate D001	.02	U		✓		✓
Princeton	Roofing tar residue D001	.72	U		✓	✓	
Princeton	Silicon solution w/Tolvene D001	.21	U	✓		✓	
Princeton	Silver & sodium cyanide P030, P104, P106	.02	U		✓		✓

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
Princeton	Silver solution D011	.04	U		✓		✓
Princeton	Sodium nitrite D001	.02	U		✓		✓
Princeton	Solvent contam debris/ports D001,F001, F003, F005	.03	U		✓	✓	
Princeton	Solvents from degreasing D001, F001, F003, F005	.79	U	✓		✓	
Princeton	Spent acids from acid cleaning D002, D007	.02	U		✓		✓
Princeton	Spent freon F002	.06	U	✓			
Princeton	Spent halo. & non-halo solvents F002, F005	.02	U	✓		✓	
Princeton	Spent solvents from cleaning D001, F001, F005	.38	U	✓		✓	
Princeton	Spent solvents from degreasing D001, F001, F003	.21	U	✓		✓	
Princeton	Toluene & xylene based cocktails F003, F005	0	.012	✓		✓	
Princeton	Trichlorofluoroethane and/or lube oil F001	.41	U	✓		✓	
Princeton	Vacuum pump oil	.3	U		✓		✓
Princeton	Waste oil cont. soil -VST	1920	U				✓

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
RFP	Absol dry box filters (acid)	.525	2.52		✓		✓
RFP	Absol dry box filters (non acid)	.1025	.21		✓		✓
RFP	Absorbed organic waste/LLW mixed D001	0	.84		✓		✓
RFP	Aluminum nitrate	0	2.73		✓		✓
RFP	Chromic acid D001, D007	1.37	3.57				✓
RFP	Combustible/LLW mixed D019, D035, D040, F001-F003, F005	72.23	417.93		✓	✓	
RFP	Cyanide wastes - solid F007, F009, P018, P030	0	.42		✓		✓
RFP	Dry combustibles, LLW	714	1342		✓	✓	
RFP	Electrochemical milling (EMC) sludge haz D001, D007	0	9.03		✓		✓
RFP	Excess chemical solid LLW (IDC 545)	.63	1.26	✓		✓	
RFP	Excess chemical solid LLW mixed (IDC 545) D001	.21	.42		✓	✓	
RFP	Excess chemical - liquid/LLW mixed D001, D002	.1050	U		✓		✓
RFP	Excess chemicals/LLW mixed D000, P000, U000	.5250	1.26		✓		✓

U=Unknown, not listed in the available data.

Table F-1 (continued). *Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies*

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
RFP	FB1 oil (LLW mixed) Several D and F wastes)	U	109.7	✓		✓	
RFP	Filter media (LLW)	.21	.42		✓		✓
RFP	Filters/LLW mixed D019, D035, D040, F001-003, F005	7.4950	12.62		✓		✓
RFP	FUL-FIA filters (LLW)	0	.21		✓		✓
RFP	FUL-FIA filters (non incin) LLW	.3150	1.47		✓		✓
RFP	Gasoline spill residues D001, D007, D008, D018	6.3	1.26				✓
RFP	Graphic molds (LLW)	.525	1.05	✓			✓
RFP	HEPA filters LLW	34.87	77.67		✓		✓
RFP	Ignitable non halogenated solvents D001, F001-003, F005	1.26	7.56	✓		✓	
RFP	Leaded gloves/acid contamiated LLW/mixed D001, D002, D008	U	.21		✓		✓
RFP	Leaded gloves/LLW mixed D008	.84	2.73		✓		✓
RFP	Machine coolants/antifreeze	U	44.21	✓		✓	
RFP	Miscellaneous liquids/LLWmixed D002, D019, F001, F002, F003, F005	0	.41		✓		✓

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
RFP	Miscellaneous waste-liquid D001, F001, F002, F003	.32	2.94		✓		✓
RFP	Mixed IDCs outside PS7 (LLW)	22.4	43.94		✓		✓
RFP	Oil filters with trace solvent contam	2.1	0		✓		✓
RFP	Organics discard level LLW mixed D019, F001, F002	.1050	8.61	✓		✓	
RFP	Paint, paint thinner, paint solvents Numerous D and F codes	8.2	27.1	✓		✓	
RFP	Paints/LLW mixed D001, D035	0	.38	✓		✓	
RFP	DCB (solids)/LLW mixed D040, F001	0	16.8		✓		✓
RFP	PCB and solvent contaminated solid waste F001	.02	4.78		✓		✓
RFP	PCB contaminated liquid waste	U	6.93	✓		✓	
RFP	PCB contaminated liquid waste ignitable D001	U	.21	✓		✓	
RFP	PCB contaminated solid waste	4.2	12.18		✓		✓
RFP	PCB (liquid)/LLW mixed D040, F001	0	.63	✓		✓	
RFP	Plastic LLW	37.585	103.64		✓		✓

U=Unknown, not listed in the available data.

Table F–1 (continued). *Summary of DOE EM–30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies*

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
RFP	Plenum prefilters/LLW mixed D019, F001, F002, F003, F005	.525	3.78		✓	✓	
RFP	Scintillation cocktail D001, D002, F002, F003, F005	.21	1.89	✓		✓	
RFP	Silver nitrate D001, D002, D011	0	.84		✓		✓
RFP	Soft waste D001, D007, D008	21.0	84.0		✓	✓	
RFP	Solvents contaminated w/oil/gas Numerous D and F codes	2.1	25.83	✓		✓	
RFP	Spent solvents F001, F002, F003, U228	1.05	8.19	✓		✓	
RFP	Waste oils D001, D007, D008, D010, D018	2.1	2.52	✓		✓	
RFP	Wet combustibles - LLW	119.51	148.83		✓		✓
RLO	1,4 - Dichlorobenzene containing waste	0	U	✓		✓	
RLO	1991-1/7:RMW1: Fuels fabric sludge 183-H. D001, D007, P029, other P and U coeds	0	693		✓		✓
RLO	1991-3/7: RMW3: LL mixed waste non RCRA PCB	10.13	45.57		✓	✓	
RLO	1991-4/7: RMW4: LL mixed waste non RCRA WA	18.23	81.97		✓	✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
RLO	1991-5/17: RMW5: TRU- mixed waste (RCRA) D001-003, D008, D019, D029, D035, D039, D040, F003)	36.9	166.03		✓		✓
RLO	1991-6/7: RMW6: TRU-mixed non RCRA PCB	.33	1.47		✓	✓	
RLO	1991-7/7: RMW7: TRU-mixed non RCRA WA	.47	2.1		✓		✓
RLO	Appendix IV lab packs	3.25	11.37		✓		✓
RLO	Appendix IV lab packs (CA,HG) D001, D002, D006, D008, D009	.19	.68		✓		✓
RLO	Appendix IV lab packs (CA, PCB) D006, D007, D008	.6	.21		✓		✓
RLO	Appendix V lab packs D001	1.14	4.0		✓	✓	
RLO	Benzene - Contained in diesel fuel D018	0	U		✓	✓	
RLO	Benzene containing soil, debris and oil D018	0			✓		✓
RLO	Benzene MEK - Containing debris (Rags) D018, D035	0	U		✓		✓
RLO	Cresol - containing waste D026	0	U		✓		✓
RLO	Hexone D001, F003	0	0.4		✓		✓

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
RLO	Ingitable liquids - TOC > 10% D001	.12	.42	✓		✓	
RLO	Methyl ethyl ketone - containing debris D035	0	U		✓		✓
RLO	Non RCRA PCB solids 10-100 ppm	.3	1.05		✓		✓
RLO	Non RCRA PCB solids	9.55	33.44		✓		✓
RLO	Non TC met/sol org. solid debris (CA,CO)	.18	.63		✓	✓	
RLO	Non TC metal/solvent sludges dry part	2.0	6.98				✓
RLO	Org non RCRA PCB liquid 50-500 ppm	.54	1.9		✓	✓	
RLO	Org non RCRA PCB liq >500 ppm	2.01	7.04		✓	✓	
RLO	Organic RMW PCB liquids 10-100 ppm (CA) D001	3.24	11.34		✓	✓	
RLO	Organic RMW PCB liquids >500 ppm (CA) D001	6.21	21.75		✓	✓	
RLO	Solvent appendix V lab packs D001, F001, F002, F003, F005	3.67	12.83		✓		✓
RLO	Solvent appendix V lab packs (CA) D001, D019, D039, D040, F001-005	1.38	4.83		✓		✓

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
RLO	Solvent appendix V lab packs (CA,O) D016, D025, F004	.06	.21		✓		✓
RLO	Solvent organic solid debris D001, D002, F001, F003, F005	22.86	80.01		✓		✓
RLO	Solvent organic solid debris D001, F001, F002, F003, F005	3.72	13.02		✓		✓
RLO	Solvent sludges/dry particulate (CA) F001-003, F005	.55	1.92		✓		✓
RLO	Solvent/TC metal org. solid debris (CA) D005-008, D040, F001-F003	.90	3.15		✓		✓
RLO	Solvent/TC metal org. solid debris CA Q D005, D008, D012, F002, F003, F005	.3	1.05		✓		✓
RLO	Solvent/TC metal organic solid debris D008, D010, D039, D040, F002, F003, F005	.6	2.1		✓		✓
RLO	Solvent/TC metal sludges/dry part (CA) D005, D008, F001, F003, F005	.01	.03				✓
RLO	TC metal organic solid debris D001, D002, D005-008, D010	6.21	21.7				✓
RLO	TC metal organic solid debris (CA)	3.16	11.07		✓		✓

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m³/yr)	Inventory m³ at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
RLO	TC metal organic solid debris (CA, AS) D002, D004, D007, D011	.30	1.05		✓		✓
RLO	TC metal organic solid debris (HG) D009	.18	.63		✓		✓
RLO	Trichloroethylene containing solutions D040	0	U	✓		✓	
RLO	Vinyl chloride containing oil D043	0	U	✓		✓	
RLO	WA non-TC metal/solv org. solid debris	.6	.21		✓	✓	
RLO	WA reg ignitable liquid TOC > 10%	.02	.03		✓		✓
RLO	WA reg TC metal org. solid debris	13.47	47.13		✓		✓
RMI	Chlor solv/Stoddard solvent D001, F001	.221	3.315		✓	✓	
RMI	Chlor solvent/Stoddard Solv D001, F001	.221	.663	✓		✓	
RMI	Cont cardboard and paper	15.86	18.353		✓	✓	
RMI	Contaminated filters	1.586	7.028		✓	✓	
RMI	Contaminated floor sweepings	4.42	7.735				✓
RMI	Contaminated gloves	4.42	6.851		✓	✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
RMI	Contaminated plastic	11.05	22.542		✓	✓	
RMI	Contaminated tarps	0	7.479				✓
RMI	Contaminated wood	15.86	29.232		✓	✓	
RMI	Die head residue D005	0	7.1566		✓		✓
RMI	Filter pit sludge	.6035	3.298				✓
RMI	Filter sludge	0	5.304				✓
RMI	Filter sludge	2.21	14.58				✓
RMI	Floor stripping chlor solvent F002	0	5.083		✓	✓	
RMI	Lathe oil/water coolant D008	0	.221		✓		✓
RMI	Lathe oil/water absorbent D008	0	5 55 gal		✓	✓	
RMI	Non haz contam waste oils	2.21	34.697	✓		✓	
RMI	Press pit sludge w/oil	0	.5831		✓	✓	
RMI	Pump station accumulator oil D008	0	55 gal	✓		✓	
RMI	Pump station oil absorbent D008	0	.221		✓	✓	
RMI	Salt bath pads and gloves D005	0	.442		✓	✓	
RMI	TCE cont. well bail water F001	.663	3 55 gal		✓		✓
RMI	Trench sludge	0	.7837		✓		✓

U=Unknown, not listed in the available data.

Table F–1 (continued). Summary of DOE EM–30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
SAN-AL	Contamin waste oil	U	U	✓		✓	
SAN-AL	Diesel fuel contaminated soil D018	U	U				✓
SAN-AL	Gasoline-leaded & unleaded D001, D008, D018	U	U	✓		✓	
SAN-AL	Lab pack ignitable w/metals Numerous D codes	U	U		✓		✓
SAN-AL	Lab pack w/flammable solid and liquids	U	U		✓		✓
SAN-AL	Lab pack w/halogenated solvents D001, D019, D022, F001, F002	U	U		✓		✓
SAN-AL	Lab pack w/ignit. metals solvents, U waste Numerous D codes	U	U		✓		✓
SAN-AL	Lab pack w/ignitable liquids D001, D018, D021, D035, D036	U	U		✓		✓
SAN-AL	Lab pack w/non halo solvents D001, D035, F003, F005	U	U		✓		✓
SAN-AL	Lab pack - solid w/mixed solvents D001, D019, D035, D039, F001, F002	U	U		✓		✓
SAN-AL	Mixed solvents D035, D040, F001, F002	U	U	✓		✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM–30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
SAN-AL	Paint thinner/solids D018, D035, F003, F005	U	U	✓		✓	
SAN-AL	Waste diesel fuel	U	U	✓		✓	
SAN-AL	Waste trichluroethylene D040, F002	U	U	✓		✓	
SAN-LL	H-3 Contaminated compactible and noncompactible	.21	.84		✓		✓
SAN-LL	Miscellaneous rad contaminated waste	0	.21		✓		✓
SAN-LL	Radioactive oil	2.11	6.2	✓		✓	
SAN-LL	Radioactive TE	.03	.16		✓		✓
SAN-LL	Scintillation cocktail w/tritium D001, D018, F003	.32	.63	✓		✓	
SAN-LL	Tritium contaminated compactible items	.63	1.13		✓		✓
SAN-LL	U-238 & H-3 compactible items	0	.21		✓		✓
SRO	Cadmium coated HEPA filters D006	8.5	38.7		✓		✓
SRO	Compacted waste - 253H	1090	U		✓		✓
SRO	Compactible waste 300 area U235	561	U		✓		✓

U=Unknown, not listed in the available data.

Table F-1 (continued). *Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies*

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
SRO	Compactible waste 772F	85	U		✓		✓
SRO	Compactible waste ETF	221	U		✓		✓
SRO	Compactible waste SRL	45	U		✓		✓
SRO	Compactible waste Z area	75	U		✓		✓
SRO	DWPF Benzene D001, D009, D018	U	U	✓		✓	
SRO	Facilities and services LLW solid waste	21	U		✓		✓
SRO	Filter paper take up rolls F006	30	257.5		✓	✓	
SRO	Freon 11/oil	0	1.9	✓			✓
SRO	Intermediate level job control - SRL	61	U		✓		✓
SRO	Job control waste 4WD	30	U		✓		✓
SRO	Job control waste - ETF	4475	U		✓		✓
SRO	Job control waste F area separation	21363	U		✓		✓
SRO	Job control waste F area tank form	2245	U		✓		✓
SRO	Job control waste H area separations	41037	U		✓		✓

U=Unknown, not listed in the available data.

Table F-1 (continued). *Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies*

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
SRO	Job control waste H area tank form	4749	U		✓		✓
SRO	Job control waste naval fuels	136	U		✓		✓
SRO	Job control waste reactors	39205	U		✓		✓
SRO	Job control waste SWDF	25821	U		✓		✓
SRO	Job control waste Tritium	15117	U		✓		✓
SRO	Job control waste Z area	34	U		✓		✓
SRO	Job control/lab waste 772 F	1800	U		✓		✓
SRO	Job control/lab waste SRL	540	U		✓		✓
SRO	Job control/process waste RMP (500 area)	3738	U		✓		✓
SRO	Lab waste -772 D	25	U		✓		✓
SRO	Mark 15 filter paper F006	0	U				✓
SRO	Railroad cross ties	U	11000		✓		✓
SRO	Scintillation solution D001, F003, F005	1.5	4.5	✓		✓	
SRO	Solvent contaminated applicators (LLW) Numerous D and F codes	.1	2.5		✓	✓	
SRO	Spent deionizer resins	70	U		✓	✓	

U=Unknown, not listed in the available data.

Table F-1 *(continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies*

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
SRO	Spent methanol solution D001, D006, D010	0	.14	✓		✓	
SRO	Toxic cleanup material D004-D011	.2	.2		✓		✓
SRO	Tritiated oil from reactor operations	0	26.9	✓		✓	
Weldon Spring	Chlorinated hydrocarbon D001, D022, D028, D035, D040	0	.2082	✓		✓	
Weldon Spring	Contaminated liquids D001, D008, D018, D029	0	.4165	✓		✓	
Weldon Spring	Liquids D001	0	3.33	✓		✓	
Weldon Spring	Liquids - PCB D001	0	.2082	✓		✓	
Weldon Spring	Oxidizers D001	0	1.098	✓		✓	
Weldon Spring	Paint sludge D001	0	.7382		✓	✓	
Weldon Spring	Paint sludge - PCB D001	0	.3220		✓	✓	
Weldon Spring	Paint sludge - PCB >500 ppm	0	.2082		✓	✓	
Weldon Spring	D002	0	5.395	✓		✓	
Weldon Spring	D003	0	5.62		✓		✓
Weldon Spring	Solids D005	0	7.228		✓		✓
Weldon Spring	Solids D005	0	2.31		✓		✓

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
Weldon Spring	Liquids D008	0	1.988	✓		✓	
Weldon Spring	Liquids - PCB	0	.4162	✓		✓	
Weldon Spring	Solids D008	0	2.4231		✓		✓
Weldon Spring	TBP D009	0	14.0	✓		✓	
Weldon Spring	D011	0	.4164		✓		✓
Weldon Spring	D016	0	.2461		✓		✓
Weldon Spring	D018	0	8.954	✓		✓	
Weldon Spring	D040 Plastic debris	0	.2082		✓		✓
Weldon Spring	P120	0	.1136		✓		✓
Weldon Spring	Paint sludge D008, D018, D001, D007	0	.4165		✓		✓
Weldon Spring	PCB-LLW liquids	.2082	1.155	✓		✓	
Weldon Spring	PCB oils	U	U	✓		✓	
Weldon Spring	Silver lead contaminated waste D008, D011	0	.5301		✓		✓
Weldon Spring	U228	0	.4165	✓		✓	
Windsor	Lead solids D008	U	0		✓		✓
Windsor	Solid debris	U	0		✓		✓

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
Windsor	Solid rad waste	15	U		✓		✓
WV	1890 DOW Protective sealer D001	.0175	.0175	✓		✓	
WV	Acetone D001	0	.0044	✓		✓	
WV	Black seam adhesive (Pliabond 2368) D001	0	.0085	✓		✓	
WV	Decon solution U080	0	.0029	✓		✓	
WV	Electrostatic developer D001	.06	.0197	✓		✓	
WV	Fuels and lubricating fluids D001	.033	.0653	✓		✓	
WV	Gasoline D001, D018	.0200	.0282	✓		✓	
WV	Ignitable oil with lead	.020	.0021	✓		✓	
WV	Instrument oil with mercury	0	.0003	✓		✓	
WV	Methanol D001	.0009	.0009	✓		✓	
WV	Paint U154	0	.0007	✓		✓	
WV	Paint D001	0	.0064	✓		✓	
WV	Paint LIC D001, D007, D008	0	.0045	✓		✓	
WV	PCB capacitors	0	.0272			✓	
WV	PCB contaminated maerial	0	1.72			✓	
WV	PJ extraction waste D035, F003	.012	.0270	✓		✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
WV	PJ scintillation	0	.0039	✓		✓	
WV	Solvent contaminated absorbents U213	0	.1127		✓	✓	
WV	Solvents-unlisted D001	0	U	✓		✓	
WV	Unknown high TOC organic liquids	0	.01	✓		✓	
WV	Waste oil with lead D0008	.02	.0078	✓		✓	
Y-12	D001 liq var or a cont gen rate D001	12.07	U	✓		✓	
Y-12	D001 liquid one time or accidental generation D001	0	U	✓		✓	
Y-12	D001 solid one time D001	0	U		✓		✓
Y-12	D001 solid var or cont H06 D001	.5030	U		✓		✓
Y-12	D001 solid var or cont gen rate	.4230	U		✓		✓
Y-12	D004 liquid var or cont gen D004	12.39	U	✓		✓	
Y-12	F code liquid var or cont gen F001, F002, F005	23.26	U		✓		✓
Y-12	F code liquid one time gen F001, F002, F003	0	U		✓		✓
Y-12	F code solid one time or accid gen F001, F002, F003, F005	0	U		✓	✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). *Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies*

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
Y-12	Misc D listed liq var or cont gen D001, D007, F002, F003, F005, several U	20.151	U		✓		✓
Y-12	Misc D and listed liquid one time D001, D039, F001, F002, F003, F005, several U codes	0	U		✓		✓
Y-12	Misc D and listed solid var or cont gen D001, D006, D007, D000, F001, F002, F006, several U	81.45	U		✓		✓
Y-12	Misc D and listed solid one time D001, D008, F001, F002, F003	0	U		✓		✓
Y-12	Misc D code liquid one time gen D001-004, D007, D008, D011, D026, D034, D080	0	U		✓		✓
Y-12	Misc D code solids var or cont gen D005, D008, D011	14.32	U		✓		✓
Y-12	Misc D code solids w/merc one time gen D001, D002, D006, D009	0	U		✓		✓
Y-12	Misc D liq var or cont gen D001, D005, D011, D018	17.71	U		✓		✓
Y-12	Misc F code solid var cont gen F001, F002, F005	1.51	U		✓	✓	

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
Y-12	Misc solid w/merc D and listed-var or cont D002, D009, U151	.13	U		✓		✓
Y-12	Misc U code liq one time or accid U080, U107, U151, U159, U204, U226, U239, U28	0	U		✓		✓
Y-12	Misc U code liq one time or accid U213, U220, U226	19.85	U	✓		✓	
Y-12	Misc U code solid one time or accid gen U162, U270	0	U		✓	✓	
Y-12	Mix of PCB contam organic solvents D001	1.38	U	✓		✓	
Y-12	Mixed waste soil F001, F003	0	2850				✓
Y-12	Mixed waste soils (oil land farm) F001, F003	0	284				✓
Y-12	PCB article containers	U	U		✓		✓
Y-12	PCB articles	U	U		✓		✓
Y-12	PCB bulk liquid	U	U		✓		✓
Y-12	PCB containing spent solvent F001, F002, F003	30.0	113.6		✓		✓
Y-12	PCB drummed liquid	U	U		✓		✓
Y-12	PCB drummed solids	U	U		✓		✓

U=Unknown, not listed in the available data.

Table F-1 (continued). Summary of DOE EM-30 Wastes Appropriate for Treatment by MSO and/or Incineration Technologies

Site	Waste Stream Name	Generation Rate (m^3/yr)	Inventory m^3 at End of 1990	Treatment by MSO		Treatment by Incineration	
				Yes	Potentially	Yes	Potentially
Y-12	Solvent-contaminated solid waste D018, F001, F003, F005-008, P027, U002, U080, U157	. 16	49.8		✓	✓	
Y-12	TC organics wastes liquid D018, D035, F001, F002, F003	37.7	123.4	✓		✓	
Y-12	TC organics, solid waste D018, D019, D035, D037, D039, D040, D043	9.2	16.9		✓		✓
Y-12	Waste oil	3.58	U	✓		✓	
Y-12	Waste oil contam rags	.07	U		✓	✓	
Y-12	Waste soil from slosure (Drum store area) F001, F002, F003g	0	500				✓
Y-12	Waste water treatment spent carbon D007, F001-F006	100	U	✓			✓

U=Unknown, not listed in the available data.

Appendix G

DOE Office of Environmental Restoration—List of Problem Units That May Be Appropriate for Treatment by MSO

*Table G-1. Summary of DOE EM-40 Problem Units Which Are Potential Candidates for Treatment by MSO**

Site I.D.	Media	Problem Unit Name	Contaminants	Record of Decision Date
AL-KCP-PCB	Soil	PCBs Under a Building	PCBs	
AL-LANL-CANY	Sediment in Surface Water	Canyons	Metals, organics, LLW, TRU, HE	
AL-LANL-DSITE	Soil	Discrete Sites	organics, LLW, TRU, metals including PU, Be, U-235, U-238, Pb	
AL-LANL-FSITE	Soil	Firing Sites	Metals, LLW, depleted U, PCB, organics, HE, Hg, oil, solvents	
AL-LANL-OUTFALL	Soil, Surface Water	Outfalls	Unknown	
AL-LANL-RSITE	Soil	Random Sites	Organics, metals, TRU, LLW, HE	
AL-SNL-UST	Soil	UST Site	Gasoline, Fuel oil	3/98
AL-SNLL-FOS	Soil	Fuel Oil Spill	Diesel fuel oil, benzene	
AL-Pine-4.5AC-S	Soil	4.5 Acre Site - Soil	Organics, metals	
AL-Pine-NES&EP-S	Soil	Miscellaneous Solid Waste Management Units-NE Site & East Pond - Soil	Organics, metals	
AL-Pine-WP-SED	Sediments in Surface Water	Other Miscellaneous Solid Waste Management Units-West Pond - Sediments	PCBs, PAHs, acetone, carbon disulfide	
AL-Pant-PX-1	Soil	Burning Grounds	Organics, metals, PCBs, dioxins, furans, high explosives	8/96

* Typically, EM-40 wastes are contaminated water, soil, or other media that first undergo pretreatment to extract a contaminant or contaminants. The extracted residuals would then be treated by MSO.

*Table G-1 (continued). Summary of DOE EM-40 Problem Units Which Are Potential Candidates for Treatment by MSO**

Site I.D.	Media	Problem Unit Name	Contaminants	Record of Decision Date
AL-Pant-PX-1DUP	Soil	Burning Grounds	High explosives, organics, metals, PCBs dioxins, furans	8/96
AL-Pant-PX-2	Soil	Priority Reconnaissance Assessment	Cr, Pb, acids, VOCs, high explosives	9/97
AL-Pant-PX-RC-2	Process Sludges	Hypalon Pad	High explosives	
AL-Pant-PX-4	Soil	Old Sewage Treatment Plant	VOCs, high explosives, metals	7/96
AL-Pant-PX-5	Soil	Burn Pits	VOCs, metals, pesticides, PCBs, dioxins, furans, fire-suppressant chemicals	7/96
AL-Pant-PX-7	Soil	Landfills	High explosives, asbestos, Zn, dioxins, furans	7/96
AL-Pant-PX-8	Soil	Ditches & Playas	VOCs, high explosives, metals	8/96
AL-Pant-PX-10/14	Soil	Underground Storage Tanks	Gasoline, BTEX, TCE, lead	2/95
AL-Pant-PX-12	Soil	Chemical Release Sites	Metals, PCBs, dioxins, furans, acids, solvents, hydrocarbons, asbestos, high explosives	9/98
AL-Pant-PX-13	Soil	Supplemental Sites Assessments	Metals, pesticides, herbicides, organics, asbestos	7/97
AL-LANL-Outfall	Concrete, Metal Objects, Wood	Contaminated Structures		
CH-ANL-East-1	Soil	East Area Sewage Treatment Plant	LLW, metals, organics, mixed wastes	3/96

* Typically, EM-40 wastes are contaminated water, soil, or other media that first undergo pretreatment to extract a contaminant or contaminants. The extracted residuals would then be treated by MSO.

*Table G–1 (continued). Summary of DOE EM–40 Problem Units Which Are Potential Candidates for Treatment by MSO**

Site I.D.	Media	Problem Unit Name	Contaminants	Record of Decision Date
CH-ANL-East-3	Sediments in Surface Water	Sawmill Creek	PCB, semi-volatile organics	
CH-ANL-East-5	Soil	800 Area Landfill	Organics, metals, inorganics, PCB, asbestos, tritium	10/95
CH-ANL-East-6	Soil	317/319 ENE Area	VOCs, Cs-137, Sr-90, H3, PCB, semi-volatile organics, mixed waste	12/95
CH-ANL-West-1	Soil	Solid Waste Management & Land Disposal Sites	Cs-137, volatiles, PCB, dioxins, furans, heavy metals	
CH-ANL-West-1DUP	Soil	Solid Waste Management & Land Disposal Sites	Cs-137, volatiles, PCB, dioxins, furans, heavy metals	
CH-BNL-BNL-1	Soil	Former Landfill - Soil		
CH-BNL-AOC-2	Concrete, Ground Water, Metal Objects, Soil	Former Landfill		
CH-BNL-AOC-14	Ground Water, Soil	Bubble Chamber spill Area	TCA, TCE, DCA, semi-volatiles, benzopyrene, dibenzoanthracence, indeno (1,2,3-cd) pyrene	
FN-FEMP-OU2-1	Other	Solid Waste Landfill	Uranium, organics, heavy metals	
FN-FEMP-OU2-2	Process Sludges	Lime Sludge Ponds	Organics, inorganics, uranium, heavy metals	
FN-FEMP-OU2-3	Fly Ash, Soil	Fly Ash Pile/Southfield	U, Th, Ra, PCBs, Pb, other heavy metals	
FN-FEMP-OU3-1	Soil	Operable Unit 3	Uranium, Th, PCBs, DCE, TCE, Pb	

* Typically, EM–40 wastes are contaminated water, soil, or other media that first undergo pretreatment to extract a contaminant or contaminants. The extracted residuals would then be treated by MSO.

*Table G-1 (continued). Summary of DOE EM-40 Problem Units Which Are Potential Candidates for Treatment by MSO**

Site I.D.	Media	Problem Unit Name	Contaminants	Record of Decision Date
ID-INEL-WAG1-01SL	Waste Water, Process Sludges	TSF Intermediate Level Rad Waste Disposal System-SL	LLW mixed with hazardous organics and/or heavy metals	
ID-INEL-WAG1-01MO	Metal Objects	TSF Intermediate Level Rad Waste Disposal System-MO	LLW mixed with hazardous organics and/or heavy metals	
ID-INEL-WAG2-S4	Soil	TRA Hot Waste Tanks	Hg, VOCs, TRU, LLW	
ID-INEL-WAG7-S2	Other	RWMC Subsurface Disposal Ares	TRU, LLW, mixed waste, VOCs, debris, metals, petroleum products, acids	7/98
ID-INEL-WAG7-S1	Soil	RWMC - Soil	TRU, LLW, mixed waste, VOCs, debris, metals, petroleum products, acids	7/98
ID-INEL-WAG7-S2	Soil	RWMC Vadose Zone	TCE, CCl1, LLW, heavy metals	7/94
ID-INEL-D&D-X2	Process Sludges	Decommissioning & Decontamination	Pb, Hg, Co-60, Cs-137, solvents, LLW	
ID-INEL-D&D-X5	Filters	Decommissioning & Decontamination	Mixed Cs-137, Co-60, Sr-90, Pb, organics	
NV-NTS-ILF	Soil	Eight Inactive Leachfields	Radionuclides, solvents, caustics, acids	
NV-NTS-SIW1	Soil	Sumps & Injection Wells	H3, Pu, Cs-137, Sr-90, I, solvents, heavy metals, PCBs	
NV-NTS-SIW2	Sediments in Surface Water	Eighteen Sumps & Injection Wells	H3, Pu, Cs-137, Sr-90, I, solvents, heavy metals, PCBs	
NV-NTS-TANK1	Process Sludges	Seventeen Inactive Storage Tanks	HLW, LLW, TRU, solvents, mixed waste	

---

* Typically, EM-40 wastes are contaminated water, soil, or other media that first undergo pretreatment to extract a contaminant or contaminants. The extracted residuals would then be treated by MSO.

*Table G-1 (continued). Summary of DOE EM-40 Problem Units Which Are Potential Candidates for Treatment by MSO**

Site I.D.	Media	Problem Unit Name	Contaminants	Record of Decision Date
NV-NTS-TANK2	Soil	Seventeen Inactive Storage Tanks		
OR-ORGD-K25-B1	Soil	Buried Material in the K-25 Area	TCE, U, Tc-99, PCB, TH-232, solvents, oils, heavy metals, toluene, radioactive PCB	8/97
OR-ORGD-K25-S1	Soil	Soil in the K-25 Area	TCE, U, Tc-99, Se, Cr-3, Cr-6, Th, PCB, PCP, As, oils, toluene, asbestos, solvents, heavy metals, radioactive PCB	8/97
OR-ORGD-K25-W1DUP	Sediments in Surface Water	On-site Sediments in the K-25 Area	TCE, U, Tc-99, solvents, heavy metals	8/97
OR-ORO-D&DGDP	Concrete, Metal Objects	D&D for All ORO Gaseous Diffusion Plants (Paducah, Portsmouth, K-25 site)	U, Tc-99, TRU, PCBs, asbestos, Th	12/95
OR-Y-12-D&D	Concrete	D&D for the Y-12 Area	Hg, PCB, asbestos, U, Li, Th-232, Be	3/95
OR-ORNL-X10-DD	Concrete, Metal Objects	D&D for the X-10 Area	Uranium, plutonium, other TRUs, tritium, asbestos, PCB, biologically contaminated radioactive waste	
OR-ORO-FRAP-1	Soil	Soil at Non-New Jersey FUSRAP Sites	U, Ra-226, Th-232, PCB, Pb, As, heavy metals, RCRA wastes	9/94
OR-ORO-FRAP-2	Concrete, Metal Objects, Wood, Masonry	Building/Masonry at Non-New Jersey FUSRAP Sites	U, Ra-226, Th-232, Pb, As, PCB, asbestos	9/94

* Typically, EM-40 wastes are contaminated water, soil, or other media that first undergo pretreatment to extract a contaminant or contaminants. The extracted residuals would then be treated by MSO.

*Table G-1 (continued). Summary of DOE EM-40 Problem Units Which Are Potential Candidates for Treatment by MSO**

Site I.D.	Media	Problem Unit Name	Contaminants	Record of Decision Date
OR-ORO-FRAP-2DUP	Process Sludges	Drums of Material at Non-New Jersey FUSRAP Sites	U, Ra-26, Pb, As, PCB, asbestos	9/94
OR-ORO-FRAPJ1	Soil	Soil at New Jersey FUSRAP Sites	U, Th, Ra, As, heavy metals, PCBs	7/94
OR-ORNL-X10-2	Soil	Soil at X-10	LLW, Cesium-137, Strontium-90, tritium, technetium-99, mercury, PCB, VOCs, cadmium, cobalt-60	
OR-ORNL-X10-2DUP	Process Sludges	Soil at X-10	LLW, Cesium-137, Strontium-90, tritium, technetium-99, mercury, PCB, VOCs, cadmium, cobalt-60	
OR-ORNL-X10-3	Soil	Buried Materials at X-10	Cs-137, Sr-90, H3, U, Co-60, Hg, Pb, Cd, Cr, other metals, I-129, Tc-99, TRU, asbestos, solvents, radioactive biological waste	
OR-ORNL-X10-6	Metal objects	Tanks at X-10		
OR-PGDP-BW1		Buried Material at Portsmouth	TCE	
OR-PGDP-S1	Soil	Soil at Portsmouth	TCE, U, Tc-99, PCB	
OR-PGDP-SW1	Sediments in Surface Water, Surface Water	On-Site and Off-Site Surface Water at Portsmouth	TCE, Uranium	
OR-Padu-BW1	Ground Water, Soil	Buried materials at Paducah	U, TCE, Tc-99, Cr, PCB, semi-volatiles, oils	

* Typically, EM-40 wastes are contaminated water, soil, or other media that first undergo pretreatment to extract a contaminant or contaminants. The extracted residuals would then be treated by MSO.

*Table G-1 (continued). Summary of DOE EM-40 Problem Units Which Are Potential Candidates for Treatment by MSO**

Site I.D.	Media	Problem Unit Name	Contaminants	Record of Decision Date
OR-Padu-G2	Ground Water	Off-Site Ground Water at Paducah	DNAPLs, benzene, toluene, xylene	
OR-Padu-SD1	Sediments in Surface Water, Soil	Sediments at Paducah	PCB, U, Cr	
OR-Padu-S1	Soil	Soil at Paducah	TCE, PCB, U, BETX, Cr, radioactively-contaminated PCB, DNAPL	
OR-Y-12-BW-1	Concrete, Metal Objects Process Sludges, Soil	Buried Material at Y-12	PCB, U, Hg, Th-232, Be, pyrophoric U, chlorinated solvents, creosote, heavy metals, Pb, Cr, Cd	
OR-Y-12-GW-1	Ground Water	Ground Water at Y-12	TCE, PCE, U, PCB, DNAPLs, Hg, nitrate, chlorinated solvents, Cd, Ni	
OR-Y-12-S-1	Soil	Soil at Y-12	PCB, Hg, U, Th, Be, TCE, chlorinated solvents, DNAPLs, heavy metals, Pb, Cd, Cr, long-chain hydrocarbons, creosote	
OR-ORGD-K25-T	Ground Water, Soil	Tanks at K-25	Petroleum liquids	12/94
RF-RFP-OU-1S	Other	Hillside 881 Buried Materials	Pu, Am, U, Se, asbestos, fuel oil	
RF-RFP-OU-1SDUP	Soil	Hillside 881 Soil	Pu, Am, VOC, fuel oil	8/94
RF-RFP-OU-2S	Soil	903 Pad Soil	Pu, Am, U, chlorinated solvents, Se	
RF-RFP-OU-2B	Other	903 Pad Buried Waste	Pu, U, organics, metals	

* Typically, EM-40 wastes are contaminated water, soil, or other media that first undergo pretreatment to extract a contaminant or contaminants. The extracted residuals would then be treated by MSO.

*Table G-1 (continued). Summary of DOE EM-40 Problem Units Which Are Potential Candidates for Treatment by MSO**

Site I.D.	Media	Problem Unit Name	Contaminants	Record of Decision Date
RF-RFP-OU-4S	Soil	Solar Evaporation Ponds	Uranium, organics, metals, nitrates	7/98
RF-RFP-OU-5/6SS	Sediments in Surface Water	Woman & Walnut Creek Drainages	U, Am, atrazine, simazine, PCBs, Sr, H3, U, Pb (graphite), Ni, Al, Fe, Mg	1997
RF-RFP-OU-5/6B	Other	Woman & Walnut Creek Drainages	U, Am, atrazine, simazine, PCBs, Sr, H3, U, Pb (graphite), Ni, Al, Fe, Mg	1997
RF-RFP-OU-7G	Ground Water	Existing Operating Sanitary Landfill	solvents, tritium	9/98
RF-RFP-OU-8S	Soil	700 Area	Acids/bases, metals, organics, solvents, Pu, Am, sanitary sewer effluent, radionuclides	1997
RF-RFP-OU--9S	Soil	Original Process Waste Lines		10/96
RF-RFP-OU-9P	Pipe	Original Process Waste Lines	VOCs all RFP radionuclides, nitrates, mixed wastes, pesticides	10/96
RL-RLO-100-2	Soil	100 Area Surface Soils	LLW, Cs-137, Hg, PCB, cadmium, chromium, lead, mercury	
RL-RLO-100-6	Other	100 Area Burial Grounds	Cadmium, chromium, lead, mercury, Cr, Sr-90, Tc-99, U, Hg, nitrates, TCE, sodium chromate, pesticides	

* Typically, EM-40 wastes are contaminated water, soil, or other media that first undergo pretreatment to extract a contaminant or contaminants. The extracted residuals would then be treated by MSO.

*Table G-1 (continued). Summary of DOE EM-40 Problem Units Which Are Potential Candidates for Treatment by MSO**

Site I.D.	Media	Problem Unit Name	Contaminants	Record of Decision Date
RL-RLO-200-12	Soil	200 Area Cribs/Liquid Disposal Units/Vadose Zone	Cs, Co, Pu, Ru, Sr-90, Tc-99, tritium, U, ammonia, barium, chromium, cyanide, fluoride, iron, nitrate, phosphate, selenium, sodium, sulfate, vanadium, organics	
RL-RLO-200-12DUP	Soil	200 Area Cribs/Liquid Disposal Units/Vadose Zone	Cs, Co, Pu, Ru, Sr-90, Tc-99, tritium, U, ammonia, barium, chromium, cyanide, fluoride, iron, nitrate, phosphate, selenium, sodium, sulfate, vanadium, organics	
RL-RLO-200-17	Soil	200 Area Burial Grounds	Cs, Co, Pu, Ru, Sr-90, Tc-99, tritium, U, ammonia, barium, chromium, cyanide, fluoride, iron, nitrate, phosphate, selenium, sodium, sulfate, vanadium, organics	
RL-RLO-200-18	Soil	200 Area Petroleum USTs	Petroleum hydrocarbons	
RL-RLO-200-19	Ground Water, Process Sludges	200 Area Waste Waters	LLW, chemical wastes	
RL-RLO-300-20	Soil	300 Area Ponds, Trenches/Cribs/Vadose Zone	U-235, U-238, other radionuclides, metals, trace PCBs, organics	
RL-RLO-300-24	Soil	300 Area Burial Ground		
RL-RLO-300-25	Soil	300 Area Petroleum USTs	Petroleum hydrocarbons	
RL-RLO-300-26	Soil	300 Area Laboratory/Sanitary Sewers		

---

* Typically, EM-40 wastes are contaminated water, soil, or other media that first undergo pretreatment to extract a contaminant or contaminants. The extracted residuals would then be treated by MSO.

Table G-1 (continued). *Summary of DOE EM-40 Problem Units Which Are Potential Candidates for Treatment by MSO**

Site I.D.	Media	Problem Unit Name	Contaminants	Record of Decision Date
RL-RLO-1100-27	Process Sludges	1100 Area Piping	Battery acids, paint solvents, antifreeze	
RL-RLO-1100-28	Soil	1100 Area Surface Soil	PCB, arsenic, chromium, dieldrin, Bis (2-ethylhexyl) phthalate	
RL-RLO-1100-29	Soil	1100 Area Vadose Zone	Acids, paint, solvents, antifreeze, PCB, arsenic, chromium, nickel, dieldrin, Bis (2-ethylhexyl) phthalate	
RL-RLO-1100-31	Soil	1100 Area Burial Ground	Arsenic, chromium, nickel, dieldrin, PCBs	
RL-RLO-1100-32A	Soil	1100 Area Nike Site Landfill		
SF-LBL-LBL-S1	Soil	LBL Soil		1/94
SF-LBL-LBL-S2	Soil	LBL PCBs in Soil	PCBs	
SF-LEHR-LEHR-S5	Soil	Chemical Dispensing Area	VOCs, chloroethane, dichloromethane	
SF-LLNL-LLNL-USTDUP	Soil	Gasoline Tank Leak	Petroleum hydrocarbons, halogenated hydrocarbons	
SF-LLNL-300SOILVOC	Soil	Site 300 Soil with VOCs	TCE	
SF-LLNL-LL-S-VOC	Soil	LLNL Soil with VOCs	TCE, PCE, 1,1DCE, 1,2DCA, 1,1DCA, 1,2DCE, CCl4, Freon, CHCl3, 1,1,1TCA	
SF-SLAC-SLAC-S1	Soil	Horse Farm		
SF-SLAC-SLAC-S3	Soil	PCBs from Explosives		

---

* Typically, EM-40 wastes are contaminated water, soil, or other media that first undergo pretreatment to extract a contaminant or contaminants. The extracted residuals would then be treated by MSO.

*Table G-1 (continued). Summary of DOE EM-40 Problem Units Which Are Potential Candidates for Treatment by MSO**

Site I.D.	Media	Problem Unit Name	Contaminants	Record of Decision Date
SF-SLAC-SLAC-S4	Soil	Master Substation		
SF-SLAC-SLAC-X1	Metal Objects	Transformer D&D		
SR-SRO-AMVZ	Soil	A/M Area Vadose Zone	PCE, TCE	
SR-SRO-BRP	Soil	Burning/Rubble Pits-Soil	TCE, PCE, CCl4, organics	
SR-SRO-CPRB	Soil	Coal Pile Runoff Basins	Pb, Cd, Fe, Ni, As, Cu, Mn, Coal elements, organic halogens	7/97
SR-SRO-LLWDF1	Concrete, Ground Water, Metal Objects, Soil	Burial Ground Complex	Hg, C-14, LLW, TRU, organics, Ag, Pb, H3, oil, solvents, Cd	
SR-SRO-MB	Soil	Miscellaneous Basins	U, Cs, Sr, Ag, As, Ba, Cd, Cr, Pb, Se, Hg, H3, organics, Am, Co, Th, Pu, Na, inorganics	
SR-SRO-SL2	Soil	Sanitary Landfill Soil	TCE, PCE, H3, benzene, Ra-226, methane	
SR-SRO-SS2-SED	Sediments in Surface Water	Site Streams Sediment	Cs-137, Sr-90, Pu, Co-60, metals, possibly chlorinated organics	

---

* Typically, EM-40 wastes are contaminated water, soil, or other media that first undergo pretreatment to extract a contaminant or contaminants. The extracted residuals would then be treated by MSO.

Appendix H

Example Mass Balance Calculation

As an example, the mass balance calculations for Waste 8 will be explained in order. Waste 8 is entirely $C_4Cl_3F_7$, so the weight fractions listed in Table 6-2 were arrived at as follows:

$$(1.000Kg\ C_4Cl_3F_7)\times\frac{(1\ G.Mole\ C_4Cl_3F_7)}{(0.2874Kg\ C_4Cl_3F_7)}\times\frac{(4\ G.Moles\ C)}{(1\ G.Mole\ C_4Cl_3F_7)}\times\frac{(0.0120Kg\ C)}{(1\ G.Mole\ C)}=0.167Kg\ C$$

Calculations for fractions of Cl and F are done similarly. To compute the oxidation products listed in Tables 6-5 and 6-7, the weight ratios of reactants to products on the basis of stoichiometry of reactions 6-1, 6-3 or 6-4, and 6-6 or 6-7 are first needed. An example for O_2 reacting with C in reaction 6-1 follows:

$$\frac{(1\ G.Mole\ O_2)}{(1\ G.Mole\ C)}\times\frac{(0.03200Kg\ O_2)}{(1\ G.Mole\ O_2)}\times\frac{(1\ G.Mole\ C)}{(0.01200Kg\ C)}=\frac{(2.667Kg\ O_2)}{(1.000Kg\ C)}$$

Ratios for the other reactions are done in the same fashion. The amounts of reactants and products can now be determined; below are the results for the MSO process. The reaction numbers refer to those identified in Section 6.3 Primary Reactions.

Reaction 6-1

$$(0.167Kg\ C)\times\frac{(2.667Kg\ O_2)}{(1.000Kg\ C)}=0.445Kg\ O_2\ reacted\ with\ C$$

$$(0.167Kg\ C)\times\frac{(3.667Kg\ CO_2)}{(1.000Kg\ C)}=0.612Kg\ CO_2\ from\ C$$

Reaction 6-4

$$(0.370Kg\ Cl)\times\frac{(1.495Kg\ Na_2CO_3)}{(1.000Kg\ Cl)}=0.553Kg\ Na_2CO_3\ reacted\ with\ Cl$$

$$(0.370Kg\ Cl)\times\frac{(1.648Kg\ NaCl)}{(1.000Kg\ Cl)}=0.610Kg\ NaCl\ from\ Cl$$

$$(0.370Kg\ Cl)\times\frac{(0.621Kg\ CO_2)}{(1.000Kg\ Cl)} = 0.230Kg\ CO_2\ from\ Cl$$

$$(0.370Kg\ Cl)\times\frac{(0.226Kg\ O_2)}{(1.000Kg\ Cl)} = 0.084Kg\ O_2\ from\ Cl$$

Reaction 6-6

$$(0.463Kg\ F)\times\frac{(2.790Kg\ Na_2CO_3)}{(1.000Kg\ F)} = 1.292Kg\ Na_2CO_3\ reacted\ with\ F$$

$$(0.463Kg\ F)\times\frac{(2.210Kg\ NaF)}{(1.000Kg\ F)} = 1.023Kg\ NaF\ from\ F$$

$$(0.463Kg\ F)\times\frac{(1.158Kg\ CO_2)}{(1.000Kg\ F)} = 0.536Kg\ CO_2\ from\ F$$

$$(0.463Kg\ F)\times\frac{(0.421Kg\ O_2)}{(1.000Kg\ F)} = 0.195Kg\ O_2\ from\ F$$

Summing up for all reactions:

Net O_2 reacted = 0.445 - 0.84 - 0.193 = 0.166Kg
Total reactants = 1.000 + 0.553 + 1.292 + 0.166 = 3.011Kg
Total CO_2 product = 0.612 + 0.230 + 0.526 = 1.376Kg
Total products = 1.328 + 0.610 + 1.023 = 3.009Kg

For the TSCA incinerator Cl and F react with NaOH rather than Na_2CO_3, and the calculations are performed as above. Summing up for all reactions:

Net O_2 reacted = 0.445 - 0.084 - 0.195 = 0.166Kg
Total reactants = 1.000 + 0.417 + 0.975 + 0.66 = 2.558Kg
Total CO_2 product = 0.612Kg
Total products = 0.612 + 0.610 + 1.023 + 0.313 = 2.558Kg

For the waste melt discharges computed for the MSO process (Tables 6-6 and 6-7), it is assumed that if entrained solids are determining the melt discharge, the solids will be

20 percent of the total mass discharged. If salts are the limiting factor it is assumed that the salts are 90 percent of the total mass to be discharged. So, for Waste 8:

Total discharge = (mass NaCl + NaF)/0.9 = (0.610 + 1.023)Kg/0.9 = 1.814Kg
Na_2CO_3 discharge = 1.814 - 0.610 - 1.023 = 0.181Kg