U.S. ENVIRONMENTAL PROTECTION AGENCY

Background Document

on

The Tentative Determination

To Issue

Incineration-At-Sea Permits

HQ 83-001 (Special)
HQ 83-002 (Special)
HQ 83-003 (Research)

Criteria and Standards Division
Office of Water Regulations and Standards
Office of Water
October, 1983

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I. INTRODUCTION

1. Foreword

The U.S. Environmental Protection Agency (EPA) has made a tentative determination to issue special and research permits to Chemical Waste Management, Inc., Oak Brook, Illinois, and Ocean Combustion Service, B.V., Rotterdam, the Netherlands, for the M/T VULCANUS I and M/T VULCANUS II to transport and dispose of material as authorized by the Marine Protection, Research, and Sanctuaries Act of 1972 (the Act), as amended.

Chemical Waste Management, Inc., and Ocean Combustion Service (the Applicants) submitted an application for a Special Permit on July 10, 1981, and an application for a Research Permit on November 2, 1981. Public meetings were held in Brownsville, Texas, May 25, 1982, and in Mobile, Alabama, May 27, 1982, to consider the Applicants' permit requests and to discuss the preliminary results of the first research burn on PCBs (HQ 81-002). On August 31, 1982, a public hearing was held in Brownsville, Texas to receive formal comments on the Applicants' request for permits and to outline the quality assurance and quality control procedures used in monitoring the second PCB research burn. Subsequent to the public hearing and after considering the hearing record, the Agency decided to revise its approach in developing the conditions for the proposed permits. The Assistant Administrator for Water made a new tentative determination to issue

permits based on the finding that the activities under the proposed permits would not unreasonably degrade or endanger human health, welfare or amenities, or the marine environment, ecological systems or economic potentialities of the ocean because the proposed permits are consistent with the Ocean Dumping Regulations in 40 CFR Parts 220-228 and the CONVENTION ON THE PREVENTION OF MARINE POLLUTION BY DUMPING OF WASTES AND OTHER MATTER (the London Dumping Convention) to which the United States is a Contracting Party. With respect to the incineration of PCBs, the proposed permits meet the requirements of the regulations in 40 CFR 761.70(a) implementing provisions of the Toxic Substances Control Act on the incineration of liquid PCBs. In addition, as a matter of Agency policy, the proposed permits are consistent with the Resource Conservation and Recovery Act regulations on land-based incinerator facilities in 40 CFR Part 264, Subpart O.

The purpose of this background document is to provide all interested parties with an opportunity to comment on the factors considered in reaching the tentative determination to issue the permits and to invite public comment on the principles used in developing the permits for the incineration at-sea program. These principles will be used as a basis for developing specific criteria regulating incineration at-sea activities.

Public hearings will be held to receive comments on the proposed permits and the findings used as a basis for the tentative

determination to issue the permits, in the following locations on the dates and at the times specified below:

1. November 21, 1983, from 9:00 a.m to 10:00 p.m.

   Jacob Brown Auditorium
   Brownsville Civic Center
   600 International Boulevard
   Brownsville, Texas

2. November 22, 1983 from 7:00 p.m. to 10:00 p.m.
   November 23, 1983 from 9:00 a.m. to 1:00 p.m.

   Mobile Gas Service Corporation Auditorium
   2828 Dauphin Street
   Mobile, Alabama

Registration will begin at 8 a.m. for day sessions and at 6:00 p.m. for the Mobile evening session. A 30 minute staff presentation will open all sessions and if necessary, a summary of the staff presentation will be repeated at 7 p.m. for the Brownsville session. All speakers must register and will be heard in the order in which they have registered. Remarks should be summarized in five minutes or less. Speakers are encouraged to submit written statements for the record. Comments on the tentative determination to issue the permits and the principles on which the permits are based should be sent by December 8, 1983, to:

Patrick M. Tobin
Criteria and Standards Division (WH-585)
Office of Water Regulations and Standards
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460
(202) 755-0100

Information on incineration at-sea and all reports and studies cited in this background document may be examined at the following locations during normal business hours:

United States Environmental Protection Agency
Library, Room 2904 Mall (Rear)
401 M Street, S.W.
Washington, D.C. 20460
Attn: Ms. Gloris J. Butler
(202) 382-5926

U.S. Army Corps of Engineers, Brownsville,
Room 508, Boca Chica Towers
2100 Boca Chica Blvd.
Brownsville, Texas 78520
Attn: Mr. Arthur Barrera
(512) 546-2456

State of Texas Law Library
Texas Supreme Court Building
13th and Colorado Streets
Austin, Texas 78711
Attn: Ms. Kay Schlueter
(512) 475-3807

U. S. Army Corps of Engineers, Mobile
Room 5031 New Federal Building
109 St. Josephs
Mobile, Alabama 36601
Attn: Ms. Cissy Scott
(205) 690-3182

For further information on the contents of this Background Document and on the incineration at-sea program in general, contact:

Dr. Alan B. Rubin
Chief, Criteria Section
Criteria and Standards Division (WH-585)
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460
(202) 245-3030

2. Background

Incineration is a method of thermally destroying liquid organic compounds at high temperatures. The liquid wastes incinerated at-sea are generated by a variety of industrial processes and for the most part are defined as hazardous by EPA in Appendix VIII of 40 CFR 261.

Incineration at-sea is regulated under the Marine Protection, Research and Sanctuaries Act of 1972, as amended, the regulations promulgated thereunder in 40 CFR Parts 220-228 and the Annexes that are binding on the United States as a Contracting Party to the CONVENTION ON THE PREVENTION OF MARINE POLLUTION BY DUMPING OF WASTES AND OTHER MATTER (London Dumping Convention). If incinerating polychlorinated biphenyls (PCBs), the requirements of Section 6(e) of the Toxic Substances Control Act (15 U.S.C. §2605(e)), and the regulations issued thereunder in 40 CFR Part 761.70(a), apply.

The vessels used to transport hazardous wastes are certified by the International Maritime Organization (IMO) and the U.S. Coast Guard. The M/T VULCANUS I is a double-hull, double bottom cargo vessel that was converted, in 1972, to an incineration vessel. It is classified as a "Type II" chemical ship and therefore must have a significant degree of cargo containment capability. It has a length of 102 meters, a beam of 14.4 meters, and a maximum draft of 7.4 meters. The space between the two hulls is used for ballast. The ballast may be filled with sea water and emptied independently as required to trim and balance the

ship. The M/T VULCANUS II has a similar design and is also classified as a "Type II" chemical ship. It was launched in 1982 and has a length of 93.55 meters, a beam of 16 meters and maximum draft of 6.2 meters. Waste is carried in cargo tanks ranging in size from 112 cubic meters to 574 cubic meters. The waste cargo capacity on M/T VULCANUS I is 3,503 metric tons (approximately 800,000 gallons) and on M/T VULCANUS II the capacity is 3,170 metric tons (approximately 724,000 gallons).

The incinerator system on both vessels is located in the stern. The M/T VULCANUS I has two incinerators; the M/T VULCANUS II has three incinerators. The initial certification and biennial recertification of the incinerators is performed by a Contracting Party to the London Dumping Convention, which in the case of the VULCANUS vessels is the Government of the Netherlands. In addition, the U.S. Coast Guard inspects and certifies the safety of the incinerators as required by P.L. 97-389, December 29, 1982.

The incinerator systems used in these vessels are refractory lined furnaces consisting of two chambers - a combustion chamber for internal mixing and a stack to ensure that adequte retention time for complete combustion is available. Combustion gases pass through these two chambers sequentially. The wastes are fed from storage tanks in the vessels and pass through a gorator which reduces any solid particles into a pumpable slurry. The liquid pumpable wastes are fed to the combustion system by means of electrically driven pumps.

be between 1166°C and 1350°C. The average waste residence time in the incinerator will be on the order of one second or longer. Incinerator systems such as those on the M/T VULCANUS I and II can process 20 - 25 metric tons of wastes per hour (as opposed to land-based incinerators which process 2 - 4 metric tons per hour).

The emissions resulting from the incineration of mixed liquid organic compounds consist primarily of hydrochloric acid, carbon dioxide, carbon monoxide, and water vapor with minute amounts of metallic oxides, silicate ash, partially combusted organic compounds and possibly trace amounts of surviving organics. The hydrochloric acid is rapidly diluted and neutralized by the ocean's buffering capacity and any remaining metallic oxides, silicate ash, or surviving organics are in such trace amounts that they do not exceed marine water quality criteria. None of the emissions from incineration at-sea activities has been demonstrated to have an adverse impact on the marine environment.

EPA issues research and special permits for incineration at-sea. Research permits are issued for no more than 6 months and are used to demonstrate the destruction efficiency of an incinerator on a particular chemical compound. Incineration at-sea special permits are issued for no more than three years, if it has been demonstrated that the incinerator can achieve a destruction efficiency of at least 99.99 percent on the most difficult to burn compound in the waste mixture.

Incineration takes place only in specially designated areas. The incineration sites must be outside areas of commercial and recreational

There are three rotary cup type burners located on the periphery of each incinerator near the base. Waste and if necessary, fuel oil pass through a central tube to atomization nozzels near the periphery of the rotary cup. High velocity combustion air supplied by large fixed-speed blowers with a rated capacity of 90,000 cubic meters per hour per incinerator, shape the flame. The burners with their rotating cups are directed tangentially to the vertical axes of the incinerators so that along with the combustion air they are able to swirl and mix the combustion gases.

A three-way valve is employed on each burner. One valve position allows wastes to feed into the incinerator; another valve position allows fuel oil to feed into the incinerators alone or in combination with the wastes; and a third valve position shuts off the wastes to the incinerator. Wastes may only be fed though the incinerator, and then only when the incinerator reaches steady state operating conditions. The automatic shutoff valve position prevents the wastes from entering the incinerators until the operating conditions specified for temperature, oxygen, and carbon monoxide have been reached, or if any of these operating conditions are not attained during the course of a burn. Until the incinerator is in compliance with the operating conditions, auxiliary fuel oil is burned.

Wastes are fed into the incinerator when the incinertors have reached the operating conditions specified in the permit. The temperature of combustion is measured at the incinerator wall and will

traffic and away from areas of biological significance. The Gulf Incineration Site is approximately 315 kilometers south, southeast of Galveston, Texas and encompasses approximately 4,900 square kilometers. It was originally designated as an incineration site on September 15, 1976, (41 FR 39319) and was redesignated on April 26, 1982, (47 FR 17817).

Since 1974, the M/T VULCANUS I has conducted four series of burns under EPA permits. Between October 1974, and January 1975, 8400 metric tons of organochlorine wastes from the Shell Chemical Company Deer Park manufacturing complex were incinerated in the Gulf of Mexico under a Research permit. Under an interim permit,* a second series of burns, totaling 29,100 metric tons of mixed wastes were conducted at the Gulf Incineration Site in 1974-1975 and in 1977. A third series of burns followed during July 1977 under a research permit and during September 1977 under an interim permit, when Herbicide Orange was incinerated at a site 322 kilometers west of Johnston Atoll in the Pacific Ocean. The last series of burns were performed in 1981 and 1982 when liquid PCB wastes were incinerated under a research permit at the Gulf Incineration Site.

* Interim permits were used only until April 1978.

Since 1974, EPA has acquired substantial experience in regulating the incineration of mixed chemical wastes in incinerator vessels and in land-based incinerator facilities. During this same period, there have been significant improvements in analytical techniques, methodology, and instrumentation. These improvements allow the detection of minute quantities of any compound in a waste mixture, in the combustion emission, and in the environment. Based on EPA's accumulated experience in monitoring the incineration of hazardous wastes and on the improvements in incinerator technology and analytical methodology, EPA is confident that the proposed permits will provide the same or a greater degree of protection to public health and the environment as other hazardous waste disposal alternatives.

3. Summary of the Permits

The Special Permits (HQ 83-001 and HQ 83-002) would authorize the Applicants, over a three year period, to use both vessels to transport to the designated Gulf Incineration Site (in the Gulf of Mexico) and incinerate at the site a combined total of 300,000 metric tons (approximately 79.7 million U.S. gallons) of mixed liquid organic compounds. The M/T VULCANUS I would be authorized to incinerate mixed liquid organic compounds having heats of combustion of 1.79 kcal/gram or greater and the M/T VULCANUS II would be authorized to incinerate mixed liquid organic compounds having heats of combustion of 0.24 kcal/gram or greater. Both vessels are authorized to incinerate TCDD at a maximum concentration of 2 ppm and PCBs at a maximum concentration of 35 percent by weight.

The Research Permit (HQ 83-003) would be issued for six months and would authorize the Applicants to demonstrate that the M/T VULCANUS II's incinerators could attain a destruction efficiency of 99.99 percent or greater on 10 percent dichlorodiphenyl trichloroethane (DDT), 90 percent solvent wastes.

Part III of this Background Document includes a section-by-section analysis of the permits. The major provisions of the proposed permits are summarized below:

EPA Signature:

Assistant Administrator for Water

Permittees:

Chemical Waste Management, Inc., Oak Brook, Illnois and its subsidiary Ocean Combustion Service, B.V., Rotterdam, the Netherlands.

Vessels:

- HO 83-001: M/T VULCANUS I
- HO 83-002: M/T VULCANUS II
- HO 83-003: M/T VULCANUS II

Required Vessel and Incinerator Certifications

- Certificate of Fitness issued by the International Maritime Organization.
- Letter of Compliance issued by the U.S. Coast Guard
- Survey Report and Form of Approval for the incinerators issued by a Contracting Party to the London Dumping convention.

Compliance with the Requirements of Other Laws and Conventions:

- THE CONVENTION ON THE PREVENTION OF MARINE POLLUTION BY DUMPING OF WASTES AND OTHER MATTER (London Dumping Convention).
- Section 6(e) of the Toxic Substances Control Act, 15 U.S.C §2605(e). The Assistant Administrator for Pesticides and Toxic Substances must grant written approval of the Permits before the incineration of any wastes containing PCBs may occur.
- Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act, 42 U.S.C. §6901, et seq.

Permit Program Manager:

- Director, Criteria and Standards Division, Office of Water Regulations and Standards

Permit Term:

° HQ 83-001: 3 years (Special Permit)

° HQ 83-002: 3 years (Special Permit)

° HQ 83-003: 6 months (Research Permit)

Eligible Materials in Wastes to be Incinerated:

° HQ 83-001: liquid organic compounds with heats of combustion equal to or greater than 1.79 kcals/gram

° HQ 83-002: liquid organic compounds with heats of combustion equal to or greater than 0.24 kcal/gram

° HQ 83-003: liquid DDT wastes consisting of 10 percent DDT in 90 percent organic solvents having heats of combustion equal to or greater than 0.24 kcal/gram.

Prohibitions and Limitations on Materials Incinerated

° HQ 83-001 and HQ 83-002:
- Quantifiable concentrations of compounds with heats of combustion less than 1.79 kcal/gram (HQ 83-001) or 0.24 kcal/gram (HQ 83-002)
- Quantifiable concentrations of
  -- DDT and associated compounds DDD, DDE
  -- PCT (polychlorinated triphenyls)
  -- BHC (lindane)
- TCDD (dioxin) in concentrations exceeding 2 ppm
- PCBs in concentrations exceeding 35 percent
- Chlorine in concentrations exceeding 70 percent
- Over 100 ppm of arsenic, cadmium, chromium, copper, lead, nickel, selenium, thallium, zinc
- Over 9 ppm mercury
- Over 20 ppm silver
- Materials which are produced for radiological, chemical, or biological warfare, high-level radioactive wastes, materials which cannot be identified or which are persistent and may float or remain in suspension.

° HQ 83-003:
- identical to above, except TCDD and PCBs are excluded from the trial burn under the Research permit.

Waste Analysis

- Before each incineration cruise an analysis of the wastes is conducted in accordance with EPA-approved protocols (in Appendix A of the Permit) in an EPA-approved laboratory

- Duplicate samples may be taken by EPA or an EPA-authorized EPA representative and may be coded and analyzed in an EPA-approved laboratory to verify the Permittees' samples and analyses.

Authorization for Loading and Incineration:

Provided in writing by the Permit Program Manager if:

- it is determined that the Permittees successfully demonstrated compliance with the performance standard, operating conditions and other provisions of the permit on the previous incineration cruise; and

- it is determined that the wastes to be incinerated meet the specifications in the permits.

Port of Departure:

Port of Mobile, Alabama

Incineration Site:

Gulf Incineration Site

Amount of Material Authorized to be Incinerated:

- HQ 83-001 and HQ 83-002: a combined total of 300,000 metric tons

- HQ 83-003: 900 metric tons

Performance Standard:

- HQ 83-001: 99.99 percent destruction efficiency; 99.9 percent combustion efficiency

- HQ 83-002: 99.99 percent destruction efficiency; 99.9 percent combustion efficiency

- HQ 83-003: 99.99 percent destruction efficiency and 99.9 percent combustion efficiency

Operating Parameters:

° HQ 83-001:
  - temperature: minimum-1280°C; average-1303°C; prior to waste feed initiation-1353°C
  - oxygen: minimum-5%; average-10.1%
  - carbon monoxide: maximum-100 ppm; average-8 ppm

° HQ 83-002:
  - temperature: minimum-1166°C; average-1200°C; prior to waste feed initiation-1250°C
  - oxygen: minimum-5%; average-10.6%
  - carbon monoxide: maximum-100 ppm; average-22 ppm
  - if incinerating TCDD or PCBs, same as HQ 83-001

° HQ 83-003:
  - minimum and maximum parameters only are specified for temperature, oxygen and carbon monoxide and are the same as HQ 83-002.

Automatic Waste Feed Shut-off:

Automatic devices shut-off the waste feed to the incinerator whenever:

° flameout occurs

° minimum temperature or oxygen, or maximum carbon monoxide, are reached; or

° monitoring devices fail for temperature, air flow, draft (negative pressure) in the combustion chambers, oxygen, carbon monoxide, carbon dioxide, waste feed and/or auxiliary fuel (if used).

Monitoring Requirements:

° Automatic, tamper proof devices are to continuously monitor and record temperature, air flow, oxygen, carbon monoxide, carbon dioxide, draft (negative pressure) in the combustion chambers, and waste feed and/or auxiliary fuel (if used).

° At least hourly recordings of time, date, wind speed and direction and vessel position, course and speed are to be made.

° All monitoring data are to be submitted to the Permit Program Manager for evaluation of compliance with the performance standard, operating conditions and monitoring requirements of the permit.

Instrument Calibration:

- Calibration of the instrument measuring temperature, air flow, draft (negative pressure) in the combustion chambers, oxygen, carbon monoxide, carbon dioxide, waste feed flow and auxiliary fuel flow (if used) is to be done before each cruise, and in accordance with manufacturer's recommendations or, more frequently if conditions warrant. A permanent record is to be made of each calibration.

Other Requirements:

- No black smoke or extension of the flame above the plane of the stack is allowed.

- Ammonia is to be added to the plume, if necessary, to make it visible.

- A draft (negative pressure) of at least one (1) inch of water column is to be maintained in all combustion chambers.

- If tanks are washed, they must be washed with a combustible solvent and such washings and any residues or ash remaining after incineration are to be incinerated at-sea or, upon return to port, incinerated in EPA-approved facilities or otherwise properly disposed of in accordance with applicable EPA regulations.

- Any wash waters, ballast waters, or pump room bilge water found to be contaminated are to be incinerated at sea or, on return to port either incinerated in EPA-approved land-based facilities or alternatively, treated in accordance with applicable EPA regulations. In no case are these contaminanted waters to be discharged directly to the ocean or into the harbor.

Verification of Permit Conditions:

Verification is by:

- automatic tamper proof monitoring devices; and

- 24 hour per day independent observation of the incineration activities by shipriders employed by and/or approved by and responsible to EPA.

Contingency Plan:

The Contingency Plan, approved by the U.S. Coast Guard and EPA, is to be followed during any accident or emergency.

Modifications to or Revocation of the Permit:

May result from:

- Factors stated at 40 CFR Section 223.3(a)(1-4)
- The violation of any provision of the Permit including any misrepresentation, inaccuracy or failure to disclose all relevant facts in the permit application.
- A change in any condition or fact upon which the Permit is based that adversely affects human health or welfare or the environment.
- Failure to meet the performance standard or operating conditions.

Penalties

- Civil penalty of up to $50,000 per violation, per day.
- Criminal penalty of up to $50,000 per violation, per day and/or 1 year in prison for each violation.

Liability Insurance

- The Permittees shall inform the Permit Program Manager of any decrease in their liability insurance.

The two sections that follow include: the FINDINGS and the SECTION-BY-SECTION ANALYSIS of the Permits. The FINDINGS demonstrate that the proposed permits are consistent with the requirements of: the Ocean Dumping Regulations, and the London Dumping Convention and for the purposes of incinerating PCBs, the TSCA regulations on the incineration of liquid PCBs. In addition, as a matter of Agency policy, the proposed permits are consistent with the RCRA regulations on land-based incineration of hazardous wastes. The FINDINGS section also give the U.S. Coast Guard's views on the Contingency Plan as a guide for responding to potential emergencies and accidents while at sea or in the harbor. The SECTION-BY-SECTION ANALYSIS of the proposed Permits discusses the permit conditions and the rationales for their selection.

II. FINDINGS

1. INTRODUCTION

The Environmental Protection Agency (EPA) is authorized by the Marine Protection, Research and Sanctuaries Act of 1972 (the Act), as amended (33 USC §1412), to issue permits for the dumping of material into the ocean "where the Administrator determines that such dumping will not unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities." In establishing criteria for the review and evaluation of permit applications, Section 102 of the Act requires that consideration be given to the following:

"(A) The need for the proposed dumping.
"(B) The effect of such dumping on human health and welfare, including economic, esthetic, and recreational values.
"(C) The effect of such dumping on fisheries resources, plankton, fish, shellfish, wildlife, shorelines and beaches.
"(D) The effect of such dumping on marine ecosystems, particularly with respect to-
  (i) the transfer, concentration, and dispersion of such material and its byproducts through biological, physical, and chemical processes,
  (ii) potential changes in marine ecosystem diversity, productivity, and stability, and
  (iii) species and community population dynamics.
"(E) The persistence and permanence of the effects of the dumping.
"(F) The effect of dumping particular volumes and concentrations of such materials.
"(G) Appropriate locations and methods of disposal or recycling, including land-based alternatives and the probable impact of requiring use of such alternate locations or methods upon considerations affecting the public interest.

"(H) The effect on alternate uses of oceans, such as scientific study, fishing, and other living resource exploitation, and nonliving resource exploitation.
"(I) In designating recommended sites, the Administrator shall utilize wherever feasible locations beyond the edge of the Continental Shelf."

In addition, the Act provides that the standards and criteria binding on the United States as a Contracting Party to the London Dumping Convention, shall be applied to the extent that application of such criteria do not relax the requirements of the Act.

EPA made the tentative determination to issue the proposed permits because the proposed dumping would "not unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, ecological systems or economic potentialities." The basis for that determination included a comparison of the proposed permits with:

- the criteria for the review and evaluation of ocean dumping permits in 40 CFR Parts 220-228, which implement Section 102 of the Act;
- the regulations and technical guidelines of the London Dumping Convention;
- the regulations in 40 CFR 761.70(a) implementing the Toxic Substances Control Act (15 USC §2601, P.L. 94-466, Oct. 11, 1976), because the applications proposed to incinerate polychlorinated biphenyls (PCBs) in the mixed organic chemical wastes ;
- the regulations in 40 CFR 264.340-.351 implementing the requirements for land-based incinerators under the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (42 USC 6905, 6912(a), 6924, 6925, and 6927), if applicable, as a matter of Agency policy that incineration

at-sea permits be at least equivalent to land-based incinerator permits.

The FINDINGS compares the requirements in each of the above to the proposed permits and gives EPA's rationale for concluding that the proposed permits are consistent with each of them.

In addition, EPA requested the assistance of the U.S. Coast Guard in evaluating the adequacy of the Contingency Plan in implementing procedures to protect the environment, if accidents or life threatening incidents should occur in the harbor or at-sea.

2. COMPLIANCE WITH THE OCEAN DUMPING REGULATIONS

The Ocean Dumping Regulations require in 40 CFR 220.3(f) that "permits for incineration at-sea are to be issued only as research permits... until specific criteria to regulate this type of disposal are promulgated, except in those cases where studies on the waste, the incineration method and vessel, and the site have been conducted and the site has been designated for incineration at-sea in accordance with the procedures of Section 228.4(b). In all other respects the requirements of Parts 220-228 apply".

If the studies have been performed and an incineration site has been designated in accordance with Part 228, the criteria that the Administrator is to use in reviewing and evaluating ocean dumping permits, as required by Section 102 of the Act, are in Part 227. Subpart A of Part 227 states that:

> "(a) If the applicant satisfactorily demonstrates that the material proposed for ocean dumping satisfies the environmental impact criteria set forth in Subpart B, a permit for ocean dumping will be issued unless:
> (1) There is no need for the dumping, and alternative means of disposal are available, as determined in accordance with the criteria set forth in Subpart C; or
> (2) There are unacceptable adverse effects on esthetic, recreational or economic values as determined in accordance with the criteria set forth in Subpart D; or
> (3) There are unacceptable adverse effects on other uses of the ocean as determined in accordance with the criteria set forth in Subpart E" (emphasis added).

The following discussion explains, in detail, the studies of the waste, the incineration method and vessel, and the site necessary for issuing a special permit under Section 220.3(f). Then, the requirements of Part 227, Subparts B, C, D and E, and the criteria that were taken into consideration in establishing the Gulf Incineration Site, are discussed. In applying the criteria in Parts 227 and 228 for

incineration at-sea permits, EPA evaluated the emissions resulting from the incineration of mixed liquid organic compounds as the materials to be disposed of by ocean dumping. The emissions may include: hydrochloric acid; carbon dioxide; carbon monoxide; water vapor and trace amounts of metallic oxides, silicate ash and partially combusted and surviving organic compounds.

(a) Permits for Incineration at-Sea (40 CFR 220.3(f)

> "Permits for incineration of wastes at sea will be issued only as research permits... until specific criteria to regulate this type of disposal are promulgated, except in those cases where studies on the waste, the incineration method and vessel, and the site have been conducted and the site has been designated for incineration at-sea in accordance with the procedures of §228.4(b). In all other respects the requirements of Parts 220-228 apply."

EPA has not promulgated any specific criteria for incineration at-sea permits. However, EPA has concluded that adequate studies have been conducted on the waste, incineration method and vessel, and the site. This part describes the system that will be used to satisfy the requirement that studies on the waste and incineration method, and vessel be conducted without requiring that a study on the incineration method and vessel be conducted for each compound in a waste mixture. In addition, this part discusses the tests that were conducted to qualify the vessels for the wastes that they are authorized to incinerate. Descriptions are also given on the environmental monitoring studies conducted at the Gulf Incineration Site.

(1) The heat of combustion of principal organic hazardous constituents (POHCs) is used as a surrogate for determining the incinerability of the entire waste mixture.

The liquid organic wastes to be incinerated are complex mixtures of many different compounds. A surrogate system was developed so that

a trial burn would not have to be conducted on each compound in a waste mixture prior to authorizing that waste mixture to be incinerated.

This surrogate system was first described in the rulemaking for "Incinerator Standards for Owners and Operators of Hazardous Waste Management Facilities" - Interim Final Rule Parts 264 and 122, 46 FR 7666, January 23, 1981, and has been used in recent permits for land-based incineration of complex wastes mixtures under the Resource Conservation and Recovery Act (RCRA).

Under the system, principal organic hazardous constituents (POHCs) are selected to measure the performance of the incinerator during test burns under a research permit. A POHC is an organic chemical in the waste mixture that has been identified as hazardous by EPA in Appendix VIII of 40 CFR 261. Generally, those organic constituents which are most difficult to destroy, as measured by their heat of combustion, and most abundant in a waste mixture, are selected as POHCs.* During the trial burn, the incinerator is operated to demonstrate a destruction efficiency** of at least 99.99 percent on each POHC designated for the trial burn.

* For examples of how the POHCs are selected see Appendix I to this document.

** The formula for determining Destruction Efficiency is:

$$\text{Destruction Efficiency} = \frac{\text{Total POHC fed} - \text{POHC in combustion gases}}{\text{total POHC fed}} \times 100$$

A destruction efficiency of at least 99.99 percent was established as a performance standard based on extensive data indicating that such a destruction efficiency is attainable and can be routinely measured in incinerators burning a wide range of organic hazardous wastes in concentrations over 100 ppm. A 99.99 percent destruction efficiency ensures that there will be no products of incomplete combustion from the incineration process, except as trace contaminants as required in 40 CFR 227.6 and as discussed elsewhere in the FINDINGS.

Waste mixtures that are eligible for incineration under special permits are those mixtures that contain only those compounds or classes of compounds with heats of combustion equal to, or greater than, the POHC with the lowest heat of combustion on which the incinerator demonstrated a destruction efficiency of 99.99 percent. By demonstrating that an incinerator can achieve a destruction efficiency of 99.99 percent on a particular POHC, EPA can generally be assured that any less thermally stable hazardous constituents burned in that incinerator under comparable conditions will be destroyed also.

Compounds with a lower heat of combustion have greater thermal stability and are therefore more difficult to burn than compounds with a higher heat of combustion. The Agency has ranked 293 hazardous constituents by their heats of combustion* (expressed in kilo calories

* Heat of combustion is determined empirically in the laboratory through bomb calorimetry or may be calculated through chemical bond strengths.

per gram (kcal/ gram)) in an index, "Ranking of Organic Hazardous Constituents by Incinerability" (Index of Incinerability). The ranking on the Index of Incinerability is in ascending order by ease of incineration. For example, the compound most difficult to destroy has the lowest heat of combustion and is listed first and the compound least difficult to destroy has the highest heat of combustion and is listed last.

Prior to loading the vessel, the permits require that an analysis of the waste mixture to be incinerated be performed using EPA-approved sampling and analytical protocols (listed in Appendix A of the permits), and be conducted in an EPA-approved laboratory. The compounds identified in the analysis of the waste mixture can be compared to the Index of Incinerability to determine whether there are any quantifiable concentrations* of chemicals in the mixture that have a heat of combustion less than that of the POHC tested.

For a waste mixture containing compounds not listed on the Index of Incinerability, the Permittees would have to demonstrate by one of three methods that the incinerator could destroy such compounds to at

*Quantifiable concentration is defined as a minimum concentration of a discrete chemical constituent (element or compound) in a chemical waste that can be detected, identified, and quantified without confirmatory analyses. The amount of this concentration will vary depending on the chemical constituent, possible interferences of other constituents in the chemical waste, the method of sample preparation, and method of analytical detection, identification, and quantification (as defined in Appendix A of the permits).

least 99.99 percent efficiency. First, the Permittee could determine the heat of combustion of the compound and then compare the heat of combustion of the compound in question to that of any of the POHCs for which the incinerator was tested. If the compound in question's heat of combustion was equal to or greater than any of the POHCs tested, it could be burned. However, if the heat of combustion was lower, then the compound could not be incinerated until a test burn was conducted to prove that the incinerator could destroy the compound to at least 99.99 percent efficiency.

Second, the Permittees could determine the chemical class to which the compound belongs and compare the lowest heat of combustion of any member of that class to any of the POHCs on which the incinerator was tested. Only if the heat of combustion of any member of that class was greater than or equal to the POHCs tested could the compound be incinerated.

Third, the Permittees could demonstrate the capability of the incinerator to destroy the compound to at least 99.99 percent efficiency by conducting a trial burn under a research permit. This approach is resource intensive and, therefore, expensive.

There are five compounds identified in Annex 5 to the London Dumping Convention on which doubts as to incinerability exist. These compounds are:

- Polychlorinated biphenyls (PCRs)
- Polychlorinated triphenyls (PCTs)
- Tetrachlorodibenzo-p-dioxin (TCDD, dioxin)
- Dichlorodiphenyl trichloroethane (DDT)
- Benzene hexachloride (BHC, lindane)

In order for these compounds to be eligible for incineration under a special permit, the applicant must demonstrate the ability of the incinerator to achieve at least a 99.99 percent destruction efficiency on the compound. At such time when substantial scientific data from trial burns on these five compounds show a strong correlation between destruction efficiency and incinerator operating conditions and/or other data becomes available on the similarity of the performance of incinerators on different vessels, EPA may make a determination that there is no longer doubt as to the incinerability of these compounds. If and when doubt no longer exists regarding the incinerability of these five compounds, then incineration of these compounds will be permitted in a manner similar to other organic hazardous compounds using the Index of Incinerability.

In EPA's judgment, use of the POHC/Index of Incinerability surrogate system as described above and the trial burns conducted on the vessels, as described below, meet the requirements that studies of the waste and incineration method and vessel be conducted prior to issuing special permits for incineration at-sea.

(2) Studies of the Incineration Method and Vessel

In accordance with Article VII(1) of the London Dumping Convention, the incineration system for every vessel must be initially surveyed under the direction of a Contracting Party to the London Dumping Convention. An initial survey is carried out to ensure that during incineration of waste and other matter, combustion efficiency (on the entire waste mixture) and destruction efficiency (on the POHCs tested) are in excess of 99.9 percent.

The proposed permits require a destruction efficiency of 99.99 percent on the POHCs tested and a combustion efficiency of 99.9 percent on the entire waste mixture. Extensive Agency data indicate a high correlation between a 99.9 percent combustion efficiency and a 99.99 percent destruction efficiency. The lower combustion efficiency of 99.9 percent is due to the fact that a waste mixture is not pure; it includes such elements as metals, sand and moisture which cannot be destroyed completely. Combustion efficiencies are continuously calculated on each incineration cruise. Destruction efficiencies are calculated on each research permit cruise, but not necessarily on each cruise under the special permits.

Annex 5, Regulation 3 of the London Dumping Convention specifies that the Contracting Party under whose direction the survey is being carried out shall:

"(i) approve the siting, type and manner of use of temperature measuring devices;
(ii) approve the gas sampling system including probe locations, analytical devices, and the manner of recording;
(iii) ensure that approved devices have been installed to automatically shut off the feed of waste to the incinerator if the temperature drops below approved minimum temperatures;
(iv) ensure that there are no means of disposing of wastes or other matter from the marine incineration facility except by means of the incinerator during normal operations;

(v) approve the devices by which feed rates of waste and fuel are controlled and recorded;
(vi) confirm the performance of the incineration system by testing under intensive stack monitoring, including the measurements of O_2, CO, CO_2, halogenated organic content, and total hydrocarbon content using wastes typical of those expected to be incinerated."

The incineration system is to be surveyed at least every two years to assure that the incinerator continues to comply with the regulations. In addition and in accordance with PL 97-389, December 29, 1982, the U.S. Coast Guard inspects and certifies the safety of the incineration system.

Initial inspection and certification of the M/T VULCANUS I's and M/T VULCANUS II's incineration system was performed by the Rijkswaterstaat, Government of Netherlands. Certificate of Approvals were issued in June 1983, for the M/T VULCANUS I and in July 1983, for the M/T VULCANUS II and therefore are current and valid.

Prior to issuing special permits allowing regular incineration of mixed chemical wastes, EPA issues research permits or uses the initial incinerator survey by a Contracting Party to the London Dumping Convention to determine the destruction efficiency of an incinerator on a particular compound, or to establish the incinerability of the five compounds identified in Annex 5 of the London Dumping Convention.

The M/T VULCANUS I's incinerators are certified to incinerate tetrachlorodibenzo-p-dioxin (TCDD, dioxin) in concentrations of less than 2 ppm based on a 1977 trial burn of Herbicide Orange which contained concentrations of dioxin averaging 1.9 ppm. The most recent study of the M/T VULCANUS I's incineration system was the second trial burn under Research Permit HQ 81-002, August 15-31, 1982 which

qualified the M/T VULCANUS I to burn PCBs in concentrations of 35 percent and mixed liquid organic compounds with a heats of combustion equal to or greater than 1.79 kcal/gram (hexachlorobenzene). A discussion of these two trial burns follows.

(i) M/T VULCANUS I's Trial Burns

Incineration of U.S. Air Force stocks of Herbicide Orange was performed onboard the M/T VULCANUS I operating in the Pacific Ocean west of Johnston Atoll. Approximately 10,400 metric tons were incinerated under permits granted to the U.S. Air Force and ocean Combustion Service, BV. The first shipload was incinerated under Research Permit No. 770DH001R and the second and third shiploads under Special Permit No. 770DH001S.

EPA contracted with TRW, Inc., to perform combustion gas monitoring during the incineration of the herbicide. The U.S. Air Force issued a contract (No. F41608-77-C-0169) to the Brehm Laboratory of Wright State University to analyze the stack gas samples for 2,3,7,8-tetrachlorodibenzo-p-dioxin.

Stack sampling operations utilized a USAF-OEHL benzene impinger train and a modified U.S. EPA Method 5 train (Lear-Siegler) which incorporated an organic vapor sorbent trap. The USAF-OEHL train was the primary train for acquiring samples for the dioxin analysis, whereas the Lear-Siegler train was used to acquire samples to be analyzed for other organic species potentially present in the stack gases. The Lear-Siegler train also served as a backup to the USAF-OEHL train. Stack gas samples were acquired by a remotely activated, water-cooled, stainless, steel probe capable of traversing the starboard stack diameter of 3.4 meters.

Usually a concentration of at least 100 ppm of a compound is needed in a waste mixture to analytically measure and demonstrate an incinerator's destruction efficiency on a compound to at least 99.99 percent. In the Herbicide Orange mixture, TCDD averaged only 1.9 ppm.

While an overall destruction efficiency of greater than 99.93 percent was obtained for dioxin in the three burns, EPA believes that in actuality the incinerators probably achieved at least a 99.99 percent destruction efficiency on TCDD based on the fact that during the same trial burn, the destruction efficiencies for 2,4-D and 2,4,5-T were calculated to be greater than 99.999 percent. However, to be able to demonstrate an unqualified destruction efficiency, there has to be a detectable and quantifiable amount of a compound in the stack gas samples. Failure to detect a compound does not mean that the compound is not there, if the level of detection of the methodology is not adequate to measure low levels of a particular compound. At that time, the sampling methodologies employed did not have the analytical sensitivity to measure such low levels of potentially surviving dioxin in stack gas samples, particularly for mixtures that contained compounds with a similar chemical structure as dioxin.

Dioxin is easier to incinerate than other compounds that the vessels are authorized to include in a waste mixture. Dioxin has a

heat of combustion of 3.43 kcal/gram, while hexachlorobenzene has a heat of combustion of 1.79 kcal/gram and tetrachlormethane has a heat of combustion of 0.24 kcal/gram on which the M/T VULCANUS I and M/T VULCANUS II, respectively, demonstrated greater than 99.99 percent destruction efficiencies.

In addition, incinerator plume modelling and subsequent ocean dispersion modelling have demonstrated that emissions resulting from the incineration of chemical wastes containing 2 ppm of dioxin at a destruction efficiency of 99.93 percent will cause no adverse environmental impact. This is based on a determination that any potential uncombusted dioxin in the emissions would result in an ambient marine water concentration of dioxin below the marine aquatic life no-effect level for dioxin and below the limiting permissible concentration as required by 40 CFR 227.27.

The test results are shown in Figure I below.

FIGURE I

° Incinerator wall temperature	1273°C (average)
° Concentration of Oxygen (O_2)	8.9 percent (mean)
° Concentration of Carbon Dioxide (CO_2)	10.3 percent (mean)
° Concentration of Carbon Monoxide (CO)	10 pm (mean)
° Residence time	1.0 second
° Combustion Efficiency (CE)	> 99.9
° Destruction Efficiency*:	
Dioxin (TCDD)	> 99.93 (average)
2,4-D	> 99.999
2,4,5-T	> 99.999

More detailed information may be found in:

U.S. EPA, Office of Research and Development, At-Sea Incineration of Herbicide Orange Onboard the M/T VULCANUS. 1978 (EPA-600/2-78-086).

For the August 1982, trial burns, EPA contracted with the Energy and Environmental Division of TRW Inc., Redondo Beach, California, to sample and monitor the incineration process and to analyze both raw waste and combustion gas samples in order to determine whether the vessel met the performance and operating requirements in the permit. A representative from EPA was onboard during the testing, and a technician-employee of EPA assisted the TRW test team.

*$DE = 100 \times \frac{Co-Cf}{Co}$

Where Co = emission concentration at 0% destruction efficiency
Cf = emission concentration determined from analyses

A standard EPA-specified sampling train* mandated for use in testing land-based incinerators for emissions of PCBs was modified for at-sea analysis and was used to acquire samples of the effluent combustion gases. A fixed-position, water-cooled probe was mounted in the starboard incinerator and directed stack gas to the train. Samples from the emissions were analyzed for PCBs and chlorobenzenes by TRW.

The test results, in Figure II indicated below, show that the operating conditions on the M/T VULCANUS I meet the requirements for incineration at-sea permits. The operating conditions established in this trial burn are the average operating conditions required in the permit.

More detailed information on the study of the M/T VULCANUS I's incineration system and the wastes incinerated, including the analytical procedures and quality assurance/quality control procedures used in the study, may be found in:

U.S. EPA, Industrial Environmental Research Laboratory. At-Sea Incineration of PCB-Containing Wastes on the M/T VULCANUS (I). 1983. (EPA-600/7-83-024).

* A sampling train is laboratory equipment used in collecting samples of the emissions from incinerator stacks at high efficiency.

FIGURE II. M/T VULCANUS I TRIAL BURN DATA

° Incinerator wall temperature	1303°C (average)
° Concentration of Oxygen (O_2)	10.1 percent
° Concentration of Carbon dioxide (CO_2)	9.1 percent
° Concentration of Carbon Monoxide (CO)	8 ppm
° Residence time	1.3 seconds
° Combustion Efficiency (CE)	99.99 percent
° Destruction Efficiency (DE)*	
-PCB, Octachloro	>99.99
-Hexachlorobenzene	>99.99

(ii) M/T VULCANUS II's Trial Burns

A study of the M/T VULCANUS II's incineration system and its initial survey and certification is based on a trial burn conducted by the Government of the Netherlands during January and February 1983, at the North Sea Incineration Site. As part of the initial survey, Chemical Waste Management, Inc., contracted with the Energy and Environmental Division of TRW Inc., to measure the emissions of several POHCs selected from the waste mixture incinerated. This study established the eligibility of the M/T VULCANUS II to incinerate mixed liquid organic compounds with a heats of combustion equal to or greater

* $DE = 100 \times \frac{Wi - Wo}{Wi}$

Where:

Wi = mass feed rate into the incinerator
Wo = mass emission rate in the stack gas before release to the atmosphere
Wo = FoCo

Where:

Fo = flow rate (dry) of combustion effluent in $m^3/hr.$
Co = concentration in combustion effluent

Thus

$DE = 100 \times \frac{Wi-FoCo}{Wi}$

than 0.24 kcal/gram (tetrachloromethane on the Index of Incinerability).

Sampling and chemical analyses were conducted according to a test plan reviewed by EPA. (See Plan for Sampling and Analysis of Volatile Organics During a Certification-Voyage of the M/T VULCANUS II. Report to Chemical Waste Management January, 1983). A standard volatile organic sampling train (VOST)*, incorporating approved minor improvements in design, was used to acquire samples of the effluent gas. A stainless steel-jacketed, water-cooled probe with a quartz liner was designed and fabricated for use with the VOST train. Four complete tests were performed, and each test generated six pairs of adsorbent tubes containing organic vapors from the combustion gases.

Pertinent process-related data were acquired from computer printouts maintained by the Chief Engineer of the M/T VULCANUS II. These data included: temperatures in the incinerators, feed rates of waste and air, and concentrations of carbon dioxide, carbon monoxide, and oxygen in the stack gases.

The test results, as indicated below show that the operating conditions on the M/T VULCANUS II meet the Agency's requirements for

* The VOST is used for testing land-based incinerators on tetrachloromethane, one of the POHC's tested in the trial burn.

incineration at-sea. The operating conditions established in this trial burn are the average operating conditions required in the permit, except when incinerating TCDD and PCBs, as explained later in this section.

FIGURE III. M/T VULCANUS II TRIAL BURN DATA

° Incinerator wall temperature	1166°C (average)
° Concentration of Oxygen (O_2)	10.6 percent
° Concentration of Carbon dioxide (CO_2)	9.6 percent
° Concentration of Carbon Monoxide (CO)	22 ppm
° Residence time	1.1 seconds
° Combustion Efficiency (CE)	99.9
° Destruction Efficiency (DE)	
Tetrachloromethane*	>99.99 percent
Chloroform*	>99.99 percent
1,1,2 Trichloroethane*	>99.99 percent
1,2 Dichloroethane*	>99.99 percent
1,1 Dichloroethane*	>99.99 percent

More detailed information on the study of the M/T VULCANUS II's incinerator system and the wastes incinerated may be found in:

TRW, Incineration of Volatile Organic Compounds on the M/T VULCANUS II. Prepared for Chemical Waste Management, Inc. April 1983.

Memorandum from Merrill Jackson, to Steven Schatzow, Review of Reports of At-Sea Incineration Onboard the M/T VULCANUS II. June 24, 1983.

The requirement for test burns for the M/T VULCANUS II to incinerate mixed liquid organic wastes containing TCDD and PCBs have been waived. These waivers are based on a determination by EPA's

* These numbers are conservatively expressed based on a minimum 50% VOST recovery.

Industrial Environmental Research Laboratory (IERL-CI) that both the M/T VULCANUS I and M/T VULCANUS II are using the same equipment and on EPA's accumulated experience with the monitoring of incinerators for TCDD and PCBs emissions. These findings are contained in:

> Memorandum from David G. Stephan, Director, IERL-CI, to Patrick M. Tobin, Acting Director, Criteria and Standards Division. Recommended Operating Parameters, Past Performance Reliability Considerations, and Similarity Considerations for VULCANUS I and II. August 10, 1983.

> Memorandum from Marcia E. Williams, Acting Director, Office of Toxic Substances to Patrick M. Tobin, Acting Director, Criteria and Standards Division. Waiver of a PCB Trial Burn for the VULCANUS II. July 9, 1983.

Because of the determination that the equipment on both vessels is the same, the operating conditions specified in the permit for the M/T VULCANUS II (HQ 83-002) when it is incinerating TCDD and PCBs are the same as those used in the permit for the M/T VULCANUS I (HQ 83-001).

(3) Environmental Studies at the Gulf Incinerator Site

In addition to the studies of the efficiency of the incinerator systems, EPA has conducted environmental monitoring studies in conjunction with the research permits. These studies include both air and water quality monitoring and are summarized below.

(i) Water quality studies

During the 1974-1975 incineration in the Gulf of Mexico of the Shell Chemical Company's organochlorine wastes on the M/T VULCANUS I, monitoring was conducted from airplanes and onboard two research vessels (ORCA and OREGON II owned by NOAA and the Scripps Institute of Oceanography, respectively). The incineration plume near the M/T VULCANUS I was monitored by aerial photography and the air was sampled from an Environmental Monitoring Systems Laboratory (EMSL), Las Vegas aircraft which followed and periodically contacted the vessels' incinerator plume. Dye tests were run to determine water current patterns and diffusion rates, and samples of marine organisms (plankton) were collected for identification and analysis. Surface water was collected under the plume and analyzed for organochlorine content, pH, chlorinity, trace metals, chlorophyll and adenosine tri-phosphate (ATP) levels. No PCBs or other organochlorines were detected and there were no noticeable effects on marine life due to the incineration operations. Additional information on these studies may be found in:

U.S. EPA, Disposal of Organochlorine Wastes by Incineration at-Sea, 1975. (EPA-430/9-75-014).

During the August 1982, incineration of PCBs on the M/T VULCANUS I under Research Permit HO 81-002, TerEco personnel, under contract to EPA, conducted a 4-day baseline or pre-burn cruise to the Gulf Ocean Incineration Site to check on the environmental conditions at the site prior to the incineration of PCB wastes and to launch two pelagic biotical ocean monitors (P-BOM's). In August, they participated in the

monitoring cruise during which time they launched five P-BOM's, three of which were impacted by the fallout of the plume from the M/T VULCANUS I, and two of which served as controls. Three species of marine organisms were exposed in each P-BOM and were processed for laboratory analyses while still aboard the OSV ANTELOPE (an EPA owned and operated research vessel).

Laboratory analyses involved determining the concentrations of PCBs in the surface waters, in collectors placed on each P-BOM, in neuston, and in the tissues of Menidia beryllina and Fundulus grandis (both finfish). No increase in ambient water background levels of organochlorines was detected from the incineration. Results show that Fundulus and Menidia did not accumulate additional PCBs above their background levels. The core of the monitoring effort centered in determining the adenylate energy charge (AEC) of test (exposed to fallout plume) and control individuals of the above species and the grass shrimp Palaemonetes/pugio. Although the results of AEC calculations revealed that all three species suffered some stress during their stay on the ship and their exposure in the P-BOM's, it was concluded that plume contact from the incineration of PCB wastes could not have caused this physiological reaction. The more likely cause was the stress caused by the long delay in deciding upon the vessel's departure and the related long period that the test organisms had to stay in crowded conditions.

Metabolic enzyme analyses carried out on Fundulus tissues compare favorably with results obtained by TerEco in other environmental studies. No evidence was generated that related any metabolic change in test animals directly to the incineration process. This study is reported in greater detail in:

U.S. EPA, Monitoring Results and Environmental Impact on the Gulf of Mexico Incineration Site from Incineration of PCB's Under Research Permit HQ 81-02. April 1983. Appendix V.

(ii) Air Monitoring Studies

In a 1978 report to EPA, monitoring data obtained from the Shell at-sea incinerations in 1974-1975 and in 1977 and mathematical modeling were used to describe the plume formed during incineration. Simulation plume models estimating the maximum hydrochloric acid, organohalogens and metal oxides released from the plume to the air and to the water were compared to actual observations. The report indicated a strong correlation between the simulation models and actual observations. There was no increase in ambient air concentrations of organochlorines in the vicinity of the vessel or wherever the plume contacted the water surface. These findings are described in:

U.S. EPA, Environmental Assessment: At-Sea Incineration and Land Based Incineration of Organochlorine Wastes. Prepared by TRW, Inc., under Contract No. 68-02-2660 (EPA-600/2-78-087).

Similar results were also documented in:

U.S. Department of State and EPA, Final Environmental Impact Statement for Incineration of Wastes At Sea, Under the 1972 Ocean Dumping Convention, 1979.

Michael Guttman, et al., Ambient Air Monitoring of the August 1982, M/T VULCANUS PCB Incineration at the Gulf of Mexico Designated Site, La Jolla, California, JRB Associates, January 1983.

In this latter report, JRB Associates using EPA's survey vessel OSV ANTELOPE as a sampling platform, tracked the incineration plume and collected ambient air samples for PCB measurement. The primary objective was to determine if any detectable amounts of fugitive PCBs or organochlorine residues from the incineration process could be found in the atmosphere. Using a dispersion model to predict plume location and guide the sampling, a secondary objective was to check the model's validity using hydrogen chloride (HCl) from the incineration process as a tracer.

Results from the baseline survey indicated only trace amounts of air-borne organic materials, and no organochlorines were present. By comparison, during the incineration monitoring significantly higher amounts of air-borne organics were measured, but again no PCBs or other organochlorines were detected. Presumably, the elevated airborne organics were generated by combustion on the M/T VULCANUS I, either from the waste incineration or from the vessel's engines. Real-time HCl monitoring assured that the incineration emission plume generated by the M/T VULCANUS I was being sampled. Although there were discrepancies between measured airborne HCl levels and distributions predicted by the model, agreement between the two was relatively good considering the uncertainties involved in modeling atmospheric stability.

A report prepared by the Texas Air Control Board furnished monitoring data for incineration plume remnants at several shore locations taken during the test burn of PCBs in August 1982. The Texas Air Control Board used special high volume air samplers with glass fiber pre-filters and polyurethane foam plugs to collect particulate and gaseous PCBs, chlorinated dibenzodioxins, and chlorinated dibenzofurans. Based on trajectory forecasts, it was estimated that the plume from the M/T VULCANUS I would impact only one of the samplers over one 48 hour period during the 339 hours of sampling conducted during the burn period from August 16-28, 1982. Gas chromatographic (GC) and gas chromatographic/mass spectrometric (GC/MS) analysis of the foam plugs and pre-filters collected during the burn and post-burn sampling did not indicate the presence of PCBs, other organochlorine compounds, or hydrochloric acid. Further discussion of these tests may be found in:

Texas Air Control Board, Report on Air Sampling for PCB's Along the Texas Gulf Coast During Incineration Operations Conducted by the M/T VULCANUS I, April 1983.

In summary, based on the studies of the wastes, the incineration systems on the M/T VULCANUS I and M/T VULCANUS II and the effects of incineration on the incineration site, EPA has concluded that:

- adequate studies have been conducted in accordance with 40 CFR 220.3(f);
- the incinerators onboard the M/T VULCANUS I and M/T VULCANUS II have demonstrated a destruction efficiency of at least 99.99 percent on the compounds proposed for incineration;

- no short term increases have been found in background concentrations of organochlorines in the water, and no short term effects have been found on water chemistry or biota exposed to the plume in the vicinity of the vessels; and

- air monitoring studies indicate no air borne emissions of PCBs or other organochlorine residues from the incineration process.

(b) Subpart R - Environmental Impact

Subpart B, Sections 227.5 - 227.13 of the Ocean Dumping Regulations sets forth specific environmental impact prohibitions, limits and conditions for the dumping of materials in the ocean. Section 227.4 states that "if the applicable prohibitions, limits and conditions are satisfied, it is a determination of EPA that the proposed disposal will not unduly degrade or endanger the marine environment and that the disposal will present:

- "No unacceptable adverse effects on human health and no significant damage to the resources of the marine environment;
- "No unacceptable adverse effect on the marine ecosystem;
- "No unacceptable adverse persistent or permanent effects due to the dumping of the particular volumes or concentrations of these materials; and
- "No unacceptable adverse effect on the ocean for other uses as a result of direct environmental impact."

The analyses used in making that determination follow.

(1) Section 227.5 Prohibited Materials

"The ocean dumping of the following materials will not be approved by EPA... under any circumstances:"

- "High-level radioactive wastes as defined in §227.30;"
- "Materials in whatever form (including without limitation, solids, liquids, semi-liquids, gases or organisms) produced or used for radiological, chemical or biological warfare;"

"° Materials insufficiently described by the applicant in terms of their compositions and properties to permit application of the environmental impact criteria of this Subpart B;"

"° Persistent inert synthetic or natural materials which may float or remain in suspension in the ocean in such a manner that they may interfere materially with fishing, navigation, or other legitimate uses of the ocean."

The incineration at-sea permits specifically prohibit these materials from the wastes to be incinerated. There are a number of provisions in the permits which will ensure that these prohibited materials are not included in the wastes. As discussed earlier, prior to loading the wastes onto the vessel, the Permittees must analyze the wastes in accordance with EPA-approved procedures in EPA-approved laboratories. The Waste Sampling and Analyses Procedures included in Appendix A of the permits are the analytical protocols that must be followed by the Permittees in analyzing their wastes. These protocols require identification of quantifiable concentrations of the chemical classes of the constituents. This is sufficient analytical detail to ensure that prohibited materials are not in the wastes. In addition, through the Permit Program Manager, EPA may authorize a duplicate sample be taken by EPA or an EPA-authorized representative from the blending/holding tanks, from the vessels' or dockside storage tanks to verify the original chemical analyses submitted by the Permittees. Loading of the vessel and incineration of the wastes are authorized only after EPA is certain that the wastes do not contain prohibited or restricted materials.

(2) Section 227.6 - Constituents prohibited as other than trace contaminants

Subpart B, 40 CFR 227.6(a) also prohibits the dumping of organohalogens, mercury and mercury compounds, cadmium and known carcinogens, mutagens or teratogens, except as trace contaminants. Section 227.6(h) states that the prohibitions and limitations of Section 227.6(a) do not apply "for the granting of permits for the transport of these substances for the purpose of incineration at-sea, if the applicant can demonstrate that the stack emissions consist of substances which are rapidly rendered harmless by physical, chemical or biological processes in the sea." These requirements are to be established on a case-by-case basis.

The regulations do not define the criteria for determining whether stack emissions are rapidly rendered harmless. However, Annex 5, Regulation 5.2.1 of the London Dumping Convention states, "based on current scientific knowledge on the environmental effects of incinerating liquid organochlorine compounds, substances are rapidly rendered harmless if the Regulations and Technical Guidelines are observed." These Regulations and Technical Guidelines contain specific operating parameters for the incinerators. As discussed under "Compliance with the London Dumping Convention," and shown in Table 3, "Hazardous Waste Incineration: Comparison of At-Sea and Land-based Requirements", page 88, the requirements of the incineration at-sea permits are equivalent to or more stringent than the requirements of London Dumping Convention.

In addition, the permits prohibit the incineration of wastes containing compounds with heats of combustion less than that of the principle organic hazardous constituent (POHC) for which the incinerator demonstrated at least a 99.99 percent destruction efficiency. This prohibition means that all compounds in the wastes should be destroyed to at least 99.99 percent efficiency and any emissions from incineration will be rapidly rendered harmless, as required in Section 227.6(h).

As discussed later in this part, modelling studies also indicate that if the destruction efficiency on the organic compounds is at least 99.99 percent, the emissions from the incinerator meet all the conditions necessary to establish that they are rapidly rendered harmless.

Therefore, EPA concludes that the stack emissions will not contain any prohibited constituents in Section 227.6(a) except as trace contaminants which are "rapidly rendered harmless" as provided for under Section 227.6(h) and in accordance with the Regulations and Technical Guidelines of the London Dumping Convention.

(3) Section 227.7 - Limits established for specific wastes or waste constituents

Section 227.7 establishes additional limitations on certain materials for these materials to be acceptable for ocean dumping. The permits comply with this section as follows:

(i) Section 227.7(a). Incinerating the entire waste mixture to the required 99.9 combustion efficiency is more than sufficient to assure that the trace contaminants in the emission when they reach the water are totally soluble.

(ii) Section 227.7(b). The permits do not allow the incineration of containerized wastes. Therefore, the provision that low level radioactive materials be containerized is not applicable.

(iii) Section 227.7(c). The gaseous emissions are sterile and therefore do not contain living organisms.

(iv) Section 227.7(d). The stack emissions contain hydrochloric acid but in amounts which EPA has determined are rapidly neutralized by the ocean after allowance for initial mixing as defined in 40 CFR 227.29.

(iv) Section 227.7(e). The gaseous emissions contain no biodegradable constituents or constituents which consume oxygen in any fashion.

(4) Section 227.8 - Limitations on disposal rates of toxic wastes.

Section 227.8 states that "no wastes will be deemed acceptable for ocean dumping unless such wastes can be dumped so as not to exceed the limiting permissible concentrations as defined in Section 227.27. Limiting permissible concentration is defined as "that concentration of a constituent which, after allowance for initial mixing as defined in Section 227.29, does not exceed applicable marine water quality criteria..." or where there are no marine water quality criteria, that concentration of a waste which ... "will not exceed a toxicity threshold defined as 0.01 of a concentration shown to be acutely toxic to appropriate sensitive marine organisms in a bioassay carried out in accordance with approved EPA procedures."

To determine the maximum concentration of metals which could be included in a waste mixture so that the resulting emissions reaching the water would not exceed applicable marine water quality criteria or the limiting permissible concentration, a model was developed for EPA that was more stringent than necessary to comply with Section 227.9 for initial mixing. The model used a combination of a mixing zone model and a plume dispersion model. This model was then used to calculate the maximum concentrations of metals in the stack gases to ensure that the marine water quality criteria for the metals would not be exceeded. It was then possible to determine the maximum concentration of metals in the wastes so that the marine water quality criteria were not exceeded as a result of incinerating the wastes. A full discussion of the model may be found in:

> JRB Associates. Permissible Metal, PCB, and Dioxin Concentrations in Incineration Waste Material. Report submitted under EPA Contract No. 68-01-6388, Work Assignment No. 37, September 1983.

Other than silver, which the model indicated should not exceed 20 ppm in the waste mixture and mercury, which should not exceed 9 ppm, metals could be in significantly higher concentrations than the 100 ppm requirement included in the proposed permit and still would not exceed the marine water quality criteria for each of the metals. However, EPA has retained the 100 ppm concentration limit for each of the metals other than for silver and mercury, in recognition of the modelling uncertainties and until long term monitoring can verify that emissions of trace amounts of metals indeed have no impact on the environment.

Only after substantial long term monitoring, will EPA evaluate all the data and seek public input to determine if these allowable metal concentrations in waste can be relaxed.

A similar set of models was used to document that trace quantities (if any) of TCDD and PCBs which might be released in the stack gases would not cause the marine aquatic life no effect level or the marine water quality criterion to be exceeded. TCDD and PCB were chosen as surrogates for all organic compounds because TCDD and PCBs are among the most toxic, persistent and bioaccumulative of all the organic compounds. The model showed that if TCDD and PCBs were in concentrations of 2 ppm and 35 percent or less, respectively, and if TCDD was destroyed to 99.93 percent efficiency and PCBs were destroyed to at least 99.99 percent efficiency, any surviving TCDD or PCBs emitted in the incinerator plume would result in ambient marine water concentrations of TCDD and PCBs below the marine aquatic life no effect level or the marine water quality criterion for TCDD and PCB, respectively, which is below the limiting permissible concentrations as required in 40 CFR 227.27. In fact, after incineration and mixing of surviving PCBs in the water, PCBs were not detected in concentrations beyond background levels. This determination was based on the environmental monitoring conducted in conjunction with the August 1982, trial burn. Based on these studies, TCDD and PCBs may be included in the wastes in concentrations no greater than 2 ppm and 35 percent by weight, respectively.

The special permits do not require that destruction efficiency be determined for constituents on each load of wastes that are incinerated. However, from time-to-time, the Permit Program Manager

may request that the Permittees sample and analyze the wastes and emissions to verify that the operating conditions established in the special permits achieve the performance standard of 99.99 percent destruction efficiency. The special permits do require that a performance standard of at least 99.9 percent combustion efficiency be attained on each load of wastes incinerated. Based on EPA's accumulated experience and judgment, a combustion efficiency of at least 99.9 percent on the entire load of mixed chemical wastes corresponds to destruction efficiencies of at least 99.99 percent on compounds with heats of combustion greater than the POHCs tested. Combustion efficiencies are continuously calculated on each incineration cruise. Therefore, EPA concludes that the permits will result in emissions below the limiting permissible levels as required in Section 227.8.

(5) Section 227.9 - Limitations on quantities of waste materials

The permits are consistent with Section 227.9 because the quantity of material in the emissions will not damage the ocean environment or reduce its amenities. Monitoring conducted thus far shows no detectable adverse environmental impact, as shown in the foregoing discussion of environmental monitoring conducted at the site. As a precaution, EPA is restricting, at this time, the use of the Gulf Incineration Site and any other site which is designated to one vessel at a time. This is being done for navigational safety and until the Agency evaluates the monitoring data from the site. This does not mean that only one Permittee may use a site. Rather, EPA will assure that there is an equitable distribution of the use of a site among all Permittees.

EPA, in cooperation with the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce, has developed a monitoring strategy to measure the long-term impacts on human health and the marine environment associated with the incineration at-sea of mixed liquid organic wastes. Measurements for the strategy include both atmospheric and ambient physical, chemical and biological analyses of the marine environment. The monitoring strategy is designed to produce generic and site-specific long-term monitoring plans that can be used both as predictive tools for identifying potential areas of environmental impact and, if necessary, for triggering permit modifications. The computer models generated for the implementation of the strategy will be sufficiently flexible to predict cumulative effects of multiple vessel and long-term burns.

(6) Section 227.10 - Hazards to fishing, navigation, shorelines or beaches

The permits meet the requirements of Section 227.10. The location of the incineration site was specifically chosen because it is removed from fishing areas and it is outside of the normal shipping fairways for commercial and recreational vessels. As the monitoring data discussed earlier indicate, the emissions pose no threat to fishing, navigation, shorelines or beaches. The characteristics of the site are discussed in detail later in the FINDINGS.

(7) Sections 227.11 - Containerized wastes; Section 227.12 - Insoluble wastes; Section 227.13 - Dredged material

Sections 227.11, 227.12, and 227.13 are not applicable to the incineration at-sea permits because the permits do not authorize the incineration of containerized wastes or dredge material. The emissions from incineration are below limiting permissible levels, which complies with the criteria for soluble wastes established in Section 227.12.

Based on the above analysis, EPA has determined that the incinerator emissions will meet the criteria of Subpart B and that the proposed release of the emissions to the marine environment will not unduly degrade or endanger the marine environment.

Section 227.2(a) provides that if the applicants' wastes satisfy the environmental impact criteria in Subpart B, a permit will be issued unless:

(1) There is no need for the dumping, and alternative means of disposal are available, as determined in accordance with the criteria set forth in Subpart C; or

(2) There are unacceptable adverse effects on esthetic, recreational or economic values as determined in accordance with the criteria set forth in Subpart D; or

(3) There are unacceptable adverse effects on other uses of the ocean as determined in accordance with the criteria set forth in Subpart E.

The remaining sections of this part discusses EPA's determination that there is a need for ocean dumping, that there are no unacceptable impacts on esthetic, recreational or economic values of the ocean and that there are no unacceptable adverse effects on other uses of the ocean.

(c) Subpart C - Need for Ocean Dumping

Subpart C of Part 227 (40 CFR 227.14-.16) states the basis on which an evaluation will be made of the need and the alternatives to ocean dumping. Section 227.15 lists the factors to be considered in determining the need for dumping, and section 227.16 lists the determinations that must be made, after thorough evaluation of those factors. The determinations that must be made include:

"(1) There are no practicable improvements in process technology or overall waste treatment to reduce the adverse impact of the waste in the total environment;

"(2) There are no practicable alternative locations or methods of disposal or recycling available, including without limitation storage until treatment facilities are completed, which have less adverse environmental impact or potential risk to other parts of the environment than ocean dumping" (Emphasis added).

Section 227.16 (b) defines practicable as "...available at reasonable incremental cost and energy expenditures, which need not be competitive with the costs of ocean dumping..."

The determinations and the factors to be considered in making the determinations are discussed below.

1. There are no practicable improvements in process technology or overall waste treatment to reduce the adverse impact of the waste on the total environment.

Section 227.15 lists two factors which are pertinent to this determination. EPA's analyses of each factor is presented below.

(i) Degree of treatment useful and feasible for the waste to be dumped, and whether or not the waste material will be treated to this degree before dumping.

EPA has determined that incineration of the mixed liquid organic wastes under the terms of this permit constitutes a very effective means of treating those wastes. As is explained elsewhere in this document, incineration at-sea will result, at a minimum, in the destruction of 99.99 percent of each of the organic constituents contained in the waste. Thus, the amount "dumped" in the sense of actually being released to the environment will consist of only a very small fraction of the wastes. The by-products of the incineration process consist of hydrochloric acid, carbon dioxide, carbon monoxide, water vapor and trace amounts of metal oxides, silicate ash, and may additionally consist of trace quantities of surviving organic compounds and partially combusted organic compounds. Surviving waste constituents (metallic oxides or organic by-products of incomplete combustion) comprise no more than 0.1 percent of the emissions. Although not completely destroyed, the incineration process degrades surviving organic compounds by lowering their molecular weight and their chlorine content. As a result, these products of incomplete combustion are less toxic than the original compounds. As discussed earlier, all the emissions, including products of incomplete combustion, will be below the limiting permissible level, which ensures that the marine water quality criteria or, the marine aquatic life no effect level are not exceeded and therefore are rapidly rendered harmless as required in Section 227.6(h).

The permit does not require treatment of the wastes before being loaded onto the vessels for incineration because EPA is unaware of any treatment method for the wastes which would be useful, in terms of further reducing the potential impact of the emissions from ocean incineration. Therefore, EPA concludes that the wastes will be treated to an appropriate degree prior to their release to the environment.

(ii) "Raw materials and manufacturing or other processes resulting in the waste, and whether or not these materials are essential to the provision of the applicant's goods and services, or if other less polluting materials or processes could be used."

In evaluating this factor, EPA is asked to consider changes in raw materials, manufacturing, or other processes which, if used, would reduce the amount of wastes generated and the need for ocean dumping. By its nature, this factor applies only to actions which could be taken before the wastes are generated; it cannot apply to wastes which have already been generated. Waste reduction is thus inapplicable to wastes which are stored and awaiting incineration under these permits (approximately one million gallons), but could be applied to the wastes yet to be generated which, over the term of the permit, might be incinerated (approximately, an additional 78 million gallons).

It is difficult to address waste reduction alternatives with much specificity because of the large number of different processes used in generating the wastes covered under this permit. As the Office of

Technology Assessment* points out, there are several ways to reduce the amount of waste generated:

- source segregation or separation
- process modification
- end-product substitution
- material recovery and recycling

No one method provides the ultimate means of reducing the volume of wastes. Often these approaches are used simultaneously or sequentially.

Source segregation is the simplest and probably the least costly method of reducing waste volume. This approach avoids the contamination of large volumes of nonhazardous waste by segregating hazardous from non-hazardous constituents and forming a concentrated hazardous waste. Implementation of this method can be accomplished in a short-to-medium time period by individual generators.

Process modifications are, in general, made on a continuous basis in existing plants to increase production efficiencies, to make product improvements, and to reduce manufacturing costs. These modifications include relatively small changes in operational methods, such as a change in temperature, pressure, or raw material composition, as well

*Office of Technology Assessment. Technologies and Management Strategies for Hazardous Waste Control. Washington, D.C., GPO, March 1983

as major changes such as the use of new processes or equipment. Although a manufacturing process often may be used in several plants, each facility has slightly different operating conditions and designs. Thus, a modification resulting in hazardous waste reduction in one plant may not be applicable industrywide. Proprietary concerns have inhibited the transfer of information on process changes and the use of process modifications to reduce hazardous wastes.

End-product substitution is the replacement of hazardous waste-intensive products, that is, industrial products the manufacture of which involves significant hazardous waste, by a new product the manufacture of which would eliminate or reduce the generation of hazardous waste. This is a long-term effort. As the Office of Technology Assessment points out, the general problems with this method are:

- Not all of the available substitutes avoid the production of hazardous waste.
- Substitution may not be possible in all situations.

A change in consumer behavior may motivate product changes, but if the only benefit is the reduction of potential adverse effects on human health or the environment other incentives may be needed to accomplish end-product substitution, such as tax incentives, regulations, limitation of raw materials, etc.

Recovery and recycling are often used together but technically they are different. Recovery involves the separation of a substance from a mixture. Recycling is the use of such a material recovered from the mixture. Recovery and recycling are usually considered a waste reduction method; however, in the Ocean Dumping Regulations, recycling also must be examined as an alternative to incineration at-sea.

Therefore, except for the summary in Table 1 below comparing the four reduction methods, recovery and recycling is discussed in the analysis of the alternatives to ocean dumping.

EPA believes that there is a high potential for the use of new processes and technologies to substantially reduce the amount of hazardous waste generated in this country. At present, however, the Agency is unaware of any technological modifications which would substantially reduce the amount of wastes generated over the period of the permits. While waste reduction technologies need to be encouraged, the timing of their implementation is a factor to be considered in evaluating the need for ocean dumping under this permit. Even if there were changes which were known and could be made in all the processes involved in generating the wastes covered by the proposed permit, these process changes, product substitutions, recovery operations, etc., take time to implement. General adoption of the changes discussed may take years. EPA generally is supposed to take action on a permit within 180 days of a completed application. Unless public comments on the proposed permits demonstrate that there are generally available waste reduction technologies applicable to the wastes that are to be incinerated under this permit, EPA will not deny these permits <u>solely</u> on the premise that in the future these technologies may be available. However, as changes in technology and process design occur, EPA will evaluate these alternatives for each new permit, or renewal, according to the availability of the process and raw material alternatives known at that time.

Table 1 - A Comparison of the Four Reduction Methods

Advantages	Disadvantages
SOURCE SEGREGATION OF SEPARATION	
1) Easy to implement; usually low investment	1) Still have some waste to manage
2) Short-term solution	
PROCESS MODIFICATION	
1) Potentially reduce both hazard and volume	1) Requires R&D effort; capital investment
2) Moderate-term solution	2) Usually does not have industrywide impact
3) Potential savings in production costs	
END PRODUCT SUBSTITUTION	
1) Potentially industrywide impact-large volume, hazard reduction	1) Relatively long-term solutions
	2) Many sectors affected
	3) Usually a side benefit of product improvement
	4) May require change in consumer habits
	5) Major investments required - need growing market
RECOVERY/RECYCLING	
° In-plant	
1) Moderate-term solution	1) May require capital investment
2) Potential savings in manufacturing costs	2) May not have wide impact
3) Reduced liability compared to commercial recovery or waste exchange	
° Commercial recovery (offsite)	
1) No capital investment required for generator	1) Liability not transferred to operator
2) Economy of scale for small waste generators	2) If privately owned, must make profit and return investment
	3) Requires permitting
	4) Some history of poor management
	5) Must establish long-term sources of waste and markets
	6) Requires uniformity in composition
° Waste Exchange	
1) Transportation costs only	1) Liability not transferred
	2) Requires uniformity in composition of waste
	3) Requires long-term relationships-two-party involvement

SOURCE: Office of Technology Assessment.

The second determination to be made is:

(2) There are no practicable alternative locations and methods of disposal or recycling available, including without limitation, storage until treatment facilities are completed, which have less adverse environmental impact or potential risk to other parts of the environment than ocean dumping.

Section 227.15 lists two factors which must be examined in making the above determination. The factors are:

(i) The relative environmental risks, impact and cost for ocean dumping as opposed to other feasible alternatives including but not limited to:
(A) Land-fill;
(B) Well injection;
(C) Incineration;
(D) Spread of material over open ground;
(E) Recycling of material for reuse;
(F) Additional biological, chemical, or physical treatment of intermediate or final waste streams;
(G) Storage

(ii) Irreversible or irretrievable consequences of the use of alternatives to ocean dumping.

Before discussing each of these factors, a relevant question to ask is how much hazardous waste must be disposed of? Uncertainty pervades as to how much hazardous waste is generated in the United States each year. Estimates range from 41 to 275 million metric tons depending on the definition of hazardous wastes used. Recently, EPA has estimated that 150 million metric tons of wastes regulated by the Agency were generated in 1981.

Many States define hazardous wastes more broadly than EPA. High BTU wastes burned in commercial and industrial boilers and wastes from small generators (less than 1 ton per month) are exempted from EPA's

estimates. The Association of State and Territorial Solid Waste Management Officials recently surveyed the States for the study by the Office of Technology Assessment referenced earlier. That survey indicated that, based upon the State's definitions, 255 to 275 million tons of hazardous waste are generated annually.

There is, in fact, no "one" method of disposal which is effective for all hazardous wastes generated in the United States. EPA's analysis of each of the factors is in terms of liquid hazardous wastes similar to those which would be destroyed under incineration at-sea permits.

(i) The relative environmental risks, impact and cost for ocean dumping as opposed to other feasible alternatives including, but not limited to:

(A) Land fill

Nationwide, EPA has estimated that almost 95 percent of the hazardous wastes generated are managed at the site where they are produced. Of the wastes disposed of by industry, as much as 95 percent of the hazardous wastes are disposed of on land. In the Gulf Coast Region, which has approximately 21 percent of the nation's hazardous waste generators, use of land disposal varies among the States as it does nationwide. In Louisiana, 97 percent of the wastes are managed onsite. Of the three percent disposed of offsite, 50 percent of these wastes are disposed of on land. In Texas, 95 percent of all hazardous wastes generated are disposed of on land.*

* ibid Office of Technology Assessment p. 8

Virtually any waste can be physically buried in a landfill. However, as the Office of Technology Assessment pointed out, landfills are not effective in controlling the migration of liquid wastes. Landfilled wastes that are toxic, persistent, soluble, and volatile present significant risk to human exposure.*

The scientific community, the public, Congress and several States are beginning to doubt the long-term safety and reliability of even the most advanced landfills for the type of liquid hazardous waste that the Applicants seek to incinerate. Congress is considering legislation to ban the disposal of highly toxic wastes on land (see Senate bill, S. 757 and House bill, H.R. 2867). In addition, as Table 2 summarizes, several States are active in banning or restricting land disposal of hazardous wastes.

Table 2 - Summary of State Activities on Restricting Land Disposal of Hazardous Wastes

State	Legislative Action	Report Required by Legislature	Regulatory Action Draft	Regulatory Action Proposed	Regulatory Action Final
Arkansas					X
California	X	X			X
Illinois	X				
Louisiana	X (proposed)				X
Maryland					
Massachusetts			X		
Minnesota	X		X	X	
Missouri					X
New York	X	X			
Ohio	X				
Pennsylvania					X
Rhode Island					X
Wisconsin	X	X			

Source: Office of Solid Waste, U.S. EPA

* ibid Office of Technology Assessment p. 175

An extensive study is currently being undertaken by EPA's Office of Solid Waste to define the hazards of various types of wastes, identify the wastes found to be inappropriate for land disposal, identify alternative disposal technologies, and assess the respective capacities and environmental acceptability of such technologies.

In EPA's judgment, the environmental risks associated with the incineration at-sea of liquid organic compounds are significantly less than those associated with landfilling of liquid organic compounds.

(B) Well injection

Injection of liquid waste into subsurface formations is a technology that uses porous sedimentary strata to hold liquid waste. Essentially, underground injection entails drilling a well to the depth required to intersect an appropriate geologic formation (known as the injection zone) and pumping the liquid waste in with pressure sufficient to displace the native fluids, but not so greater as to cause fracturing of the strata and waste migration.

Wells are categorized into five classes (47 FR 4992). Federally defined hazardous liquid waste can be disposed of in Class I or Class IV wells. Class I wells are those wells used for the disposal of municipal and industrial waste liquid which is injected below the deepest underground source of drinking water. Class IV wells are those wells used to inject hazardous liquids into or above a formation that

is within one-quarter mile of a drinking water source. The exact number of these wells is not known. Some Class IV wells are already banned and the Agency has proposed a possible ban on the remainder.

The majority of Class I wells are comparatively deep, that is 600 to 1800 meters (2,000 to 6,000 ft). Disposal at these depths is unlikely to contaminate surface or near-surface water. Technologies for constructing and operating wells for disposal are well established. In general, waste disposal through properly constructed and operated injection wells into deep formations below the lowest drinking water source is much less likely to contaminate surface or shallow aquifers than is waste disposal through landfills. In EPA's judgment the risks associated with incineration-at-sea are no greater than those associated with deepwell injection.

(C) Land-based Incineration

Land-based incineration is permitted under the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act (RCRA) and the regulations found in 40 CFR 264.340-264.351 or in the case of polychlorinated biphenyls (PCBs), the Toxic Substances Control Act (TSCA) and the regulations found in 40 CFR 761.70. Table 3 "Hazardous Waste Incineration: Comparison of At-Sea And Land-Based Requirements," on page 88, compares the major provisions of each of the programs.

As shown in the Table and discussed elsewhere in the FINDINGS, the environmental effects of incinerating at-sea will be no greater than those of incinerating on land. This finding is based on the determination that if at-sea and land-based incinerators each attain a 99.9 percent combustion efficiency and attain a 99.99 percent destruction efficiency or destruction removal efficiency, and adhere to the stipulated operating parameters, at-sea and land-based incinerators are equally effective. In addition, both at-sea and land-based incinerators meet applicable water quality and air pollution standards.

The differences in land-based and at-sea incineration are most apparent in the type of risks involved. Both land-based and at-sea incineration permits require that contingency plans and safety procedures be implemented if there are spills, accidents or other potentially hazardous incidents. In case of catastrophic or periodic malfunctions at land-based facilities, the potential for acute adverse human health and environmental effects is greater due to the close proximity of population centers and areas of environmental concern. However, the ability to fully clean up small spills is greater at land-based facilities.

The risks involved with at-sea incineration vessels are collisions in a harbor or potentially life threatening incidents at-sea which might require jettisoning the cargo. All practicable precautions have been taken, including the design and safety features of a Type II chemical carrier, the "Broadcast to Mariners" warning other ships of the vessel's progress to and incineration at the Gulf site, the preparation and provision for execution of a detailed emergency response (Contingency) Plan, and the location of the Gulf Incineration Site on the continental slope, away from population centers, shipping fairways, and ecologically productive areas.

Because land-based and at-sea incinerators are subject to the same performance standards and the risks involved in each process are comparable, EPA finds that the overall environmental, human health and

safety risks associated with at-sea incineration are no greater than those associated with land-based incineration.

(D) Spread of material over open ground

Spreading liquid hazardous wastes on open land is not a viable alternative. If disposed of in this manner, the wastes could easily contaminate water supplies or, through air transport of volitile components, could directly affect human health.

(E) (Recovery and) Recycling of Material for Reuse

Recovery and recycling are not new industrial practices. In certain instances they are an excellent way of reducing the volume of hazardous waste. If extensive recovery i.e., the separation of a substance from an effluent is not required prior to recycling a waste constituent, in-plant operations are relatively easy. But as is shown on Table 1, on page 61, capital investment is normally required to implement recycling processes. In many industrial processes, recovery and recycling it is not yet a viable alternative.* Complex component separation techniques such as reverse osmosis are being investigated for application to organic liquids. These are generally expensive operations and have not been applied commercially. However,

* ibid. Office of Technology Assessment p. 148

distillation and evaporation, though energy intensive, are used commercially on organic liquids.

Chlorinolysis, which uses a chemical transformation process on chlorocarbon waste, is an emerging technology. However, the process is capital intensive, requires a pure waste stream and, as the Office of Technology Assessment* points out, is a limited option because there is an insufficient U.S. market for carbon tetrachloride, the major end-product of chlorinolysis.

While stricter disposal regulations, or prohibitions of certain disposal practices (i.e. landfilling) for particular wastes, might increase the attractiveness of both in-plant and commercial recovery/ recycling facilities, storing hazardous wastes longer than 90 days requires a permit. This permit requirement may discourage recycling if large quantities of a waste must accumulate (for economic reasons) from different generators prior to recycling or recovery. A further disincentive to commercial recovery and recycling is that until recovery and recycling is complete, the generator cannot transfer his liability for the waste to the recycling operator.

EPA believes that recovery and recycling is an environmentally preferable option to incineration at-sea and other hazardous waste disposal options. Over the period of the permits, however, EPA is unaware of any generally applicable technological modifications which

*ibid. Office of Technology Assessment p. 214

would substantially increase the applicability of this option to the type of wastes to be incinerated.

(F) Additional biological, chemical, or physical treatment of intermediate or final waste streams

As indicated above, EPA is unaware of any commercially available, practicable treatment that could supplement incineration to make the emissions more environmentally acceptable.

(G) Storage

Storage postpones and delays for future generations the inevitable need to dispose of the wastes. Were storage the only option, huge areas would be required. While storage of hazardous wastes for over 90 days requires a RCRA permit and implementation of safety measures, these requirements do not alleviate the potential for leakage and adverse effects on human health and the environment. As a result, EPA does not believe that storage is a viable alternative to incineration at-sea.

(ii) Irreversible or Irretrievable Consequences of the Use of Alternatives to Ocean Dumping

Section 227.15(d) asks EPA to evaluate the irreversible or irretrievable consequences of using the alternatives just described in (i)(A)-(G). The irreversible consequence of land-based incineration is

similar to that of ocean incineration. Only trace amounts of uncombusted materials are discharged to the environment.

Landfills require, as a practical matter, the restriction of land areas from other uses for an indefinite period, as many of these wastes are likely to remain hazardous for a long time. Landfills also pose the potential threat of contaminating surface or ground waters at some future time. While cleanup of contaminated ground water is technically possible, as a practical matter the cleanup is very difficult and in some cases is prohibitively expensive. The advantage of incineration is that the wastes for all practical purposes are destroyed completely.

There are risks associated with the land-based and at-sea incineration alternatives. EPA does not believe that at-sea incineration has any greater irreversible or irretrievable consequences than the other alternatives. Therefore, based on the forgoing analysis of the factors to be considered in determining the need for ocean dumping, EPA finds that:

(1) There are no practicable improvements which can be made in process technology or in overall waste treatment to reduce the adverse impacts of the waste released to the environment from the incineration at-sea emissions.

(2) There are no practicable alternative locations and methods of disposal or recycling available which have less adverse environmental impact or potential risk to other parts of the environment than incineration at-sea.

(d) Subpart D - the Impact of the Emissions on Esthetic, Recreational and Economic Values; Subpart E - the Impact of the Proposed Ocean Dumping on Other Uses of the Ocean

In order to evaluate the impact of incineration at-sea on esthetic, recreational and economic values, and on other uses of the ocean included in Subparts D and E of Part 227, EPA reviewed the basis for designating the Gulf Incineration Site, the area where the incineration activities will be carried out under these permits. By their nature, Subparts D and E of Part 227 are dependent on the characteristics of the site where the incineration is to take place as well as on the effects of the incineration emissions on the site. Therefore, this discussion begins by focusing on the criteria which were considered in the designation of the Gulf Incineration Site.

(1) The Gulf Incineration Site

The Gulf Incineration Site was designated as an ocean disposal site for high temperature incineration at-sea of mixed liquid organic wastes on September 15, 1976 (41 FR 39319). The Gulf Site was the first site designated because the initial experimental incineration at-sea permits were granted to waste generators from the Gulf Coast region. The Site was redesignated on April 26, 1982 (47 FR 17817).

The Gulf Incineration Site lies 315 kilometers south, southeast of Galveston, Texas, and 350 kilometers south, southwest of Cameron,

Louisiana. It occupies approximately 4900 square kilometers in the Gulf of Mexico.* The water depth at the site's center is approximately 1,375 meters (4,500 feet).

Sites for incineration at-sea are designated through a rulemaking procedure. The criteria and procedures for designating sites are found in 40 CFR Part 228. In evaluating potential sites, initial consideration is given to those areas where:

- there would be minimal interference with existing fisheries and shellfisheries or regions with heavy commercial or recreational navigation, and
- temporary changes in water quality or other environmental conditions during initial mixing are expected to be reduced to normal ambient seawater levels or undetectable contaminant concentration or effects before reaching beaches, shorelines, or marine sanctuaries.

For those areas meeting the criteria in 40 CFR 228, a draft Environmental Impact Statement (EIS) is prepared and made available for public comment with the notice proposing the site. A final EIS is made available at the time of final site designation.

Under research permits, air and water quality monitoring studies were conducted to assess the impact on the marine environment of incinerating organochlorine wastes at-sea. A designated Site is not

* The coordinates of the Gulf Incineration Site are:

Latitude	Longitude
26°20'00"N	93°20'00"W
26°20'00"N	94°00'00"W
27°00'00"N	93°20'00"W
27°00'00"N	94°00'00"W

required for a research permit (see 40 CFR 228(4)(b)). For a discussion of these studies conducted at the Gulf Incineration Site, see Environmental Studies at the Gulf Incineration Site at page 38.

The following summary briefly describes the reasons for EPA's determination that the Gulf Incineration Site meets the criteria outlined in 40 CFR 228.6. More detailed information may be found in:

U.S. EPA, Final Environmental Impact Statement. Designation of a Site in the Gulf of Mexico for Incineration of Chemical Wastes. Washington, D.C., July, 1976.

(i) Geographic position, depth of water, bottom topography, and distance from the coast.

The site is positioned over the continental slope of the northern Gulf of Mexico, some 300 kilometers from the nearest coast, where the minimum depth of water is 1100 meters. This satisfies the requirement of Section 228.5, that "EPA will, wherever feasible, designate ocean dumping sites beyond the edge of the continental shelf." Furthermore, the Site is located as near as possible to the industries that produce substantial quantities of highly toxic organic wastes thereby reducing transportation distance and the risks associated with long distance transport of hazardous waste.

(ii) Location in relation to breeding, spawning, nursery, feeding, or passage areas of living resources in adult or juvenile phases.

Available evidence indicates that the waters of the site contain low levels of nutrients, few standing crops of phytoplankton, few larvae of commercially important shrimp species, and few large nektonic species.

(iii) Location in relation to beaches and other amenity areas.

Results of testing indicate no detectable concentrations of pollutants reaching the beaches. The site is so far from shore that only under the most unlikely of physical conditions would products of the incineration process reach Gulf beaches and then only in such high dilution as to be undetectable by even the most advanced chemical analytical techniques.

(iv) Types and quantities of wastes proposed to be disposed of, and proposed methods of release, including methods of detecting the wastes after release.

The results of the research burns demonstrate that combustion efficiencies of greater than 99.9 percent as required in these permits, are achievable. This means that less than 0.1 percent of the waste will be discharged to the environment. The principal products of combustion are hydrochloric acid, carbon dioxide, water vapor, metallic oxides, silicate ash and may additionally contain trace quantities or surviving or partially combusted organochlorines. It has been demonstrated that no detectable deleterious effects on the marine environment have occurred during the incineration of organochlorine wastes.

(v) Feasibility of surveillance and monitoring.

The location of the site poses no special problems of monitoring either from sea or from the air. The configuration of the site has been established congruent with specific Loran* C lines in order to facilitate navigation and surveillance.

The possibility of vessels being involved in an accidental collision at the site is extremely remote. Poor visibility at the site is rare. In addition, the permit allows only one vessel to operate at the site at any one time. A U.S. Coast Guard "Broadcast to Mariners" warns commercial and recreational vessels to not enter the site during the incineration.

(vi) Dispersal, horizontal transport and vertical mixing characteristics of the area, including prevailing current direction and velocity.

Prevailing winds over the site are from the eastern quadrant and are at a velocity such that total atmospheric dispersion of the plume will take place before it reaches land, some 300 kilometers away. This eliminates all but the remotest possibility of any remnants of the incineration plume reaching land areas. Under all but the most unsual wind conditions, the plume touches the sea surface within one to two nautical miles downwind of the incinerator ship, distances well within the site boundaries. In a 100 year period, it is estimated that 43

* The Loran System is a method of precisely determining a geographical position on the ocean.

tropical storms and 26 hurricanes are expected to occur within or very near the incineration site. These storms are predictable far enough in advance so that appropriate action may be taken to suspend or defer ocean incineration operations and thus these metorological events will have minimal effect on incineration at the site.

Current flow at the site prevails to the west or northwest. Water movement in this direction assures additional mixing and travel time before reaching shallow water since these waters enter a counter-clockwise gyre west-northwest of the site.

The depth of the water at the site is more than sufficient to provide adequate mixing for the minute concentrations of organic chemicals possibly being added by the incineration process.

(vii) Existence and effects of current and previous discharges and dumping in the area (including cumulative effects).

The flow and resultant short residence time of the waters at the site precludes the possibility that previous incineration activities could have produced measurable effects upon pelagic life while within the site boundaries. In view of the great depth of water at the site and the nature of the plume fallout, no effects on bottom life will

occur within the site boundaries. Additionally, since no known dumping has previously occurred at the site, the only effects would be from incineration and these have been shown to be nonexistant or negligible.

(viii) Interference with shipping, fishing, recreation, mineral extraction, desalination, fish and shellfish culture, areas of special scientific importance and other legitimate uses of the ocean.

The site is beyond shipping fairways (the site is at least 75 kilometers from the nearest shipping fairway) and the normal reach of recreational vessels. It does not support viable shellfisheries or finfisheries. It is also 90 kilometers or more from the 180 meter bottom contour inshore of which numerous submarine banks of scientific interest, such as the East and West Flow Garden banks, occur.

(ix) The existing water quality and ecology of the site as determined by available data or by trend assessment or baseline surveys, as described in the Guidelines for Ocean Disposal Site Baseline and Trend Assessment Surveys.

Data obtained from earlier studies and from monitoring observations which have been carried out reveal that the water quality at the site is typical of normal ocean Gulf waters both chemically and biologically.

(x) Potentiality for the development or recruitment of nuisance species in the disposal site.

It is unlikely that the growth of nuisance species of any type would be encouraged by incineration at the site in view of the fact that the plume products are sterile, non-nutritive and do not change the water quality.

(xi) Existence at or near the site of any significant natural or cultural features of historical importance.

There are no known natural or cultural features of historical importance located within or near the boundaries of the site.

(2) Subpart D, Part 227 - Impact of the Proposed Dumping on Esthetic, Recreational and Economic Values

This discussion considers, in accordance with the criteria listed in Subpart D of Part 227, the impact of incineration at-sea activities conducted at the Gulf Incineration Site on esthetic, recreational and economic values according to the criteria listed in Subpart D of Part 227. The findings are based on: (1) EPA's knowledge of the incineration site, acquired through the site designation process and by conducting biological and chemical studies at the site during the research permit burns; and (2) EPA's accumulated data and knowledge from monitoring incineration at-sea activities and sampling the stack emissions similar to those that will be discharged as a result of the proposed permit activities.

The factors to be considered and EPA's findings follow.

(i) Nature and extent of present and potential recreational and commercial use of the site affected by the proposed dumping;

The Gulf Site was selected in part because one, it is far from normal commercial shipping fairways, two, it is beyond the reach of most recreational vessels, three, it is low in marine resources of recreational or commercial value, and four, it is sufficiently far from shore to ensure that any trace contaminants from the emission plume are in such minute amounts or are so diluted by the ocean that on-shore or near shore activities would not be affected. Therefore, EPA finds no adverse impact on commercial or recreational activities from incineration at-sea activities.

(ii) Existing water quality, and nature and extent of disposal activities, in the areas which might be affected by the proposed dumping; and

(iii)Applicable water quality standards.

The monitoring data indicate that the water quality at the site is typical of normal oceanic Gulf water. Since the site is more than three miles from the shore, there are no applicable State water quality standards for the site.

As discussed earlier, EPA has found no impact on the quality of the water or on the biota from the emissions due to incineration at-sea activities. However, until EPA can verify through a long term monitoring program that there are no long term impacts from extended incineration at-sea activities, EPA is limiting the use of the Site to one vessel at a time. This will ensure adequate time for mixing and

dilution of any emission products and will allow time for the Site to recover from any potential impacts without overloading and hindering its capability for recovery in future burns. Therefore, EPA does not believe there will be any adverse water quality or biological impacts from incineration at-sea activities.

(iv) Visible characteristics of the materials (e.g. color, suspended particulates) which result in an unacceptable esthetic nuisance in recreational areas.

The contents of the emission plume pose no problem for recreational areas. The hydrochloric acid in the gaseous emissions is neutralized and buffered by the ocean waters within a few miles of the vessel.

The plume itself is not likely to be visible from any recreational areas because the site is so distant from the shore. In fact, the permits require the addition of ammonia to the plume, when needed, to ensure its visibility in order that any ships which wander off course or which have not heard the "Broadcast to Mariners" will be aware of and avoid the incineration operations. EPA is convinced that the plume and its contents will have no impact on recreational areas.

(v) Presence in the material of pathogenic organisms which may cause a public health hazard either directly on through contamination of fisheries or shellfisheries.

This factor is not appropriate for incineration at-sea permits because the emission by-products are sterile.

(vi) Presence in the material of toxic chemical constituents released in volumes which may affect humans directly.

(vii) Presence in the material of chemical constituents which may be persistent or bioaccumulate and which may have an adverse effect on humans directly or through food chain interactions;

(viii) Presence in the material of any constituents which might significantly affect living marine organisms of recreational or commercial value.

EPA has shown through modelling studies that if TCDD is destroyed to 99.93 efficiency and if PCBs are destroyed to 99.99 percent efficiency, any remaining TCDD or PCBs in the emissions would result in ambient marine concentrations of TCDD or PCBs below the marine aquatic life no-effect level for TCDD and the marine water quality criterion for PCBs, respectively (the limiting permissible concentrations defined in 40 CFR 227.27). In addition, the permits preclude the incineration of wastes with compounds that have a heat of combustion less than that of compounds successfully incinerated in the trial burn. And finally, the concentration of metals in the waste is limited so that the metallic oxides released to the environment will not exceed marine water quality criteria (the limiting permissible concentrations as defined in 40 CFR 227.27). Therefore, EPA concludes that the emissions will contain no products that could present a risk to human health directly or through contamination of fisheries or shellfisheries.

Based on the nature of the site and the contents of the emissions, EPA finds that incineration at-sea, when conducted in accordance with the proposed permits, will not have an unacceptable impact on esthetic, recreational or economic values of the ocean according to the factors outlined in Subpart D.

(3) Subpart E, Part 227 - Impact of the Proposed Dumping on Other Uses of the Ocean

EPA considered the impact of the proposed incineration at-sea permits on the uses set forth in Section 227.21. Consistent with Section 227.20, EPA considered the potential effects of the ocean incineration activities on the specific uses listed. Based on our knowledge of the site and the by-products of the incineration process, EPA's determination is that incineration-at sea will not have an unacceptable impact, as shown by the following analysis:

(i) Commercial fishing in open ocean areas, coastal areas and in estuarine areas.

The Gulf Incineration Site is located over the continental slope, 300 kilometers from the nearest coast. The minimum depth at the site is 1100 meters. Available evidence indicates that, consistent with its location, the water at the site has a low level of biological activity and would not and could not support a viable commercial fishery. The site is approximately 4900 square kilometers. It is large enough so that the plume containing the emission products will touch down well

within in the site, usually within a few miles of the Vessel. Upon initial mixing after touch down, these incineration by-products are rapidly rendered harmless or are below levels which would exceed marine water quality criteria. Any by-products reaching the shore would be so diluted as to be undetectable by the most sophisticated analytical techniques.

(ii) Recreational fishing in open ocean areas, in coastal areas and in estuarine areas;

The site is beyond the reach of most recreational vessels and, as indicated above, it is highly unlikely that the emission products would be detectable outside the site area.

(iii)Recreational Use of Shorelines and Beaches;

The environmental monitoring conducted as part of the 1982 trial burn discussed earlier, indicated that there would not be any detectable effect of incineration at-sea activities on recreational or other uses of the shorelines and beaches.

(iv) Commercial and recreational navigation;

The site is 75 kilometers from the nearest commercial shipping fairway and beyond the reach of most recreational vessels. During

incineration operations, the U.S. Coast Guard issues a "Broadcast to Mariners", warning vessels to stay away from the incineration site.

(v) Actual or anticipated exploitation of living marine resources;

The site is over the continental slope and has a low level of living marine resources. Existing or future exploitation of living marine resources would not be affected.

(vi) Actual or anticipated exploitation of non-living resources, including without limitation, sand and gravel and other mineral deposits, oil and gas exploration and development and offshore marine terminal or other structure development;

The site is beyond the area where incineration activities would interfere with any sand and gravel operations or offshore marine terminal or other structural development. Available evidence indicates that oil, gas and other mineral deposits, exploration and development are unlikely in or near the site.

(vii) Scientific Research and Study

There are no known natural or cultural features within or near the site that would draw scientific research or study other than the monitoring of the effect of incineration activities.

(e) Finding

EPA finds that the proposed permits meet all the requirements of the Ocean Dumping Regulations applicable to incineration at-sea and Section 102 of the Act.

As part of the tentative determination to issue the permits, EPA compared the provisions of the proposed permits to the requirements of the London Dumping Convention, TSCA regulations for the incineration of PCBs and RCRA regulations for land-based incinerator facilities. These analyses follow. Table 3 "Hazardous Waste Incineration: Comparison of At-Sea, and Land-based Requirements", below, summarizes the major provisions of the proposed special permits, the London Dumping Convention and TSCA and RCRA requirements.

TABLE 3
HAZARDOUS WASTE INCINERATION
COMPARISON OF AT-SEA AND LAND-BASED REQUIREMENTS

	CWM SPECIAL PERMITS	LDC	RCRA	TSCA (PCBs)
A. Performance Standards				
1) DE/DRE	DE: 99.99%	DE 99.9%	DRE 99.99%	DRE (non-liquid) 99.9999% (liquids). See note 1.
2) CE	99.9%	99.9%		99.9%
3) Other Standards	HCl rapidly rendered harmless.	HCl rapidly rendered harmless.	HCl emissions: if > 4 lbs/hr., control to no greater than larger of 4 lbs/hr. or 1% of HCl in stack gas pre-pollution control equipment.	Water scrubbers to control HCl emissions to RA's specifications
	Metals limited to trace amounts (100 ppm, except silver, 20 ppm, and mercury, 9 ppm) so that they will not exceed marine water quality standards.	Metals limited to trace amounts.	Particulate emissions. $\leq$ .08 grains/dscf when corrected for amount of oxygen in stack gas.	
B. Incinerator Certification/Test Burn	An initial trial burn is performed to certify attainment of performance standards for POHCs and compliance with operating and monitoring requirements. Additional trial burns may be necessary for burning a new POHC with a lower heat of combustion. Trial burn needed to include in a waste mixture DDT (and DDD, DDE) PCT, and BHC. Incinerator must be recertified every two years.	Incinerator "survey" is initially required to certify attainment of performance standards, compliance with operating and monitoring requirements. Trial burns necessary for PCBs, DDT (and DDD, DDE), PCT, BHC and TCDD. Incinerator must be recertified every two years. No significant changes without approval.	An initial trial burn or data submitted in lieu thereof is required to certify attainment of performance standards for POHCs of each specific waste feed and compliance with operating and monitoring requirements. Additional trial burns and permit modifications may be necessary for burning new waste feeds, or after facility modifications.	RA determines necessity of initial trial burn to certify attainment of performance standards. An additional trial burn may be required after any pertinent facility modifications.
C. Operating Conditions				
1) Temperature	Vulcanus I: Wall, mnm. prior to waste feed 1353°C; mnm. 1280°C; avg. 1303°C. Vulcanus II: Wastes w/ PCBs, TCDD: 1353°C / 1280°C / 1303°C. Wastes w/o PCBs, TCDD: 1250°C / 1166°C / 1200°C.	Flame: $\geq$ 1250°C unless CE and DE achieved at lower temperature. Wall: $\geq$ 1200°C unless as above.* See Note 2.	Minimum specified on case by case basis. See note 3. Measuring location should be specified.	Liquids $\geq$ 1200°C or 1600°C ($\pm$ 100°C), depending on dwell time.
2) Dwell time	On the order of 1.0 seconds.	"On the order of" 1.0 seconds.*	Established indirectly through combustion gas velocity, temperature requirements and specification of allowable waste feed locations, if variable.	Liquids: 2 seconds @ 1200°C or 1.5 seconds @ 1600°C.

	CWM SPECIAL PERMITS	LDC	RCRA	TSCA (PCBs)
3) O_2 in stack gas	Vulcanus I: mnm. 5%, avg. 10.1% Vulcanus II: Wastes w/ PCBs,TCDD: 5%, 10.1% Vulcanus II: Wastes w/o PCBs,TCDD: 5%, 10.6%	Minimum 3%*		Liquids 3% @ 1200°C or 2 % @ 1600°C.
4) CO in stack gas	Vulcanus I: max. 100 ppm, avg. 8 ppm Vulcanus II: Wastes w/ PCBs,TCDD: 100 ppm, 8 ppm Vulcanus II: Wastes w/o PCBs,TCDD: 100 ppm, 22 ppm		Maximum specified on case by case basis.	
5) Waste feed rate			Maximum specified on a case by case basis; effectively controlled by stipulation of maximum total thermal input rate. Turndown allowable if other operating conditions complied with. Mass or volume feed rates may also be imposed. Waste feed locations are to be specified.	
6) Combustion gas Velocity			Maximum specified on case by case basis.	
7) Flame/Plume Conditions	No black smoke or flame extension above stack plane; no plume impingement, ammonia-adding device to make plume visible.	No black smoke or flame extension above stack plane.		
8) Other Operating Conditions	Combustion chamber draft (negative pressure) maintained greater than 1 inch of water below atmospheric pressure.		No hazardous waste to be fed during start-up or shut-down unless incinerator within specified conditions.	Scrubber effluent shall comply with applicable standards.
	Prompt reply to all radio calls, broadcast regular radio warnings, during incineration, operating controls and monitoring devices to be supervised during incineration. Waste-contaminated water to be ocean incinerated or land disposed, residues shall be land disposed.	Reply to all radio calls, broadcast regular radio warnings*, during incineration. Waste-contaminated tank washings, pump room bilges incinerated @ sea or land disposed, incinerator residue disposal shall conform to LDC provisions.*	Combustion zone fugitive emissions controlled by 1) totally sealed combustion zone 2) combustion zone pressure < atmospheric pressure, or 3) alternate means providing control equal to 2), above.	
D. Automatic waste feed cut-off	Linked to minimum wall temperature, flame-out, minimum O_2, maximum CO, and failure of monitoring devices for temperature; air flow; draft (negative pressure), O_2, CO, CO_2, and waste and auxiliary fuel flow.	Linked to wall temperature and flame-out.*	Linked to operating parameters for: CO in stack gas, waste feed rate, combustion temperature, combustion gas velocity. Should be interlocked to all required continuous monitoring devices. For each operating parameter, permit specifies a range for operation and, "somewhat beyond that," a level at which cut-off system must be activated.	Triggered by 1) insufficient temperature, 2) failure of monitoring devices for, O_2, CO, CO_2, PCB rate and quantity, 3) insufficient excess oxygen.

	CWM SPECIAL PERMITS	LDC	RCRA	TSCA (PCBs)
E. Monitoring Requirements				
1) Temperature (wall or flame)	Continuous	"Continuous"	Continuous	Continuous
2) Air flow	Continuous	Required; frequency unspecified.		
3) Draft (negative pressure)	Continuous			
4) CO	Continuous	Required; frequency unspecified.	Continuous	Continuous
5) CO_2	Continuous	Required; frequency unspecified.		At RA-specified intervals.
6) O_2	Continuous	"Routine" (by use of an automatic oxygen analyzer).*		Continuous
7) Waste feed and auxiliary fuel rate	Continuous	Continuous for liquid waste and fuel, except vessels existing pre-1/1/79.	Continuous	Feed rate and quantity measured at regular intervals, maximum of 15 minutes.
8) Combustion Gas Velocity			Continuous	
9) Other Monitoring Requirements	Vessel position, course and speed, wind speed and direction; incineration date, time, thereof.	Vessel position, course, speed; meteorological conditions (wind direction, speed)*; air feed rate, if variable*; waste incinerated,* and date, time thereof.	HCl; particulates.	Scrubber effluent.
F. Instrument Calibration/ testing	Before each cruise and according to manufacturer's specifications, for devices measuring CO, CO , O , wall temperature, waste flow and fuel (if used), air flow, and draft (negative pressure).		Inspection schedule required. At least daily visual inspection of incinerator and associated equipment.	
	Cut-off system tested before each incineration cruise.		At least weekly testing of cut-off system.	
G. Outsider Observation/ Supervision	Mandatory 24 hour per day "shipriders", who can terminate a burn for cause. EPA can board vessel, enter incineration- related premises, and inspect required records, monitoring devices and incineration and navigation equipment.		R.A. can enter and inspect facility premises and required records, can sample any substances and monitor operations.	
H. Waste Analysis	Chemical analysis to be submitted to EPA before each burn. EPA may request that a duplicate sample be taken and analyzed.		Waste analysis plan must be developed, and followed frequently enough to verify waste feed is within permit-specified physical and chemical composition limits.	

	CWM SPECIAL PERMITS	LDC	RCRA	TSCA (PCBs)
I. Waste Limitations	Waste containing detectable quantities of organic compounds with a heat of combustion < 1.79 kcals/gm (VULCANUS I) or <0.24 kcals/gm (VULCANUS II). Trial burn required for PCT, BHC and DDT. Dioxin is limited to 2 ppm. The PCB and chlorine concentration of the waste is limited to 35% and 70%, respectively. The concentration of arsenic, cadmium, chromium, copper, lead, nickel, selenium, thallium, zinc is limited to 100 ppm. Mercury concentration is limited to 9 ppm, silver concentration is limited to 20 ppm. Material containing high-level radioactivity, material produced for radiological, chemical, or biological warfare, or that is persistent and may float or remain suspended in the ocean, is prohibited.	Trial burn required for PCBs, PCTs, TCDD, BHC, and DDT.	HCl emissions* if > 4 lbs/hr., control to no greater than larger of 4 lbs/hr. or 1% of HCl in stack gas pre-pollution control equipment. Particulate emissions* <.08 grains/dscf when corrected for amount of oxygen in stack gas.	
J. Safety/Contingency Plan	Application requirement. Shall be followed during emergencies. Activities requiring its implementation must be reported to EPA.		Application requirement. Must be implemented during emergency. Report to R.A. required whenever implemented.	

Notes

1. If applicable operating conditions are met, it is believed that a DRE of 99.9999% will be attained.

2. LDC Technical Guidelines state that temperature controls and records are based upon wall measurements.

3. As RCRA permits are performance-based, there are no generic operating conditions. Each facility's operating conditions are determined by the conditions necessary for achievement of the performance standard, as demonstrated during the trial burn.

*Indicates provisions of the LDC Technical Guidelines. Contracting Parties to the LDC are to "take full account of" the Technical Guidelines.

Abbreviations

avg Average
BHC Benzene hexachloride
CE Combustion efficiency
CO Carbon monixide
CO_2 Carbon dioxide
DDD Dichlorodiphenyl dichloroethane
DDE Dichlorodiphenyl dichloroethane
DDT Dichlorodiphenyl trichloroethane
DE Destruction efficiency
DRE Destruction and removal efficiency
dscf dry standard cubic feet
gm gram
HCl Hydrochloric acid
hr hour
max maximum
min minute
mtn minimum
O_2 Oxygen
PCT Polychlorinated triphenyls
POHC Principal organic hazardous constituent
ppm parts per million
sec second
TCDD Tetrachlorodibenzo-p-dioxin

3. COMPLIANCE WITH THE LONDON DUMPING CONVENTION

As a Contracting Party to the CONVENTION ON THE PREVENTION OF MARINE POLLUTION BY DUMPING OF WASTES AND OTHER MATTER (the London Dumping Convention), EPA is bound by the "Regulations for the Control of Incineration of Wastes and Other Matter at Sea", and is required "to take full account of" the "Technical Guidelines" implementing the Regulations. The Regulations and Technical Guidelines are in Annex 5 of the London Dumping Convention.

The following discussion shows that the proposed permits are equivalent to and in many cases more stringent than the Regulations and Technical Guidelines of the London Dumping Convention. The Regulations are discussed first, followed by the Technical Guidelines.

(a) Regulations of the London Dumping Convention

(1) Regulation 2.2:

> Contracting Parties shall first consider the practical availability of alternative land-based methods of treatment, disposal or elimination, or of treatment to render the wastes or other matter less harmful, before issuing a permit for incineration at sea in accordance with these Regulations. Incineration at sea shall in no way be interpreted as discouraging progress towards environmentally better solutions including the development of new techniques.

This requirement is satisfied by EPA's consideration of the need for ocean dumping discussed in "Compliance With the Ocean Dumping Regulations."

(2)Regulation 3:

(1) The incineration system shall be subject to the surveys specified below.... The Contracting Party which proposes to issue an incineration permit shall ensure that the surveys have been completed and the incineration system complies with the provisions of these Regulations. If the initial survey is carried out under the direction of a Contracting Party a special permit, which specifies the testing requirements, shall be issued by the Party. The results of each survey shall be recorded in a survey report.

(a) An initial survey shall be carried out in order to ensure that during the incineration of waste and other matter combustion and destruction efficiencies are in excess of 99.9 per cent.

(b) As a part of the initial survey the State under whose direction the survey is being carried out shall:

(i) approve the siting, type and manner of use of temperature measuring devices;
(ii) approve the gas sampling system including probe locations, analytical devices, and the manner of recording;
(iii) ensure that approved devices have been installed to automatically shut off the feed of waste to the incinerator if the temperature drops below approved minimum temperatures;
(iv) ensure that there are no means of disposing of wastes or other matter from the marine incineration facility except by means of the incinerator during normal operations;
(v) approve the devices by which feed rates of waste and fuel are controlled and recorded;
(vi) confirm the performance of the incineration system by testing under intensive stack monitoring, including the measurements of O_2, CO, CO_2, halogenated organic content, and total hydrocarbon content using wastes typical of those expected to be incinerated.

(c) The incineration system shall be surveyed at least every two years to ensure that the incinerator continues to comply with these Regulations. The scope of the biennial survey shall be based upon an evaluation of operating data and maintenance of records for the previous two years.

(2) Following the satisfactory completion of a survey, a form of approval shall be issued by a Contracting Party if the incineration system is found to be in compliance with these Regulations. A copy of the survey report shall be attached to the form of approval. A form of approval issued by a Contracting Party shall be recognized by other Contracting Parties unless there are clear grounds for believing that the incineration system is not in compliance with these Regulations. A copy of each form of approval and survey report shall be submitted to the Organization.

(3) After any survey has been completed, no significant changes which could affect the performance of the incineration system shall be made without approval of the Contracting Party which has issued the form of approval.

In addition to the Certificate of Approval required by the above Regulation, the U.S. Coast Guard inspects the incineration system to ensure its safety, as required by P.L. 97-389, December 29, 1982.

Prior to issuing a special permit, EPA requires vessels to demonstrate a destruction efficiency of at least 99.99 percent on a principle organic hazardous constituent (POHC). This is more stringent than the London Dumping Convention regulation. The M/T VULCANUS I, in a trial burn conducted in August 1982, demonstrated a destruction efficiency of greater than 99.99 percent on hexachlorobenzene which had the lowest heat of combustion (1.79 kcal/gram) of the POHCs tested. The M/T VULCANUS II, during its survey by the Government of the Netherlands and EPA during January and February 1983, demonstrated a

destruction efficiency of greater than 99.99 percent on tetrachloromethane, which had the lowest heat of combustion (0.24 kcal/gram) of the POHCs tested.

(3) Regulation 4:

(i) Where a Contracting Party has doubts as to the thermal destructability of the wastes and other matter proposed for incineration, pilot scale tests should be undertaken.

EPA has limited the compounds eligible for incineration in a waste mixture to those compounds with a heat of combustion greater than the POHC for which a trial burn demonstrated a destruction efficiency of 99.99 percent. Therefore, EPA does not doubt the thermal destructability of wastes that are to be incinerated under the proposed special permits.

(ii) Where a Contracting Party proposes to permit incineration of wastes over which doubts as to the efficiency of combustion exist, the incineration system shall be subject to the same intensive stack monitoring as required for the initial incineration system survey. The specific compounds referred to, in Technical Guideline 4.1.2, are: (i) Polychlorinated biphenyls (PCBs); (ii) Polychlorinated triphenyls (PCTs); (iii) Tetrachlorodibenzo-p-dioxin (TCDD, dioxin); (iv) Dichlorodiphenyl trichloroethane (DDT); and (v) Benzene hexachloride (BHC, lindane).

Without a trial burn which demonstrates a destruction efficiency of at least 99.99 percent by the vessels' incinerators, the proposed permits prohibit the incineration of PCT, DDT (and associated compounds DDD and DDE), and BHC. TCDD and PCBs may be incinerated based on the trial burns on the M/T VULCANUS I. EPA waived a trial burn for the M/T

VULCANUS II to incinerate TCDD and PCBs because of the determination that the incinerator equipment on the M/T VULCANUS II is the same as the equipment on the M/T VULCANUS I and the Agency's accumulated experience in monitoring the incineration of TCDD and PCBs emissions.

The proposed Research Permit, HQ 83-003, would fulfill the requirements of the London Dumping Convention to conduct a trial burn on DDT and its associated compounds DDD and DDE prior to including these compounds in a waste mixture, under a special permit. The trial burn is to be conducted and if successful the Special Permit for the M/T VULCANUS II will be modified to authorize the incineration of DDT, DDD and DDE.

(4) Regulation 5:

The operation of the incineration system shall be controlled so as to ensure that the incineration of wastes or other matter does not take place at a flame temperature less than 1250 degrees centigrade, unless the results of tests demonstrate that the required combustion and destruction efficiency can be achieved at a lower temperature.

A flame temperature of 1250°C is equivalent to a wall temperature of 1200°C. Wall temperature is used in the proposed permits.

The proposed permits require a minimum wall temperature of 1280°C for the M/T VULCANUS I and 1166°C for the M/T VULCANUS II. In addition, prior to initiating the waste into the incinerators, the proposed permits require a wall temperature 50°C higher than the

average temperature which must be maintained during incineration. These temperatures are 1353°C for the M/T VULCANUS I and 1250°C for the M/T VULCANUS II. If the M/T VULCANUS II is incinerating PCBs, then the minimum wall temperature must be the same as those for the M/T VULCANUS I.

The specified minimum temperatures are based upon data collected from actual trial burns on both vessels and from evaluations of a large number of other incinerators. These values are used as an operating guide. Waste feed is automatically stopped to an incinerator unit if it drops below the specified minimum temperature or a flame out occurs. Auxiliary fuel must be substituted for waste feed to raise the temperature to the level specified for waste feed initiation before wastes may be fed again into the incinerator.

The proposed special permits also stipulate average wall temperatures that must be maintained during waste incineration. The average temperatures are based on the average temperatures attained in the trial burns that demonstrated destruction efficiencies of 99.99 percent on the POHCs tested. The average wall temperature required is 1303°C for the M/T VULCANUS I and 1200°C for the M/T VULCANUS II. Although the average attained during the February 1983, trial burn was 1166°C for the M/T VULCANUS II, EPA used the usual 1200°C London

Dumping Convention requirement as the average for the M/T VULCANUS II since a minimum and average cannot be the same.

The Research Permit does not stipulate an average wall temperature because the trial burn will establish the average which is to be maintained during incineration.

(5) Regulation 5.2:

The combustion efficiency shall be at least 99.95± 0.05% based on:

$$\text{Combustion efficiency} = \frac{C_{CO_2} - C_{CO}}{C_{CO_2}} \times 100$$

where C_{CO_2} = concentration of carbon dioxide in the combustion gases
C_{CO} = concentration of carbon monoxide in the combustion gases.

The proposed special and research permits have this identical requirement expressed in a slightly different formula:

$$\text{Combustion Efficiency} = \frac{[CO_2] \times 100}{[CO_2] + [CO]}$$

Where:
CO_2 = concentration of carbon dioxide in the combustion gases

CO = concentration of carbon monoxide in the combustion gases

(6) Regulation 5.3:

There shall be no black smoke nor flame extension above the plane of the stack.

The proposed permits include the same provision.

(7) Regulation 5.4:

The vessel shall reply promptly to radio calls at all times during the incineration.

A similar requirement is included in the proposed permits.

(8) Regulation 6:

(11) At a minimum, the following data shall be recorded during each incineration operation and retained for inspection by the Contracting Party who has issued the permit:

(a) continuous temperature measurements by approved temperature measuring devices;
(b) date and time during incineration and record of waste being incinerated;
(c) vessel position by appropriate navigational means;
(d) feed rates of waste and fuel - for liquid wastes and fuel the flow rate shall be continuously recorded; the latter requirement does not apply to vessels operating on or before January 1979;
(e) CO and CO_2 concentration in combustion gases;
(f) vessel's course and speed.

The proposed permits also stipulate that monitoring devices record these parameters. In addition to monitoring and recording wall temperature, and the waste and fuel feed rates, the proposed permits require continuous monitoring and recording of air flow to the incinerators, the level of oxygen, carbon monoxide, and carbon dioxide in the stack gases and draft (negative pressure) in the combustion chamber. The permits require the continuous monitoring and recording of the feed rates of waste and/or fuel (if used) on the M/T VULCANUS I, even though the vessel was operating prior to January 1, 1979. This requirement together with the requirement to continuously monitor and record air flow were added not only to be consistent with EPA's land-based permit programs, but also to ensure adequate data are available to calculate dwell time, the time the liquid waste and its gaseous combustion by-products are in the lower combustion chamber and upper incinerator stack.

Continuous monitoring of wall temperature, and the level of oxygen and carbon monoxide in the stack gases are required because these are the key parameters for determining the operating efficiency of tne incinerators. In addition, continuous monitoring of the level of carbon dioxide in the stack gases and the waste feed flow and/or auxiliary fuel flow (if used) are required in order to calculate combustion efficiency, dwell time and overall incinerator performance.

EPA is also requiring the continuous monitoring and recording of draft (negative pressure) in the combustion chamber to ensure that there is sufficient oxygen in the combustion gases from the blowers and to prevent the escape of fugitive emissions from the incinerators and thereby protect shipboard personnel.

(9) Regulation 7:

A permit application for the incineration of wastes or other matter at-sea shall include information on the characteristics of wastes or other matter sufficient to comply with the notification requirements (which includes an analyses of the wastes and the properties of the wastes).

The application for the special permits included a request to incinerate approximately 300,000 metric tons of mixed liquid organic wastes, EPA has limited the mixed chemical wastes eligible for incineration (see Section-by-Section Analysis, Special Provision No. 2). In addition, prior to the loading of a vessel for each incineration cruise, a chemical analysis of the wastes to be incinerated on that cruise must be submitted to EPA.

The analyses of the wastes are to be conducted in accordance with EPA-approved protocols, (listed in Appendix A of the Permits), in an EPA-approved laboratory. Use of the protocols will ensure the identification of all chemical compounds present in the wastes in

quantifiable concentrations. EPA may take duplicate samples from the blending/holding tanks or from the vessels' and/or the dockside storage tanks to verify the analyses. Only when EPA is convinced that the wastes meet the specifications of the permits will written authorization for loading and incineration be provided.

Therefore, the proposed permits exceed the requirement of this Regulation because the exact composition of each load of wastes will be known prior to each incineration cruise.

(10) Regulation 8:

Provisions to be considered in establishing criteria governing the selection of incineration sites shall include the following:

(A) the atmospheric dispersal characteristics of the area - including wind speed and direction, atmospheric stability, frequency of inversions and fog, precipitation types and amounts, humidity - in order to determine the potential impact on the surrounding environment of pollutants released from the marine incineration facility, giving particular attention to the possibility of atmospheric transport of pollutants to coastal areas;
(B) oceanic dispersal characteristics of the area in order to evaluate the potential impact of plume interaction with the water surface;
(C) availability of navigational aids.

The Environmental Impact Statement on the designation of the Gulf Incineration Site, published in July 1976, covered the points indicated in this London Dumping Convention Regulation. A description of the site may be found under "Consistency with the Ocean Dumping Regulation."

(11) Regulation 9:

Contracting Parties shall comply with notification procedures adopted by the Parties in consultation. These notification procedures include a form which is to contain the following information for each permit:

(1) issuing authorities;
(2) date issued;
(3) period for which the permit is valid;
(4) country of origin of wastes and port of loadings;
(5) total quantity of wastes (in metric units) covered by the permit;
(6) form in which the waste is presented (bulk or containers; in the latter case, also size and labelling);
(7) composition of the waste, such as:
    .1 principal organic components;
    .2 organohalogens;
    .3 main inorganic components;
    .4 solids in suspension; and
    .5 other relevant constituents.
(8) properties of the waste, such as:
    .1 physical form;
    .2 specific gravity;
    .3 viscosity;
    .4 calorific value;
    .5 radioactivity; and
    .6 toxicity and persistence, if necessary.
(9) industrial process giving rise to the waste;
(10) name of the marine incineration facility and state of registration;
(11) area of incineration (geographical location; distance from the nearest coast);
(12) expected frequencies of incineration;
(13) special conditions relating to the operation of the marine incineration facility which are more stringent than those specified in the Regulations or other than those in the Technical Guidelines;
(14) additional information, such as relevant factors listed in Annex III to the Convention.

If the Assistant Administrator for Water makes a final determination to issue the permits, after taking into consideration public comments received on the proposed permits and the findings in the Notice, EPA will notify the International Maritime Organization of the Permits, in accordance with this Regulation.

(b) Technical Guidelines

(1) Technical Guideline 3.1.2:

Where solid wastes are burned, the waste type and rate of input should be recorded in the log.

The design limits of the incinerator systems on the M/T VULCANUS I and II preclude the incineration of solids. Therefore, this Guideline is not applicable.

(2) Technical Guidance 3.1.3:

The feeding of wastes in containers to the incinerator will necessitate special design and operational requirements in order to comply with the Regulation.

For the same reason as stated immediately above, this Guideline is not applicable.

(3) Technical Guideline 3.2.1:

The amount of air entering the incinerator should be sufficient to ensure that a minimum of 3 per cent oxygen is present in the combustion gases near the incinerator stack exit. This requirement should be monitored by an automatic oxygen analyzer to routinely record oxygen concentrations.

The proposed permits are more stringent than this London Dumping Convention Guideline. Based on EPA's extensive data base on all types of hazardous waste incinerators, oxygen levels in the range of approximately 5 through 15 percent have been identified as a consistently successful operating range for oxygen levels in the combustion gases. Therefore, a minimum 5 percent oxygen level in the stack gases is stipulated in the permits. Based on the trial burns,

the average oxygen level in the combustion gases must be equal to or greater than 10.1 percent for the M/T VULCANUS I and 10.6 percent for the M/T VULCANUS II, except if incinerating TCDD or PCBs. If incinerating TCDD or PCBs, the average oxygen level for the M/T VULCANUS II must be equal to that of the M/T VULCANUS I.

(4) Technical Guideline 3.3.1:

Temperature controls and records should be based on the measurement of wall temperature. Unless otherwise determined by the Contracting Party there should be three or more temperature measurement devices for each incinerator.

(5) Technical Guideline 3.3.2:

The Contracting Party should define the operating wall temperature and the temperature below which the flow of waste to the incinerator should be automatically shut off by approved equipment.

(6) Technical Guideline 3.3.3:

The minimum wall temperature should be 1200°C unless the results of tests on the marine incineration facility demonstrate that the required combustion and destruction efficiencies can be achieved at a lower temperature.

The proposed permits are consistent with these temperature guidelines because:

- the permits are contingent on a survey of the incineration system by a Contracting Party to the London Dumping Convention;
- EPA has defined a minimum temperture of 1280°C for the M/T VULCANUS I and 1166°C for the M/T VULCANUS II unless incinerating TCDD or PCBs when the minimum temperature shall be 1280°C. If reached, these minimums trigger automatic devices that shut off the flow of wastes to the incinerators;
- the minimum wall temperature is 1200°C unless, as in the case of the M/T VULCANUS II, the required destruction efficiency was achieved at a lower temperature.

- EPA has defined a minimum temperature that must be attained prior to feeding wastes to the incinerators. This temperature is 1353°C for the M/T VULCANUS I and 1250°C for the M/T VULCANUS II (1353°C when incinerating TCDD or PCBs).

(7) Technical Guideline 3.4.1:

Destruction efficiency should be determined not only for the total organic components of the wastes but additionally for particular substances such as PCBs, PCTs, TCDD, BHC, DDT in the survey and approval of the incineration system.

The proposed special permits were developed in accordance with this Technical Guideline. EPA has developed a system based on comparing the heats of combustion of compounds in a waste mixture to the heats of combustion of the principle organic hazardous constituents (POHCs) used in the trial burn. As discussed previously in greater detail, one or more POHCs in a waste mixture are selected, based on their heat of combustion and on their concentration in the mixture. During a trial burn, under a research permit or as part of an initial survey of an incineration system, the POHCs selected are carefully monitored to determine the destruction efficiencies for the incinerator. If the incinerators demonstrate a destruction efficiency of 99.99 percent or greater on each of the POHCs, then the waste mixtures under a special permit may contain compounds with heats of combustion equal to or greater than the POHC with the lowest heat of combustion.

In order to incinerate any of the five compounds listed above, a trial burn is performed. Various trial burns for the M/T VULCANUS I included waste mixtures containing TCDD, PCBs and hexachlorobenzene and the trial burn for the M/T VULCANUS II included a waste mixture

containing tetrachloromethane. Therefore, the M/T VULCANUS I is authorized to incinerate TCDD and PCBs as well as compounds that have a heat of combustion equal to or greater than 1.79 kcal/gram, the heat of combustion of hexachlorobenzene. Trial burns on TCDD and PCBs were waived for the M/T VULCANUS II based on a determination that the incinerators on the M/T VULCANUS II are similar to those of the M/T VULCANUS I and on the Agency's accumulated experience in monitoring incinerator emissions for TCDD and PCBs. Therefore the M/T VULCANUS II is authorized to incinerate TCDD, PCBs and compounds with heats of combustion equal to or greater than 0.24 kcal/gram.

(8) Technical Guideline 3.5.1:

The mean residence time of the incinerator should be on the order of one second or longer at a flame temperature of 1250°C (or a wall temperature of 1200°C) during normal operating conditions. Technical Guideline 3.5.1)

The proposed permits have an identical provision.

(9) Technical Guideline 3.6:

Devices to shut off the waste feed to the incinerator should include the following:

(1) flame sensors with each burner to stop waste flow to that burner in the event of a flame-out; and
(2) automatic equipment to stop waste flow in the event of wall temperatures falling below 1200°C.

The proposed permits require that automatic devices shut off the flow of the wastes to the incinerators not only if the flame goes out or the temperature falls below a specified reading, but also if carbon

monoxide or oxygen in the combustion gases exceeds or falls below the specified levels, respectively, or the monitoring devices for wall temperature, air flow, draft (negative pressure) in the combustion chambers, carbon monoxide, oxygen, carbon dioxide and waste feed flow or auxiliary fuel (if used) fail.

(10) Technical Guideline 3.7.1:

In approving the siting of temperature measuring devices and gas sampling probes, the Contracting Party should take into account that in certain cases flames can be non-homogeneous (e.g. through vortex formation in the incinerator or during incineration of solid or containerized wastes). (Technical Guideline 3.7.1)

During the 1977 Research Permit burn of Herbicide Orange, EPA positioned the gas sampling probe at different locations in the cross section of the stack and found from carbon monoxide, carbon dioxide and oxygen readings that the combustion gas composition was homogeneous.

(11) Technical Guideline 4.1.1:

Due to the risk of spillages wastes should not be transferred from barges to the Vessel outside harbour limits except where special arrangements have been made for the prevention of spillages to the satisfaction of the Contracting Party.

Consistent with this Technical Guideline, the proposed permits require that the loading of the vessels may take place only in the Port of Mobile, Alabama.

(12) Technical Guideline 4.1.2:

Wastes in damaged containers should not be taken on board marine incineration facilities.

(13) Technical Guidelines 4.1.3:

Containers loaded on board should be adequately labelled.

(14) Technical Guideline 4.1.4:

Containerized wastes should be stowed in accordance with the regulations of the IMCO International Maritime Dangerous Goods Code (IMDG Code).

These provisions are not applicable to the proposed permits because containerized wastes are not authorized for incineration.

(15) Technical Guideline 4.2.1:

Tank washings and pump-room bilges contaminated with wastes should be incinerated at sea in accordance with the Regulations for the Control of Incineration of Wastes and Other Matter at Sea and with these Technical Guidelines, or discharged to port facilities. (Technical Guideline 4.2.1)

The proposed permits require that if tanks are washed, they may only be washed with combustible solvents and such washings must be incinerated at-sea or, on return to port either incinerated in EPA-approved land-based facilities or treated in accordance with 40 CFR 761.60 and TSCA Compliance Program Policy No. 6 PCB-2 -- Physical Separation Techniques (August 16, 1983).

(16) Technical Guideline 4.2.2:

Residues remaining in the incinerator should not be dumped at sea except in accordance with the provisions of the Convention.

The proposed permits require that any residues remaining in the incinerator must be incinerated in EPA-approved facilities.

(17) Technical Guideline 4.3.1:

In licensing the incineration of wastes and other matter on board approved marine incineration facilities, the Contracting Party should have regard to the need to avoid hazards to other vessels by appropriate location of the incineration sites or incineration zones concerned and by ensuring that the relevant maritime authorities are notified of the date of sailing and/or intended schedule, as well as the intended movements of the marine incineration facility (whether underway, at anchor, etc.).

As discussed under "Consistency with the Ocean Dumping Regulations", the Gulf Incineration Site is 75 miles from the nearest commercial shipping fairway and beyond the reach of most recreational vessels. In addition, the proposed permits require that 10 days before the loading of the vessels is to begin, the Permittees notify the U.S. Coast Guard and the Captain of the Port Mobile and, 24 hours before sailing the Permittees notify the Captain of the Port, Mobile.

(18) Technical Guideline 4.3.2:

Regular radio warnings should be broadcast during the period of incineration.

During transport to and incineration at the Gulf Incineration Site, the U.S. Coast Guard issues "Broadcasts to Mariners" warning ships away from the Site.

(19) Technical Guideline 4.3.3:

Contracting Parties in a given geographical area should endeavor to designate common incineration sites in the area.

Mexico is a Contracting Party to the London Dumping Convention. Although at this time Mexico has not indicated an interest in incinerating at-sea mixed liquid organic wastes, it would be appropriate for the United States and the Government of Mexico to work

out a joint agreement on the use of the Gulf Incineration Site should the Government of Mexico wish to initiate incineration at-sea activities.

(20) Technical Guideline 4.4.1:

For the carriage of liquid wastes an incineration ship shall carry a valid "Certificate of Fitness" as required under the IMO Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk.

As a condition of the permits, the vessels must have and prominently display a valid "Certificate of Fitness."

(21) Technical Guideline 4.5.1:

Marine incineration facilities should record (in addition to the ones previously mentioned under Regulations):

(i) the oxygen concentration in the combustion gases;
(ii) the air feed rate, if variable, the air feed used;
(iii) the tank(s) from which waste is taken; and
(iv) the meteorological conditions, e.g., wind speed and direction.

As previously indicated, the permits require continuous monitoring and recording of air flow to the incinerators and oxygen content in the combustion gases. The oxygen content of the combustion gases is a direct result and an indicator of sufficient air flow. In EPA's judgment, monitoring the oxygen content of the combustion gases is more important than the air feed flow. However, the continuous monitoring of air flow is necessary to be able to calculate dwell time for wastes entering the incinerators.

EPA requires a full accounting of all wastes before the wastes are loaded onto the vessel. The samples for the analyses are taken from

the blending/holding tanks in Emelle, Alabama. If the wastes are eligible for incineration based on the analyses from the blending/holding tanks, there is no combination of blending in the vessels' storage tanks that would make the wastes less acceptable for incineration. Therefore, during the incineration, EPA has not required the identification of the tank from which the wastes are being fed into the incinerator.

EPA does require the monitoring of meteorological conditions including wind speed and direction. Based on EPA's experience, a combination of vessel speed plus wind velocity of three knots is necessary to ensure the plume does not come in contact with the vessel.

(22) Technical Guideline 5.1.1:

Information on the characteristics of wastes or other matter to be provided should include, if possible, information on the chemical and physical transformation of the waste after incineration, in particular, subsequent formation of new compounds, composition of ashes or unburned residues.

At least 99.9 percent of the products of incineration are known. They include hydrochloric acid, carbon dioxide, carbon monoxide, water vapor and trace amounts of metallic oxides, silicate ash, and partially combusted or surviving organic compounds. Partially combusted or surviving organic compounds comprise no more than 0.1 percent of the emissions. While these products cannot be characterized completely, their impact on the environment is believed to be minimal based on the following:

- The incineration process degrades the compounds by lowering the molecular weight and chlorine content of the compounds. As a result, these partially combusted or surviving organic compounds are less toxic than the original compounds.

- Environmental monitoring of incineration at-sea over the last nine years has shown no adverse affects on the marine aquatic ecosystem from any aspect of incineration at-sea operations.

(23) Technical Guideline 4.1.2:

Examples of wastes or other matter over which doubts exist as to the thermal destruction and efficiency of combustion are listed as follows:

- Polychlorinated biphenyls (PCBs)

- Polychlorinated triphenyls (PCTs)

- Tectrachloro-dibenzo-p-dioxin (TCDD)

- Dichlorodiphenyl trichloroethane (DDT)

- Benzene hexachloride (BHC, lindane)

The requirements for trial burns and a demonstration of 99.99 destruction efficiency on these compounds were discussed above under Regulation 4.

(24) Technical Guideline 5.2.1:

The Contracting Party must ensure that the incineration of a waste containing Annex I substances (such as organohalogen compounds, mercury, cadmium) should not result in the introduction of Annex I substances into the marine environment unless these are rapidly rendered harmless or are present as trace contaminants. Based on current scientific knowledge on the environmental effects of incinerating liquid organochlorine compounds, this requirement is considered to be met if the Regulations and Technical Guidelines are observed.

EPA's findings are that the Regulations and Technical Guidelines have been observed and that incineration will not result in the introduction of organohalogen compounds, mercury and mercury compounds

and cadmium and cadmium compounds into the environment, except as trace contaminants.

(25) Technical Guideline 5.2.2:

Where it is proposed to incinerate wastes at sea containing other Annex I substances or organochlorine compounds such as PCBs, PCTs, TCDD, BHC, DDT, it will be necessary to determine that the residues entering the marine environment after incineration are rapidly rendered harmless or present as trace contaminants through procedures adopted by the Contracting Parties in consultation.

Based on EPA's accumulated data and experience in monitoring incineration emissions for TCDD and PCBs and emission plume modelling and subsequent ocean dispersion modelling, it has been demonstrated that any emissions of the incineration process will be rapidly rendered harmless or will be present as only trace contaminants, well below the limiting permissible concentrations defined in 40 CFR 227.27 as the marine water quality criterion or the marine aquatic life no effect level for PCBs and TCDD, respectively.

(26) Technical Guideline 5.3.1:

Each Contracting Party should immediately notify the International Maritime Organization of a Special Permit issued for incineration of wastes or other matter at sea.

If the Assistant Administrator for Water makes a final determination to issue the permits, after taking into consideration comments received on the proposed permits and the Notice, EPA will notify the International Maritime Organization in accordance with the procedures set out in the London Dumping Convention described under the Regulation 9 discussed above.

(c) Finding

Based on the above analysis, EPA finds that the proposed Special and Research permits are consistent with the Regulations and Technical Guidelines of the London Dumping Convention.

4. COMPLIANCE WITH TSCA REGULATIONS WHEN INCINERATING LIQUID PCBs

Section 6(e)(1)(A) and (B) of the Toxic Substances Control Act* (TSCA), requires the Administrator "to promulgate regulations to prescribe methods for the disposal of polychlorinated biphenyls and require polychlorinated biphenyls to be marked with clear and adequate warnings, and instructions with respect to their processing, distribution in commerce, use, or disposal or with respect to any combination of activities." Based on this mandate, EPA promulgated regulations in 40 CFR 761.70, controlling the incineration of wastes containing PCBs.

EPA Regional Administrators usually issue permits for incinerating PCBs; however, for at-sea incineration of PCBs, the Assistant Administrator for Water was delegated the responsibility for issuing the permits. The Assistant Administrator for Pesticides and Toxic Substances gives written approval of the permits before any incineration of PCBs.

Because the special permits apply only to liquid PCB wastes, for purposes of complying with TSCA regulations for incinerating PCBs, EPA focused on those TSCA regulations in 40 CFR 761.70(a) which apply to liquid PCB wastes. The following analysis compares the requirements of Section 761.70(a) with the proposed incineration at-sea permits.

* 5 USC §2601, P.L. 94-469, October 11, 1976, 90 Stat. 2003

(a) Operational Permits

(1) Section 761.70(a)(1)

Combustion criteria shall be either of the following:

(i) Maintenance of the introduced liquids for a 2-second dwell time at 1200°C(±100°C) and 3 percent excess oxygen in the stack gas; or
(ii) Maintenance of the introduced liquids for a 1 1/2 second dwell time at 1600°C(±100°C) and 2 percent excess oxygen in the stack gas.

If incinerating TCDD or PCBs, the proposed incineration at-sea permits require.

- a minimum wall temperature of 1280°C; a minimum temperature of 1353°C prior to waste feed into the incinerators; and an average wall temperature of 1303°;
- a mean residence time on the order of one second or longer;
- a minimum 5 percent oxygen in the stack gases; and
- an average 10.1 percent oxygen in the stack gases.

These parameters were selected based on the August, 1982 trial burn of PCBs under Research Permit HQ 81-002 which demonstrated a destruction efficiency of greater than 99.99 percent on the M/T VULCANUS I. Except for "dwell time", the time the liquid waste and its gaseous combustion by-products are in the lower combustion chamber and upper incineration stack, the parameters for the proposed permits are more stringent than the TSCA requirements.

EPA once felt that residence time was a parameter of major significance in developing regulatory policy. Residence time is

currently overshadowed by the more important parameter of destruction efficiency. While it is often stated that residence times (and therefore the need to establish chemical waste feed and air flows) of 2 seconds or more were universally needed to achieve good destruction performance for PCBs, the Agency now has an extensive data base which indicates that as little as tenths of one second may be sufficient in well designed incinerators. TSCA has a waiver provision for dwell time which basically relies on destruction removal efficiency as the primary measure of incinerator performance.

(2) Section 761.70(a)(3):

Combustion efficiency shall be at least 99.9 percent computed as follows:

Combustion efficiency =
$Cco_2/Cco_2 + Cco \times 100$

where:

Cco_2 = Concentration of carbon dioxide in the combustion gases.

Cco = Concentration of carbon monoxide in the combustion gases .

The proposed permits have an identical performance standard.

(3) Section 761.70(a)(3):

The rate and quantity of PCBs which are fed to the combustion system shall be measured and recorded at regular intervals of no longer than 15 minutes. (Section 761.70(a)(3)

The proposed permits require continuous monitoring and recording of waste feed rate and/or auxiliary fuel (if used).

(4) Section 761.70(a)(4):

The temperatures of the incineration process shall be continuously measured and recorded. The combustion temperature of the incineration process shall be based on either direct (pyrometer) or indirect (wall thermocouple-pyrometer correlation) temperature readings.

The proposed permits have an identical provision for continuously measuring and recording wall temperature.

(5) Section 761.70(a)(5):

The flow of PCBs to the incinerator shall stop automatically whenever the combustion temperature drops below the temperatures specified.

The proposed permits require automatic tamper proof devices to instanteously shut off the flow of wastes to the incinerators if the wall temperature falls below the minimum specified.

(6) Section 761.70(a)(b):

The flow of PCBs to the incinerator shall stop automatically when any one or more of the following conditions occur unless a contingency plan is submitted by the incinerator owner or operator and approved by the Regional Administrator and the contingency plan indicates what alternative measures the incinerator owner or operator would take if any of the following conditions occur:

(i) Failure of monitoring operations specified;
(ii) Failure of the PCB rate and quantity measuring and recording equipment;
(iii)Excess oxygen falls below the percentage specified.
(Section 761.70(a)(B))

An identical provision is included in the proposed permits.

(7) Section 761.70(a)(9):

Water scrubbers shall be used for HCl control during PCB incineration and shall meet any performance requirements specified by the appropriate EPA Regional Administrator. Scrubber effluent shall be monitored and shall comply with applicable effluent or pretreatment standards, and any other State and Federal laws and regulations. An alternate method of HCl control may be used if the alternate method has been approved by the Regional Administrator. (The HCl neutralizing capability of cement kilns is considered to be an alternate method).

Land-based incinerators must have auxiliary air pollution control devices such as scrubbers to neutralize the hydrochloric acid emitted as a by-product of the incineration of organochlorine compounds. Scrubbers are also used to remove excess particulate matter. Water scrubbers are not required for incineration at-sea because the hydrochloric acid is rapidly rendered harmless by the dilution and buffering action of the ocean. The proposed permits require that the vessels' direction and orientation during incineration be controlled to ensure that the hydrochloric acid in the incinerator plume is directed to the stern of the vessel. The proposed permits limit the amount of metals in the waste stream to ensure that any emissions reaching the water do not cause marine water quality criteria to be exceeded. The modeling described earlier showed that metals in excess of the 100 ppm limit except for mercury, which is limited to 9 ppm and silver, which is limited to 20 ppm, are more than adequate to ensure water quality criteria or the limiting permissible concentration of PCBs as required in 40 CFR 227.27 are not exceeded.

(8) Section 761.7(a)(6)

Monitoring of stack emission products shall be conducted:

(i) When an incinerator is first used for the disposal of PCBs under the provisions of this regulation;

(ii) When an incinerator is first used for the disposal of PCBs after the incinerator has been modified in a manner which may affect the characteristics of the stack emission products; and

(iii) At a minimum such monitoring shall be conducted for the following parameters: (a) O_2; (b) CO; (c) CO_2; (d) Oxides of Nitrogen (NO_2); (e) Hydrochloric Acid (HCl); (f) Total Chlorinated Organic Content (RCl); (g) PCBs; and (h) Total Particulate Matter.

During the August 1982, trial burn on the M/T VULCANUS I that demonstrated a destruction efficiency of greater than 99.99 percent on PCBs, the stack gases were monitored for the above parameters, except for (d) oxides of nitrogen and (h) total particulate matter.

The stack gases were not monitored for oxides of nitrogen because the wastes incinerated contained only minute concentrations of nitrogenous compounds and in EPA's judgment, there would have been no quantifiable emissions.

Total particulate matter was not measured because all surviving organic species are completely disassociated from any particulate matter in the emissions at the temperatures associated with the combustion gases in at-sea incinerators (1300°C).

Measuring total particulate matter would have no effect on the calculation of destruction efficiency. The liquid nature of the wastes being incinerated also precludes significant formation of particulates. The combustion gases are much cooler (40°C) on land-based incinerators because of the scrubbers so surviving organic species could be associated with particulate matter. Therefore, in order to accurately calculate destruction efficiency for land-based incinertors, total particulate matter must be monitored.

(9) Section 761.70(a)(7):

At a minimum monitoring and recording of combustion products and incineration operations shall be conducted for the following parameters whenever the incinerator is incinerating PCBs; (i) O_2; (ii) CO; and (iii) CO_2. The monitoring for O_2 and CO shall be continuous. The monitoring for CO_2 shall be periodic, at a frequency specified by the Regional Administrator.

The proposed permits require continuous monitoring and recording of oxygen, carbon monoxide, and carbon dioxide in the stack gases and the draft (negative pressure) in the combustion chamber.

(b) Trial Burns

Section 761.70(d)(2):

The Regional Administrator may not approve the incineration of PCBs unless he finds that the facility meets the operating and performance requirements for incinerating liquid and/or non-liquid PCBs. The Regional Administrator may approve the facility based on an initial report submitted by the applicant and a waiver for a trial burn or may approve the facility based on a trial burn. If the Regional Administrator determines a trial burn is necessary, the applicant must submit a detailed plan which includes:

(1) Date trial burn is to be conducted;
(2) Quantity and type of PCBs and PCB items to be incinerated;
(3) Parameters to be monitored and location of sampling points;
(4) Sampling frequency and methods and schedules for sample analyses; and
(5) Name, address, and qualifications of persons who will review analytical results and other pertinent data, and who will perform a technical evaluation of the effectiveness of the trial burn.

The Regional Administrator may disapprove, modify, or approve the plan. If the plan is approved, the trial burn takes place at a date and time agreed to by the Regional Administrator and the applicants.

Trial burns are used in the incineration at-sea program to conduct an initial survey of a new vessel, in accordance with the London Dumping Convention, and to determine the performance (destruction efficiency) of an incinerator on PCBs or other POHCs. Research permits are written for incineration at-sea trial burns and are similar to special permits. The research permit specifies the POHCs to be included (PCBs or other compounds), the minimum operating conditions

and, as part of Appendix A, the testing protocols to be used in determining the destruction efficiency of the incinerator. EPA reviews the qualifications of persons who will collect the samples and perform the analysis. However, it has been and it will continue to be EPA policy to have an EPA observer or an EPA-certified observer onboard the vessel during the trial burn. If the trial burn is conducted at a U.S. incineration site, EPA may conduct environmental monitoring studies from its research vessel, OSV ANTELOPE.

The waiver of a trial burn in order for the M/T VULCANUS II to incinerate mixed chemical wastes with TCDD or PCBs discussed earlier, was authorized under the above provision in the TSCA regulations. The determination to issue the waiver was based on a finding by EPA's Industrial Environmental Research Laboratory (IERL-CI) that the M/T VULCANUS I and M/T VULCANUS II are using the same equipment and on EPA's accumulated experience with monitoring incinerator emissions for TCDD and PCBs.

(c) Finding

TSCA regulations for liquid PCBs specify a performance standard of 99.9 percent combustion efficiency. However, the performance standard for non-liquid PCBs in Section 761.70(b)(1) states:

> "The mass air emissions from the incinerator shall be no greater than 0.001g PCB/kg of the PCB introduced into the incinerator"

This translates into a destruction removal efficiency* of at least 99.9999 percent. While there is no equivalent destruction removal efficiency stipulated in the TSCA Regulations for liquid PCBs, it is believed that if the incinerator meets the operating requirements (i.e., temperature, oxygen, and dwell time) and attains the stipulated performance standard for combustion efficiency of 99.9 percent on the entire waste mixture, then, the incinerator will achieve a destruction removal efficiency of at least 99.9999 percent.

The proposed incineration at-sea permits require a destruction efficiency of at least 99.99 percent. In the August 1982, trial burn the M/T VULCANUS I demonstrated a destruction efficiency of greater than 99.99 percent. A great deal of attention has been focused on this apparent difference in land-based and at-sea incineration program requirements.

In EPA's judgment, the real difference is not in the actual performance of land-based and at-sea incinerators, but in the ability to routinely detect trace quantities of surviving PCBs to demonstrate a particular performance level. Sampling of the combustion gases in land-based facilities is done after the gases pass through the scrubbers. As a result, the combustion gases are approximately 40°C at the time the gases are sampled in land-based facilities while the combustion gases on the M/T VULCANUS I and II are over 1200°C at

* Destruction removal efficiency is equivalent to the destruction efficiency of at-sea incinerators. The difference in terminology is a result of the auxiliary air pollution control devices, such as scrubbers, that are required in land-based facilities.

sampling. At these high temperatures the difficulty of sampling increases substantially. The cooler combustion gases in land-based facilities allow for longer sampling periods. The longer the sampling period, the greater the volume of gases that can be collected. The greater the volume of gases collected, the smaller the concentration of surviving organics that can be detected. EPA believes that if incinerators at-sea could be sampled in the same manner as TSCA units, at-sea destruction removal efficiencies also could be expressed to 99.9999 percent.

EPA scientists are confident that they can routinely demonstrate greater than 99.99 percent destruction efficiency for at-sea incinerators. However, until the difficulties of sampling hot combustion gases can be surmounted, EPA scientists are not confident that they can routinely demonstrate a destruction efficiency of 99.9999 percent for at-sea incineration.

Therefore, EPA finds that if at-sea incinerators attain the performance standard of 99.9 percent combustion efficiency which is the same as the TSCA requirements for liquid PCBs, and meet the operating requirements (for temperature, oxygen and carbon monoxide) which are more stringent than the TSCA requirements for liquid PCBs, then the at-sea incinerators will perform at a level at least equal to that of the land-based facilities incinerating liquid PCBs.

5. CONSISTENCY WITH LAND-BASED INCINERATORS PERMITTED UNDER RCRA

Subpart O (40 CFR 264.340-264.351) of the regulations implementing the Resource Conservation and Recovery Act (RCRA) cover land-based incineration of hazardous wastes with the exception of PCBs which are regulated under TSCA and the rules in 40 CFR 761.70. The rules on conducting trial burns under RCRA for land-based facilities are in 40 CFR 122.27(b). Although RCRA regulations do not apply to the incineration of hazardous wastes at-sea, it is EPA's policy to include requirements in at-sea incineration permits equivalent to the requirements in land-based permits, unless there is a specific reason which renders the land-based requirements unnecessary for incineration at-sea. Table 3 on page 83, "Hazardous Waste Incineration: Comparison of At-Sea and Land-Based Requirements" summarizes and compares the requirements in the proposed permits and those in RCRA issued permits.

(a) Operating Permits

(1) Performance Based Permits

RCRA-issued permits are performance based, as are incineration at-sea permits. There are no "generic" operating conditions. Each facility's operating conditions are determined by the conditions

necessary for the achievement of the performance standard as demonstrated in a trail burn. (Trial burns under RCRA and under at-sea research permits are described later in this section).

(2) Section 264.342. Principal Organic Hazardous Constituents (POHCs)

Both programs require trial burns to determine whether the incinerators can achieve a destruction efficiency of at least 99.99 percent on a POHC. A POHC is selected based on its heat of combustion and concentration in the waste mixture. Waste mixtures eligible for incineration in both programs are those that contain compounds with heats of combustion equal to or greater than that of the POHC with the lowest heat of combustion for which at least a 99.99 destruction efficiency or destruction removal efficiency was demonstrated in the trial burn.

(3) Section 264.343(a). Destruction Removal Efficiency/Destruction Efficiency

As discussed under "Compliance with TSCA Regulations", destruction removal efficiency (DRE) and destruction efficiency (DE) are equivalent.

The formula for determining destruction removal efficiency and destruction efficiency is the same:

$$DE/DRE = \frac{W_{in} - W_{out}}{Win} \times 100$$

Where:

W_{in} = Mass feed rate of one POHC in the waste stream feeding the incinerator

W_{out} = Mass emission rate of the same POHC in exhaust emissions prior to release to the atmosphere.

(4) Section 264.343(d)

For purposes of permit enforcement, compliance with the operating requirements specified in the permit will be regarded as compliance with the performance standard. However, evidence that compliance with those permit conditions is insufficient to ensure compliance with the performance requirements of this Section may be "information" justifying modification, revocation, or reissuance of a permit.

The proposed permits have a similar provision. Compliance with the operating conditions specified in the permit will be regarded as compliance with the performance standard. However, the proposed permits may be modified, revoked or reissued if subsequent analyses indicate that the operating conditions specified in the permits are insufficient to ensure compliance with the performance standard of 99.99 percent destruction efficiency and 99.9 percent combustion efficiency.

(5) Section 264.344(a):

The owner or operator of a hazardous waste incinerator may burn only wastes specified in his permit and only under operating conditions specified for those wastes.

(6) Section 264.344(b):

Other hazardous wastes may be burned only after operating conditions have been specified in a new permit or a permit modification as applicable. Operating requirements for new wastes may be based on either trial burn results or alternative data included with Part B of a permit application.

Similar provisions are included in the proposed permits.

(7) Section 264.341(b):

Throughout normal operation, the owner or operator must conduct sufficient waste analysis to verify that waste feed to the incinerator is within the physical and chemical composition limits specified in his permit.

The proposed permits require a chemical analysis of the wastes prior to each incineration cruise. The chemical analysis must be conducted in an EPA-approved laboratory in accordance with EPA-approved protocols found in Appendix A of the permits. Duplicate samples may be taken by an authorized EPA representative to verify the Permittees' chemical analysis. Only when EPA is convinced that the wastes to be incinerated meet the requirements of the permits will authorization be given for loading the vessels.

An authorization for loading is, for all practical purposes, an authorization for incineration. However, should the analyses of any samples taken by EPA from the vessels' or dockside storage tanks or from the blending/holding tanks at Emelle, Alabama demonstrate the presence of compounds that were not in, or were in concentrations greater than that indicated, in the original analyses of the Permittees' samples of the blending/holding tanks, EPA may terminate the incineration even if incineration has already begun.

(8) Section 264.345(a):

An incinerator must be operated in accordance with operating requirements specified in the permit. These will be specified on a case-by-case basis as those demonstrated in a trial burn or from alternative data included with Part B of a facility's permit application, to be sufficient to comply with the performance standard.

(9) Section 264.345(b):

Each set of operating requirements will specify the composition of the waste feed (including acceptable variations in the physical or chemical properties of the waste feed which will not affect compliance with the performance standard) for which the operating requirements apply. For each such waste feed, the permit will specify acceptable operating limits including the following conditions:

(i) Carbon monoxide (CO) level in the stack exhaust gas;
(ii) Waste feed rate;
(iii) Combustion temperature;
(iv) An appropriate indicator of combustion gas velocity;
(v) Allowable variations in incinerator system design or operating procedures; and
(vi) Such other operating requirements as are necessary to ensure that the performance standards are met.

The proposed permits specify the compounds that may not be included in a waste mixutre or are restricted. The proposed permits also specify the incinerator operating conditions necessary to assure compliance with the performance standards. The level of waste analysis to be submitted by the Permittees must be expressed as quantifiable concentrations of the chemical class of the compounds in a waste mixture. This level of analysis is more than sufficient for EPA to determine whether the compounds in a waste mixture are eligible for incineration. It is not necessary to specify the physical properties of the wastes because the design limits of the incinerator systems on the M/T VULCANUS I and II preclude wastes other than pumpable liquids. The proposed permits require that the waste feed rate be monitored but

do not specify a thermal input rate. Nor do the proposed permits specify "an appropriate indicator of combustion gas velocity." In lieu of these operating indicators, the incineration at-sea permits require demonstration of the performance standard of 99.9 percent combustion efficiency after each burn to control the performance of the incinerator.

(10) Section 264.345(c):

During start-up and shut-down of an incinerator, hazardous waste must not be fed into the incinerator unless the incinerator is operating within the conditions of operation specified in the permit. (Section 264.345(c))

The proposed permits have an identical provision.

(11) Section 264.345(e):

An incinerator must be operated with a functioning system to automatically cut off waste feed to the incinerator when operating conditions deviate from limits established. (Section 264.345(e))

The proposed permits stipulate that automatic devices shut off the flow of the wastes to the incinerators whenever the flame goes out, or the minimum temperature, minimum level of oxygen in the combustion gases or the maximum level of carbon monoxide in the combustion gases are reached or, the devices monitoring temperature, air flow, draft (negative pressure) in the combustion chambers, oxygen, carbon monoxide, carbon dioxide and waste feed flow and/or auxiliary fuel (if used) fail.

(12) Section 264.345(f):

An incinerator must cease operation when changes in waste feed, incinerator design, or operating conditions exceed limits designated in its permit. (Section 264.345(f))

This provision is not applicable to the proposed permits because prior to loading the wastes onto the vessel before each incineration cruise, EPA makes a determination that the wastes meet the requirements of the permits.

(13) Section 264.347(a)(1) and (2):

The owner or operator must conduct, as a minimum, the following monitoring while incinerating hazardous waste:

(i) Combustion temperature, waste feed rate, and the indicator of combustion gas velocity specified in the facility permit must be monitored on a continuous basis.
(ii) CO must be monitored on a continuous basis at a point in the incinerator downstream of the combustion zone and prior to release to the atmosphere.

The proposed permits require continuous monitoring and recording for:

° wall temperature

° air flow to the incinerators

° oxygen concentration in the combustion gases

° carbon monoxide concentration in the combustion gases

° carbon dioxide concentration in the combustion gases

° flow rates of the wastes or auxiliary fuel (if used)

° draft (negative pressure) in the combustion chambers

The requirement for the continuous monitoring and recording of air flow to the incinerators replaces the analogous RCRA requirement for combustion gas velocity.

(14) Section 264.347(a)(3):

Upon request by the Regional Administrator, sampling and analysis of the waste and exhaust emissions must be conducted to verify that the operating requirements established in the permit achieve the performance standards of destruction removal efficiency.

The proposed permits have a similar provision.

(15) Section 264.347(b):

The incinerator and associated equipment (pumps, valves. conveyors, pipes, etc) must be subjected to thorough visual inspection, at least daily, for leaks, spills, fugitive emissions, and signs of tampering.

The proposed permits require calibration of instruments before each cruise and in accordance with manufacturer's recommendations. In addition, the proposed permits require shipriders to provide 24 hour a day observation of all incineration activities. Shipriders may be EPA employees or EPA-approved contractors that report directly to EPA but are paid for by the Permittees. These shipriders will inspect for leaks, spills, signs of tampering, etc. A Principal Shiprider, designated by EPA, may terminate incineration operations if, in his opinion, any term or provision of the permits is not being met and harm to the environment or human health or welfare is occurring or is about to occur. The proposed permits also provide for the maintenance, continuous monitoring and continuous recording of a minimum draft (negative pressure) in the combustion chambers. This requirement will prevent the release of fugitive emissions, thereby protecting shipboard personnel and help to insure proper incinerator operation.

(16) Section 264.347(c):

The emergency waste feed cutoff system and associated alarms must be tested at least weekly to verify operability, unless the applicant demonstrates to the Regional Administrator that weekly inspections will unduly restrict or upset operations and that less frequent inspection will be adequate. At a minimum, operational testing must be conducted at least monthly.

The proposed permits require testing of the automatic devices shutting off the flow of wastes to the incinerators before each incineration cruise.

(17) Section 264.347(d):

Monitoring and inspection data must be recorded and the records must be placed in the operating log.

The proposed special permits require the Permittees to submit the monitoring and inspection data to EPA within 10 working days after the termination of each incineration cruise. Data on destruction efficiency tests conducted under the proposed research permit and on destruction efficiency tests if conducted under the special permits do not have to be submitted to EPA until 90 working days after the cruise because it it takes longer to analyze the data to calculate destruction efficiencies.

(18) Section 264.351(a):

At closure, the owner or operator must remove all hazardous waste and hazardous waste residues (including, but not limited to, ash, scrubber waters, and scrubber sludges) from the incinerator site.

The proposed permits require that waste contaminated waters or ash from the vessels be incinerated at sea or disposed of in EPA-approved land-based facilties.

(19) Section 264.347(c) and Sections 264.50-56: Contingency Plan/Emergency Procedures

A Contingency Plan must be submitted as part of the permit application for a RCRA permit as is required for the incineration at-sea permits. While the incineration at-sea Contingency Plan and emergency procedures cover similar generic topics (i.e., fires, explosions, spills, etc.) as RCRA, the at-sea Contingency Plan focuses

on different coordination mechanisms and responses based on the nature and locations of the operations. EPA asked the U.S. Coast Guard to review the Contingency Plan submitted by the applicants to determine whether the Contingency Plan meets U.S. Coast Guard's requirements for handling emergencies in the harbor and at sea. The finding by the U.S. Coast Guard is discussed in the next section.

(b) Trial burns/research permits

Sections 264.344(c), 122.27:

The purpose of trial burns is to establish permit conditions, including but not limited to, allowable waste feeds and operating conditions for a new land-based hazardous waste incinerator under RCRA, and for special permits under the Ocean Dumping Regulations. In some respects, the trial burn under RCRA corresponds to the "survey" of the vessel conducted by a Contracting Party to the London Dumping Convention and in other respects with the at-sea incineration research permits issued to determine the destruction efficiency of incinerators on POHCs and the five compounds listed in the London Dumping Convention on which doubts exist as to their incinerability.

Under RCRA, EPA approves the applicants' recommended operating conditions, and trial burn plan, including waste analysis, sampling and monitoring procedures, waste feed shut off systems, etc. These items

are specified for the applicants in a research permit for incineration at-sea trial burns.

A trial burn is limited to 720 hours (30 days) under RCRA with an option for an additional 720 hours when good cause is shown. Applicants may continue to burn wastes under the conditions specified in the trial burn until the results of the trial burn are analyzed.

Research permits for incineration at-sea trial burns are issued for six months. During the period of the research permit, incineration of wastes may occur only under the closely monitored conditions specified in the permit. Until the data from the trial burn is analyzed additional "burns" may not take place.

(c) Findings

Based upon the above comparison of RCRA program requirements and the conditions included in the proposed special and research permits, EPA finds that the proposed permits are, at a minimum, consistent with the RCRA requirements.

6. U.S. COAST GUARD'S FINDING ON THE CONTINGENCY PLAN

The Applicants were required to submit, as part of their application, a Contingency Plan which outlines the safety precautions taken in designing, constructing and equiping the vessels and the procedures to be implemented in case of an accident or other emergency at-sea. Both vessels are classified as Type II chemical ships which means that to be certified by the International Maritime Organization and the U.S. Coast Guard there must be a significant degree of cargo containment capability. Since both vessels have double hulls and double bottoms and the wastes in both vessels are stored in several compartments in the interior of the vessels, there is little likelihood that any collision would cause the rupture of the storage compartments. In addition, the safety equipment and its placement on board the vessels is governed by the Safety of Life at Sea Convention (SOLAS). As a condition of the permits and to operate in international and U.S. waters, the vessels must have on board valid certificates indicating compliance with all international and U.S. regulations.

The Contingency Plan also specifies the coordination mechanisms and responses if fires, explosions, spills, collisions, etc., should occur in the harbor or at sea. A major focus of the Contingency Plan is the steps that will be taken to minimize the environmental affect of an incident.

Because of the nature of the activities in the harbor or at sea, EPA requested that the U.S. Coast Guard review and make recommendations on the adequacy of the Contingency Plan. Based on its preliminary review, the U.S. Coast Guard concluded that both vessels have taken the necessary precautions to prevent incidents and that the Contingency Plan is a workable plan for responding to a wide variety of potential emergencies at sea or in the harbor. During the comment period on the Notice, the U.S. Coast Guard will make further recommendations on the Contingency Plan.

Besides the inspections that the U.S. Coast Guard makes of the vessels and their incinerators, the U.S. Coast Guard issues "Broadcast to Mariners", warning other ships of the vessels' progress to and incineration at the site. In addition, the Captain of the Port Mobile must be notified 24 hours before sailing which precludes the vessels from sailing if there are pending storms which would interfere with the safe passage of the vessels to the incineration site. The U.S. Coast Guard supervises the loading of the vessels and the Captain of the Port Mobile supervises the passage of the vessels through Mobile Bay to the Gulf.

7. CONCLUSION

Based on the foregoing analysis, EPA has made a tentative determination to issue special permits to Chemical Waste Management, Inc. and Ocean Combustion Service, B.V. to use the M/T VULCANUS I and the M/T VULCANUS II to incinerate a combined total of 300,000 metric tons of mixed chemical wastes according to the conditions and specifications in the permits. In addition, EPA has made a tentative determination to issue a research permit to the Applicants to incinerate 260,000 gallons of 10 percent dichlorodiphenyl trichloroethane (DDT), 90 percent solvent waste.

EPA has determined that the proposed permits are consistent with the criteria in the Ocean Dumping Regulations in 40 CFR 220-228 and the Regulations and Technical Guidelines of the CONVENTION ON THE PREVENTION OF MARINE POLLUTION BY DUMPING OF WASTES AND OTHER MATTER (the London Dumping Convention) to which the United States is a Contracting Party. With respect to the incineration of PCBs, the permits meet the requirements of the regulations in 40 CFR 761.70(a) implementing provisions of the Toxic Substances Control Act on incinerating liquid PCBs. In addition as a matter of Agency policy, the proposed permits are consistent with the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act regulations on land-based incinerator facilities in 40 CFR Part 264, Subpart O.

The following SECTION-BY-SECTION ANALYSIS identifies the permit conditions and the reasons for the choice of the particular permit conditions selected in accordance with 40 CFR 222.3(a)(4).

III. SECTION BY SECTION ANALYSIS OF THE PERMITS

This section-by-section analysis summarizes the permit conditions and the reasons for selecting the particular conditions as required by 40 CFR 222.3(a)(4).

EPA Signatory, Assistant Administrator for Water

On September 16, 1983, the Administrator of the Environmental Protection Agency delegated responsibility to the Assistant Administrator for Water to issue incineration at-sea permits.

The Assistant Administrator for Pesticides and Toxic Substances, who must grant written approval of the permits prior to any incineration of PCBs, has approved the proposed permits as meeting the requirements of TSCA for the incineration of liquid PCBs and the regulations in 40 CFR 761.70(a).

I. Authorized Permittees and Incineration Vessel

This section identifies and gives the address of the Permittees, Chemical Waste Management, Inc., and its subsidiary Ocean Combustion Service, BV. It also identifies the specific vessel that is to be used for the incineration activities included in

each of the permits. No vessel other than the vessel specified may be used for the authorized activities.

II. Vessel and Incineration Certification

This part of the permit identifies the certificates that must be obtained prior to issuing the permit. They include a "Certificate of Fitness" issued by the International Maritime Organization (IMO) and a "Letter of Compliance" from the U.S. Coast Guard. These two certificates attest to the fitness of the vessels to load and transport the material to be incinerated and to the fact that the vessels are in compliance with international and U.S. Maritime Regulations for the transport of dangerous chemicals.

In addition to the certificates authorizing the vessels to transport hazardous wastes, the incinerators must also be surveyed and certified by a Contracting Party to the London Dumping Convention. Every two years the incinerators must be recertified. The M/T VULCANUS I's incinerators must be recertified by June, 1985 and the M/T VULCANUS II's incinerators must be recertified by July, 1985. The U.S. Coast Guard inspects the safety of the incinerators as required by P.L. 97-389, December 29, 1982.

III. General Provisions

The items included in this section of the permits describe the general administrative and enforcement provisions of the permits.

The terms used in the permits have the same meanings assigned to them as those in the Marine Protection, Research and Sanctuaries Act of 1972, as amended (the Act) and the regulations issued in 40 CFR Parts 220-228. Two other terms are used in the permit: quantifiable concentration and Permit Program Manager.

Quantifiable concentration is defined as the minimum concentration of a discrete chemical constituent (element or compound) in a chemical waste that can be detected, identified, and quantified without confirmatory analyses. The amount of this concentration will vary depending on the chemical constituent, possible interferences of other constituents in the chemical waste, the method of sample preparation, and the method of analytical detection, identification, and quantification (as defined in Appendix A of the Permits).

The Permit Program Manager is identified as the Director, Criteria and Standards Division, Office of Water Regulations and Standards, U.S. EPA. The Permit Program Manager is the official who will make the decisions on all aspects of the permit and who is

ultimately responsible for ensuring that the incineration operations are carrried out safely and efficiently.

By reference, EPA has included, as a general condition of the permit, compliance with RCRA and TSCA regulations on the generation, collection, transportation, labelling, storage and reporting of hazardous materials; and U.S. Coast Guard Regulations.

To assure compliance with the terms and conditions of the permits, EPA, or an authorized representative of EPA, may enter the premises of the Permittees to inspect records and monitoring equipment and take duplicate waste samples for analyses, etc. The "Right of Entry" is a generic provision of all permits.

EPA is also requiring that shipriders be onboard the vessels during each incineration cruise to provide full and continuous observation of all incineration activities. This provision is predicated on the nature of incineration at-sea activities which precludes unannounced spot checks.

The shipriders may be EPA employees or may be independent parties selected by the Permit Program Manager. If independent parties, the shipriders are paid by the Permittees but report directly to

the Permit Program Manager. A Principal Shiprider is appointed by the Permit Program Manager. He has the authority to terminate the burn if in his opinion any term of the permit is not being met and harm to the environment or human health or welfare is occurring or is about to occur.

There is a generic prohibition against any intentional or unintentional loss of wastes during loading, transport or incineration activities. Compliance will be verified by comparing the weight of the wastes loaded with the weight of the wastes incinerated and with the weight of any remaining wastes in the cargo tanks.

The Permittees have $350,000,000 in insurance policies which appear fully adequate to protect the United States, States and the public against any and all liability arising out of the Permittees acts or emissions in the performance of the permits. EPA is not necessarily endorsing this specific amount. The Agency is requesting recommendations on appropriate methodologies for determining an adequate level of liability insurance.

For any violation of the terms or conditions of the Permit, the Permittees may be liable for a civil and/or criminal penalty of not more than $50,000 per day for each violation. In addition, any person who knowingly violates any provision of the Act, the regulations, or this Permit shall be fined not more than $50,000

per day for each violation and/or be imprisoned for not more than one year. The amount of the penalty will depend on the severity of the particular violation.

The Permit may be modified, revoked or reissued if subsequent analyses indicate that the operating conditions specified in the Permit are insufficient to assure compliance with the performance standard of 99.99 percent destruction efficiency and 99.9 percent combustion efficiency. In addition, if analyses of data obtained from long term monitoring of the Gulf Site indicate adverse environmental and/or human health impacts from incineration activities, the Permit may be revoked or reissued. There is also a provision that the Assistant Administrator for Water or the Permit Program Manager shall suspend the permit if any of the activities are likely to result in imminent and substantial harm to human health or to the environment.

Included in the General Provisions are procedures which must be followed if there is a life threatening emergency which necessitates the discharge of a portion or all of the cargo to save lives. If such an emergency should occur, the MASTER of the Vessel notifies the U.S. Coast Guard and the Permit Program Manager immediately. Within ten days of the emergency a full written report is to be made to the Assistant Administrator for Water detailing the emergency and the actions taken.

IV. Special Provisions

This section stipulates the terms and conditions necessary to assure that the mixed chemical wastes to be incinerated under HQ 83-001 and under HQ 83-002 and the 10 percent dichlorodiphenyl trichloroethane (DDT) 90 percent solvent to be incinerated under HQ 83-003 are completely and safely destroyed. Each condition is described separately, below.

1. Permit Term

The three year expiration date for the Special Permits, HQ 83-001 and HQ 83-002 is a regulatory requirement of 40 CFR 220.3(b). The six months expiration date for the Research Permit HQ 83-003 is a statutory requirement of 33 U.S.C. 1412a(b), as amended by PL 96-572, December 20, 1980.

2. Description of Material

a. Eligible Material:

Mixed liquid organic compounds including, but not limited to chlorinated organic compounds, comply with the criteria in 40 CFR 227.4, 227.8, 227.11, 227.12, and 227.27. The design of the incinerator system on the M/T VULCANUS I and the M/T VULCANUS II precludes wastes other than pumpable liquids.

The M/T VULCANUS I is authorized to incinerate mixed chemical wastes containing compounds with a heat of combustion equal to or greater than 1.79 kcal/gram. The eligibility of the M/T VULCANUS I's incinerators was established in the August, 1982 trial burn (conducted pursuant to Research Permit HQ 81-002). Hexachlorobenzene was the POHC with the lowest heat of combustion, 1.79 kcal/gram, tested. The destruction efficiency attained in the tests was greater than 99.99 percent.

Based on the February, 1983 trial burn on the M/T VULCANUS II that was conducted jointly by the Government of Netherlands and EPA, a destruction efficiency of greater than 99.99 percent was attained on tetrachloromethane which has a heat of combustion of 0.24 kcal/gram. Therefore, the M/T VULCANUS II is authorized to incinerate mixed chemical wastes with a heat of combustion equal to or greater than 0.24 kcal/gram.

b. Prohibited Materials:

(i)

The mixed chemical wastes may not include, in quantifiable concentrations, the following:

(A) compounds with heats of combustion less than 1.79 kcal/gram for the M/T VULCANUS I and less than 0.24 kcal/gram for the M/T VULCANUS II. This is consistent with the Ocean Dumping Regulations, 40 CFR 227.6(h), the requirements of the

POHC/Index of Incinerability found in RCRA's regulation at 40 CFR 122.27(b)(1) and the London Dumping Convention (Annex 5, Regulation 5).

(i) (B)-(D)

The London Dumping Convention (Regulation 4) requires a trial burn for DDT, BHC, and PCT because there are doubts as to the incinerability of these compounds.

(ii)(A)

The amount of TCDD (dioxin) in the waste mixture is limited to 2 ppm based on the 1977 trial burn in which the M/T VULCANUS I incinerated Herbicide Orange with an average concentration of 1.9 ppm TCDD. Usually a concentration of at least 100 ppm of a compound is needed in a waste mixture to analytically measure and demonstrate an incinerator's destruction efficiency for that compound to at least 99.99 percent. An overall destruction efficiency of greater than 99.93 was demonstrated for dioxin in the three burns. However, EPA believes that in actuality, the incinerators probably achieved at least a 99.99 percent destruction efficiency based on the fact that during the same trial burns, the destruction efficiencies for 2,4-D and 2,4,5-T were calculated to be greater than 99.999 percent.

At that time the methodologies employed did not have the analytical sensitivity to measure low levels of potentially

surviving dioxin in stack gas samples in order to be able to demonstrate an unqualified destruction efficiency. In order to do so, there has to be a detectable and quantifiable amount of a compound in the stack gas samples. Failure to detect a compound does not mean that the compound is not there, if the level of detection of the sampling and analytical methodology is not adequate to measure low levels of a particular compound and if, as was the case with Herbicide Orange, there were compounds with a similar chemical structure as dioxin in the stack gases sampled.

In addition to the fact that EPA believes the destruction efficiency obtained on TCDD was probably closer to 99.99 percent than the data indicate, dioxin is much easier to incinerate with a heat of combustion of 3.43 kcal/gram than hexachlorobenzene with a heat of combustion of 1.79 kcal/gram on which the M/T VULCANUS I later demonstrated greater than 99.99 percent destruction efficiency or tetrachloromethane with a heat of combustion of 0.24 kcal/gram on which the M/T VULCANUS II demonstrated greater than 99.99 percent destruction efficiency. Furthermore, incinerator plume modelling and subsequent ocean dispersion modelling have demonstrated that the emissions resulting from the incineration of chemical wastes containing 2 ppm of dioxin at a destruction efficiency of 99.93 percent will cause no adverse environmental impact. This is based on a determination that any uncombusted dioxin in the emissions would result in an ambient water concentration of dioxin below the marine aquatic life no effect level for this compound and below the limiting permissible concentration as required in 40 CFR 227.27. Therefore, EPA has

authorized the incineration of waste mixtures containing dioxin at 2 ppm or less.

A trial burn was waived for the M/T VULCANUS II to demonstrate a 99.99 percent destruction efficiency on dioxin based on a finding that the incinerator equipment on the M/T VULCANUS II is the same as that on the M/T VULCANUS I and on EPA's accumulated experience in monitoring incinerators for dioxin emissions.

(ii) (B)

The concentration of PCBs in the waste mixture may not exceed 35 percent to assure that at a destruction efficiency of at least 99.99 percent, any trace PCB emissions will not cause ambient marine water quality criteria (limiting permissible concentrations) to be exceeded as required at 40 CFR 227.27. Trial burns on the M/T VULCANUS I demonstrated destruction efficiencies of greater than 99.99 percent on PCBs. In addition, incinerator plume modelling and subsequent ocean dispersion modelling have shown that any surviving PCBs in the emission plume would result in an ambient marine water concentration of PCBs below the marine water quality criterion for PCBs as required by 40 CFR 227.27.

EPA also waived the trial burn on PCBs for the M/T VULCANUS II. This PCB waiver is based on the same determination as the TCDD waiver that the M/T VULCANUS II's incinerator equipment is the same as that on the M/T VULCANUS I and on EPA's accumulated experience in monitoring the incineration of PCBs.

(ii) (C)

EPA is limiting the chlorine content of the wastes to 70 percent of the mixture. Trial burns have shown that the incinerators on both vessels can attain combustion efficiencies of 99.9 percent on whole wastes with a chlorine content as high as 70 percent as well as destruction efficiencies of greater than 99.99 percent on POHCs in a waste mixture with a 70 percent chlorine content. In fact, EPA has found no technical basis in theory or in practice for limiting the concentration of total organochlorines. There is a self-regulating incentive for the Permittees to incinerate wastes with sufficient heating values to maintain the specified temperature and other control parameters without supplementing the wastes with auxiliary fuel.

This, therefore, will usually limit total organochlorine content in wastes to no more than 70 percent for any burn. However, consistent with other provisions of the Permit, EPA is adopting a conservative approach and specifying 70 percent as a maximum amount.

(iii) (A-C)

Limits are placed on metals, to assure that the applicable marine water quality criteria will not be exceeded. The limits are based on a model developed for EPA by JRB Associates under EPA Contract No. 68-01-6388, Work Assignment No. 37. The model was used to determine the limiting permissible concentrations of a consistuent

as required by 40 CFR 227.27. The models are discussed in the report, Permissible Metal, PCB, and TCDD (Dioxin) Concentrations in Incineration Waste Material, September 26, 1983. The model indicated that for all but two of the metals (silver and mercury), significantly higher metal concentrations than 100 ppm in waste would not emit a level of metals after incineration that would cause water quality criteria to be exceeded. EPA has limited the maximum concentration to 20 ppm for silver, 9 ppm for mercury and 100 ppm for the remaining metals to add an additional margin of safety due to the uncertainties of assumptions used in any model. Although the limits in the permits are conservative, they will be retained until EPA can verify that even trace amounts of these materials will have no long term adverse impact on the marine environment.

(iv) (A-D)

High level radioactive wastes or materials used in radiological, chemical or biological warfare are prohibited by Section 102(a) of the Act. In addition, the Ocean Dumping regulations at 40 CFR 227.5 prohibits materials which cannot be identified or, which are persistent, inert, synthetic or, which may float or remain in suspension in the ocean.

(v)

The analyses conducted to confirm that the wastes are eligible for incineration must be done in accordance with Appendix A, "Waste Sampling and Analysis Procedures".

3. Analysis of Material

(a-d)

The Ocean Dumping Regulations prohibit in 40 CFR 227.5(c) the incineration of materials insufficiently described to determine their impact on the environment. Before the wastes are loaded onto the vessels, for each incineration cruise, the Permittees must provide chemical analyses of the wastes to be incinerated. The chemical analysis must be conducted in an EPA-certified laboratory in accordance with the EPA-approved protocols found in Appendix A of the permit. The analyses will provide information on quantifiable concentrations of the chemical classes of the constituents in the waste mixture. A quantifiable concentration of an organochlorine is most likely 1-2 ppm and of a metal 1-10 ppb. This level of detail is sufficient to determine the incinerability of the wastes and the effects of a waste on the environment after incineration.

The samples are to be taken from the Permittees' blending/holding tanks at Emelle, Alabama and, at the discretion of the Permit Program Manager, from the dockside or the vessels' storage tanks.

The Permit Program Manager may require duplicate samples be taken by EPA or by an authorized EPA representative, coded and analyzed in an EPA-approved laboratory to verify the Permittees analyses. This will be done at the Permittees' expense.

Permittees' are to report, to the best of their knowledge, whether any of the wastes to be incinerated are from hazardous waste sites which are subject to a Court, State or, an EPA cleanup order. This information will assist EPA and the States in verifying the location and final disposition of such wastes and may assist EPA's determination as to whether the wastes meet the permit conditions.

4. Authorization for Loading the Vessel and Incineration

(a-c)

The Permit Program Manager will evaluate the chemical analyses submitted by the Permittees to ensure that the wastes do not contain quantifiable concentrations of chemicals with a heat of combustion less than that specified in the permits (for HQ 83-001, 1.79 kcal/gram; for HQ 83-002 and HQ 83-003, 0.24 kcal/gram), and do not contain any prohibited materials. In addition, the Permit Program Manager will verify that the duplicate samples, if taken, are equivalent. If the Permit Program Manager is convinced that the wastes meet the specifications of the Permit, he will authorize the loading of the vessel. Loading of the vessel may

begin based on a verbal authorization, but prior to departure, the specific written authorization must be onboard the vessel.

The authorization for the loading is, for all practical purposes, an authorization for incineration. However, should any of the results of analyses on samples taken by EPA from the vessels' or dockside storage tanks or from the blending/holding tanks in Emelle, Alabama demonstrate the presence of compounds that were not in or were in concentrations greater than that indicated in the original analyses of the Permittees' samples of the blending/holding tanks, the Permit Program Manager shall terminate the incineration if the newly discovered compounds or the concentrations of these compounds are not eligible for incineration. If these verification analyses of the mixed chemical wastes show the wastes are nevertheless eligible for incineration, the Permit Program Manager has the discretion to terminate or to continue the incineration. In any case, whether the incineration is terminated or not, any discrepancies, beyond the expected range of sample and/or analytical variation, constitute a violation of the permits.

The U.S. Coast Guard supervises the loading of the vessels and the Captain of the Port, Mobile supervises the passage of the vessels through Mobile Bay of the Gulf.

5. Amount of Material

The total amount of material authorized for incineration under the special permits (HQ 80-001 and HQ 83-002) between the two vessels

is 300,000 metric tons. One vessel may incinerate the entire amount or both vessels may incinerate a portion, as long as the total amount incinerated does not exceed 300,000 metric tons.

The 900 metric tons authorized under Research Permit HQ 83-003 is an amount needed to run a sufficient number of destruction efficiency tests.

6. Transportation Activities

(a)

Section 223.1(a) states that the permit shall include the port through or from which the wastes will be transported. The authorized point of departure is the Port of Mobile, Alabama. Designation of a specific port also serves to restrict the geographic area in which the activities may take place to aid in EPA's and the U.S. Coast Guard's surveillance and enforcement functions.

(b)

The Captain of the Port, Mobile and the 8th District Coast Guard are to be notified 10 days before the loading of the vessel. This notification is preliminary because the loading of the vessel may not take place until authorized by the Permit Program Manager. Twenty-four hours prior to sailing, the Captain of the Port is to be notified. At this time the written authorization for loading

the vessel from the Permit Program Manager must be onboard the Vessel.

(c)

In notifying the Captain of the Port of sailing, items, such as permit number, vessel call sign, estimated arrival at the incineration site, etc. are required so that the U.S. Coast Guard can issue the "Broadcast to Mariners" of the vessels' progress and incineration activities.

(d)

The items listed in this section including the permit, name of person notified of sailing, time of contact, confirmation code and written authorization for loading must be onboard the vessel to ensure that the proper authorization and notifications were made.

(e)(i)-(ii)

During transport, the vessels must navigate around by at least 15 nautical miles the West and East Flower Gardens and by at least 5 nautical miles the Claypile and Stetson Banks. These areas were identified in the 1976 EIS on the Gulf Incineration Site as areas of biological significance that would be adversely impacted if an accident occurred. While these areas are outside the normal shipping fairways, EPA made transport around them a condition of the Permit to provide additional protection to these areas.

7. Incineration Site

(a)

The coordinates of the Gulf Incineration Site are:

Latitude	Longitude
26°20'00"N	93°20'00"W
26°20'00"N	94°00'00"W
27°00'00"N	93°20'00"W
27°00'00"N	94°00'00"W

As provided for in 40 CFR 228.12(b)(1), incineration of the mixed chemical wastes may occur only when the vessel is within the boundaries of the site. The continuous monitoring of the vessel's location required under Special Provision No. 10(b)(viii) and submittal of these reports to the Permit Program Manager as provided for in Special Provision No. 11 will verify that incineration of the wastes occurred in the designated site only.

(b)

EPA is restricting the use of the site at this time to one vessel at a time, consistent with its authority under 40 CFR 228.7. This is being done for navigational safety and until the Agency evaluates the monitoring data from the site. This does not mean that only one Permittee may use the site. Rather, EPA will assure that there is an equitable distribution of the use of the site among all Permittees.

8. Performance Standard

(a) Destruction Efficiency of at least 99.99 percent

-- A destruction efficiency of 99.99 percent was established as a performance standard based on extensive data indicating that such a destruction efficiency is attainable and can be routinely measured in incinerators burning a wide range of organic hazardous wastes in concentrations that are over 100 ppm. This destruction efficiency ensures that any emissions from the incineration process will be rapidly rendered harmless or will be present as only trace contaminants, as required in 40 CFR 227.6. This determination is based on incinerator plume modeling and subsequent ocean dispersion modeling that show any emissions will be below the limiting permissible concentrations as required by 40 CFR 227.27.

-- The formula for calculating destruction efficiency is as follows (example for DDT):

Destruction Efficiency =

$$\frac{\text{Total DDT fed} - \text{DDT in combustion gases}}{\text{total DDT fed}} \times 100$$

(b) Combustion efficiency of at least 99.9 percent.

-- Based on EPA's accumulated experience and judgment in monitoring incineration, a combustion efficiency of at least 99.9 percent on the entire load of mixed chemical wastes (or the liquid DDT wastes under Research Permit HQ 83-003) corresponds to destruction efficiencies of at least 99.99 percent for all compounds in the wastes whose heats of combustion are equal to or greater than 1.79 kcal/gram (M/T VULCANUS I) or 0.24 kcal/gram (M/T VULCANUS II). Combustion efficiencies are continuously calculated on each incineration cruise.

-- The formula for calculating combustion efficiency is as follows:

$$\text{Combustion Efficiency} = \frac{[CO_2 \times 100}{[CO_2 + [CO]}$$

Where:
CO_2 = carbon dioxide in the combustion gases.
CO = carbon monoxide in the combustion gases.

(c) Destruction efficiencies are calculated on each incineration cruise under Research Permit HQ 83-003 if more than one cruise is necessary to obtain sufficient data, but not necessarily for each incineration cruise under Special Permits HQ 83-001 and HQ 83-002. The Permit Program Manager may request in either of the two special permits that the Permittees sample and analyze the waste and emissions to verify that the operating conditions established in

the permits achieve the performance standard of 99.99 percent destruction efficiency.

9. Operating Conditions

(a) Incinerator Conditions

In EPA's judgment, the minimum and average operating conditions set forth in this section will ensure that the incinerators attain and maintain a destruction efficiency of 99.99 percent and a combustion efficiency of at least 99.9 percent.

The minimum operating conditions are based on EPA's accumulated data and best engineering judgment that complete combustion will still occur if operating conditions less stringent than these exist. The minimum operating levels are set for temperature and oxygen concentration in the combustion gases, and a maximum level of carbon monoxide concentration in the combustion gases because these are the three key parameters in assuring complete combustion of chemical wastes.

The average operating conditions that must be maintained during incineration are based on the trial burns which demonstrated that the incinerators on the M/T VULCANUS I and M/T VULCANUS II achieved destruction efficiencies of greater than 99.99 percent on

the POHCs tested. The operating temperatures established for the M/T VULCANUS II are lower than those for the M/T VULCANUS I, except when burning TCDD or PCBs for two reasons. First, the BTU content of the wastes burned during the trial burn on the M/T VULCANUS II was lower than the M/T VULCANUS I. Second, the thermocouples measuring the wall temperature on the M/T VULCANUS II are placed higher above the burner head in a cooler part of the stack than on the M/T VULCANUS I.

The averages are to be calculated every two hours. The two hour time frame corresponds to the approximate time it takes to run a destruction efficiency test while recording the operating parameters during a trial burn. By using the same time frame, there is greater assurance that the proper combustion is attained throughout the incineration.

The minimum (or maximum for CO) operating conditions and the averages for the M/T VULCANUS II, when incinerating wastes containing TCDD and PCBs, are the same as those for the M/T VULCANUS I. The reason for this is that the waivers for trial burns on TCDD and PCBs for the M/T VULCANUS II were based, inpart, on the determination that the incinerator equipment used on the M/T VULCANUS II is the same as that on the M/T VULCANUS I.

In the Research Permit, HO 83-003 only minimum (or maximum for CO) operating conditions are specified. The Research Permit will establish average operating conditions as a result of the trial burn.

(i) The flow of the mixed chemical wastes into the incinerator shall not commence or, if the mixed chemical waste flow has been stopped for any reason, recommence, unless the incinerator wall temperature is equal to or greater than 1353°C for the M/T VULCANUS I or for the M/T VULCANIS II is equal to or greater than 1250°. If the M/T VULCANUS II is incinerating PCBs, this temperature must be 1353°C.

Prior to feeding the waste into the incinerator, a temperature 50°C higher than the average must be attained to provide an adequate margin of safety against possible transients in the operating efficiency of the combustion zone.

(ii) Except as provided in (i) above, wastes may be fed into the incinerator only if the following minimum conditions are met:

(A) The combustion wall temperature is to be equal to or greater than 1280°C for the M/T VULCANUS I and 1166°C for the M/T VULCANUS II. If the M/T VULCANUS II is incinerating wastes with TCDD and PCBs then the minimum wall temperature is to be equal to or greater than 1280°C.

The minimum specified temperatures are based upon data collected from actual trial burns on both vessels and on data from a large number of land-based incinerators. These values are to be used as an operating guide to set the temperature where waste feed should be automatically stopped to the individual incinerator unit in question. In all cases, auxiliary fuel must be

automatically substituted for waste feed at a rate to maintain the thermal operation of the incinerator until corrective action is taken to restore the proper temperature.

(B) A minimum of 5 percent oxygen (O_2) shall exist in the combustion gases.

EPA is specifying a minimum 5 percent oxygen level in the combustion gases for incinerators of the Vulcanus type based upon a review of existing M/T VULCANUS I and II performance data, land-based incinerator data, and the Agency's liquid PCB incineration regulations (40 CFR 761.70(a)).

(C) The concentration of carbon monoxide (CO) in the combustion gases shall not exceed 100 ppm.

Carbon monoxide is stated as an "upper permit limit at 100 ppm" because this represents approximately a 99.9 percent combustion efficiency at a typical 10 percent carbon dioxide operating range.

(iii) The average operating conditions are based on the trial burns of the M/T VULCANUS I and M/T VULCANUS II.

(A) The average combustion wall temperature is to be equal to or greater than 1303°C for the M/T VULCANUS I and 1200°C for the M/T VULCANUS II. If the M/T VULCANUS II is incinerating wastes with PCBs, then the average wall temperature is to be equal to 1303°C.

The temperature in the combustion zone is an operational indicator that the incinerator is performing properly.

(B) The average oxygen level in the combustion gases shall be equal to or greater than 10.1 percent for the M/T VULCANUS I and 10.6 percent for the M/T VULCANUS II, except if incinerating TCDD and PCB, the average oxygen level in the combustion gases for the M/T VULCANUS II must be equal to or greater than 10.1 percent.

The oxygen level in an incinerator combustion chamber or in the stack gases provides an indication of how well combustion air flow is adjusted to the needs of the waste combustion process. Finding oxygen in the combustion gases indicates that combustion air feed is adequate, while a lack of oxygen would present a cause for concern that not enough air was being supplied to oxidize all of the wastes or fuel fed to the incinerator.

M/T VULCANUS I and II data indicate that oxygen concentrations as low as 3.8 to 5.4 percent have been measured during trial burns which demonstrated destruction efficiencies of greater than 99.99 percent on the POHCs tested. The more typical VULCANUS operating range has been in the 6.4 to greater than 13 percent range with 8 to 11 percent being the center of this range. The land-based units that EPA has tested or has evaluated, have attained destruction efficiencies at very similar ranges of oxygen levels in the combustion chamber outlet

duct. From the extensive data base on all types of hazardous waste incinerators, EPA has found that oxygen levels in the range of approximately 5 through 15 percent are a consistently successful operating range for oxygen levels in the combustion gases.

(C) The average carbon monoxide level in the combustion gases shall be no greater than 8 ppm for the M/T VULCANUS I and 22 ppm for the M/T VULCANUS II except if incinerating TCDD and PCB, the average carbon monoxide level in the stack gases for the M/T VULCANUS II must be no greater than 8 ppm.

Preference is for as low or, as close to zero carbon monoxide level as possible. The usual performance of both M/T VULCANUS I and II vessels has been measured in the range of 3 to 20 ppm of carbon monoxide emission with most long term data showing a tendency for the 8 to 15 ppm range. The better-performing land-based incinerators also perform at the 5 to 10 or 20 ppm carbon monoxide range.

(D) The mean residence time of the mixed chemical wastes in the incinerator shall be on the order of 1.0 seconds or longer.

This requirement is included in the permits to be consistent with the London Dumping Convention. Residence time is a parameter which was once felt to be of major significance in developing regulatory policy but is currently overshadowed by the more important parameter of destruction efficiency. While EPA formerly believed that residence times of 2 seconds or more

were universally needed to achieve good destruction performance under both TSCA and RCRA permits, the Agency now has an extensive data base which indicates that as little as tenths of one second may be sufficient in well designed incinerators for many kinds of materials. RCRA policy has dropped its residence time requirements and TSCA has a waiver provision which basically relies on destruction removal efficiency as the primary measure of incinerator performance.

(b)(i)

Automatic waste feed shutoff devices must stop the flow of the wastes to the incinerators whenever the flame goes out, or whenever the minimum operating conditions specified for wall temperature and oxygen or, maximum operating conditions for carbon monoxide are not achieved or, whenever the monitoring devices for wall temperature, air flow to the incinerators, draft (negative pressure) in the combustion chambers, oxygen, carbon monoxide, carbon dioxide or waste feed flow and/or auxiliary fuel (if used) fail. This is to prevent incomplete combustion of the wastes, provide data to calculate combustion efficiency and dwell time, and prevent the escape of emissions other than through the plane of the stacks to protect shipboard personnel.

(b)(ii)

Before each cruise, the automatic devices shutting off the wastes to the incinerators are to be tested. This assures that these devices are in proper working order.

(c) Other Operating Conditions

(i)

The condition that operating controls and monitoring devices are to be supervised at all times by appropriately trained personnel is necessary, in EPA's judgment, to assure the safe and efficient operation of the incinerators.

(ii)

The condition that there be no black smoke or extension of flame above the plane of the stack is a requirement of the London Dumping Convention. Black smoke or flame above the stack is an indication of incomplete combustion.

(iii)

The condition that a draft (negative pressure) of at least one (1) inch water column be maintained in each combustion chamber will ensure that sufficient oxygen content in the combustion gases results only from the operation of the blowers and also will ensure that combustion emissions can exit only through the incinerator stack plane, thereby protecting shipboard personnel.

(iv)

To assure that the plume is directed toward the stern of the vessel and to assure that the plume does not come in contact with the Vessel, the direction and orientation of the vessel and the vessel's speed plus wind speed must be controlled. Based on EPA's experience, the vessel's speed plus wind velocity must be at least three knots to assure that the plume does not contact the vessel.

(v)

The addition of ammonia to the plume, when needed, will assure that the plume is visible and that any ships which wander off course or which have not heard the "Broadcast to Mariners" will be aware of and avoid the incineration operations. Visibility of the plume is also essential if monitoring activities such as plume tracking are conducted in the vicinity of the vessels.

(vi)

If tanks are washed, they are to be washed with a combustible solvent. These washings and any tank residues remaining after incineration are to be incinerated at-sea or upon return to port incinerated in EPA-approved land-based facilities.

This provision meets the requirements of the TSCA regulation set forth in 40 CFR 761.60 and the TSCA Compliance Program Policy No. 6 PCB-2 -- Physical Separation Techniques (August 16, 1983).

(vii)-(viii)

Any wash waters, ballast waters, or pump-room bilge water determined to be contaminated with organochlorine wastes beyond background levels (as determined by on-board analysis) or any residues (ash) remaining in the incinerator must be incinerated at-sea or, on return to port either incinerated in EPA-approved land-based facilities or, alternatively, treated according to applicable EPA regulations. In no case are these contaminated

waters or incinerator residues to be discharged directly to the ocean or into the harbor. This provision further ensures all possible measures will be taken to protect the environment.

(ix)

The requirement that all radio calls be promptly answered, is included to make certain that there is continuous communication between the vessel and the U.S. Coast Guard, the Captain of the Port, Mobile and the Permit Program Manager during transport and incineration activities. It is essential that any unusual circumstances be reported immediately and that instructions on handling the unusual circumstances be conveyed to the vessel.

(x)

During the start up of the incinerators or when the waste feed is being switched from one tank to another, vibrations may occur. Normally minor adjustments to the operating controls should eliminate the vibrations. EPA believes that any vibrations should be immediately investigated and corrective steps taken to eliminate the vibrations. The Principal Shiprider may terminate incineration operations if in his opinion, the vibrations endanger the integrity of the incinerator system, the monitoring devices, the tanks or, the vessel itself.

10. Monitoring and Recording Requirements

(a)(i-ix)

Tamper proof monitoring devices are to record during incineration, wall temperature, oxygen in the combustion gases, carbon monoxide in the combustion gases, carbon dioxide in the combustion gases, flow rates of the mixed chemical wastes and/or auxiliary fuel (if used), time, date, wind speed and direction, and vessel position, course and speed. In EPA's judgment, this information is needed to verify that the performance standards and operating conditions have been met, that the incineration took place at the designated site and that there was no direct discharge of wastes to the water.

(b)

The monitoring and recording of wall temperature, oxygen, carbon monoxide, carbon dioxide and waste feed flow and/or auxiliary fuel (if used) must be continuous. Wall temperature, oxygen and carbon monoxide are the key parameters which determine the operating efficiency of the incinerators. In addition, carbon dioxide and waste feed flow and/or auxiliary fuel flow (if used) are required in order to calculate combustion efficiency, dwell time and overall incinerator performance.

(c) The continuous monitoring and recording of draft (negative pressure) in the combustion chambers will ensure that Special Provision 9(c)(iii) is met.

(d) The continuous monitoring and recording of air flow to the incinerators will allow for the calculation of dwell (residence) time and ensure that Special Provision 9(a)(iii)(D) is met.

(e)

If the continuous recording devices fail for wall temperature, air flow to the incinerators, draft (negative pressure) in the combustion chambers, oxygen, carbon monoxide, carbon dioxide and waste feed flow and auxiliary fuel (if used), the automatic devices that shut off the wastes to the incinerator must be activated for the reasons described in (b), (c) and (d) above.

(f)

If the monitoring devices fail for measuring time, date, wind speed and direction, and vessel position, course and speed, an hourly manual log is to be kept until the devices are repaired.

(g)

Calibration of instruments measuring wall temperature, air flow to the incinerators, draft (negative pressure) in the combustion chambers, oxygen, carbon monoxide, carbon dioxide and waste feed flow and/or auxiliary fuel flow (if used) must be conducted according to the manufacturer's specifications. Calibrations are necessary to assure the devices are giving true readings. More frequent calibrations than those specified by the manufacturer may be necessary, if in the opinion of the Principal Shiprider, the vessel has been operating under unusual circumstances such as long and severe vibrations or in severe weather.

Instrument calibrations are to be done according to the manufacturer's instructions and a permanent record kept of each calibration. This record will be examined as part of EPA's analysis and evaluation of the monitoring data following each burn.

(h) (Permits HQ 83-001, HQ 83-002 and HQ 83-003)

The costs for the monitoring required to assure that the Permittees comply with the terms and conditions of the permit is a necessary and justifiable cost of business under this Permit and is to be paid for by the Permittees.

(h) (Permit HQ 83-003)

Destruction efficiency is the performance standard used by EPA in determining the ability of the incinerator to destroy particular compounds in a waste mixture, in this case, DDT, DDD and DDE. Calculations of the destruction efficiencies of the compounds are performed in accordance with the formula in Special Provision No. 8 above and in accordance with the protocols provided in Appendix A of the Permit.

The Permit Program Manager will review the qualifications of the individual(s) performing the analyses and will have the analyses

verified by independent experts. The cost of these analyses are borne by the Permittees.

(i)

All raw data generated during any cruise will be part of the public domain for independent analysis and evaluation. The data may be examined in the office of the Permit Program Manager.

11. Post-Cruise Reporting Requirements for HQ 83-001, HQ 83-002

(a)

Within 10 working days (90 days if destruction efficiency testing was required) after the vessels have returned to the Port of Mobile from an incineration cruise, the monitoring data specified in Special Provision No. 10 is to be forwarded to the Permit Program Manager. The Permit Program Manager will evaluate the data to independently verify that the Permittees met the performance standard(s) and operating conditions specified in the permit and that the monitoring devices functioned properly.

(b)

Successive incineration cruises are dependent on a demonstration by the Permittees that they complied with all provisions and requirements of the Permit. Any repairs, or adjustments in procedures must be completed by the Permittees prior to authorization of successive cruises. The Permit Program Manager

must authorize, in writing, successive cruises. Although this requirement may cause a delay in incineration activities, in EPA's judgment, it is essential to assure that incineration at-sea activities are carried out properly.

11. Post-Cruise Reporting Requirements for HQ 83-003

The Permit Program Manager is responsible for reviewing all of the monitoring data, including destruction efficiency results submitted by the Permittees to assure that destruction efficiencies of 99.99 percent or greater and a combustion efficiency of 99.9 percent were attained, and that all other terms and operating conditions of the Permit were met. The 90 day time frame for submission of this data reflects the time necessary for analyzing the monitoring data and calculating the destruction efficiencies.

12. Contingency Plan

The Contingency Plan is included in Appendix B. The Contingency Plan was prepared by the Permittees and approved by EPA and the U.S. Coast Guard. It defines the safety precautions taken to prevent incidents, the type of incidents and the response of the vessels' MASTERS, officers and crew and Chemical Waste Management and Ocean Combustion Service personnel, should an incident occur. The type of incidents covered, whether in the harbor, in transport, or at the incineration site covered in the Contingency Plan include stranding, collision, fire and explosion, foundering

and steering or propulsion failure. A major focus of the Contingency Plan is the steps that will be taken to minimize the environmental affect of any incident including the notices to be given, the communication networks to be established and the responses to be implemented should a particular type of incident occur.

The Permit requires a full written report of any incident and any activities carried out under the Contingency Plan within 10 working days after the termination of the burn in which the incident occurs. However, if jettisoning the cargo due to life threatening incidents is contemplated or carried out, immediate verbal notification of the U.S. Coast Guard and the Permit Program Manager is required as provided for in General Provision No. 7.

13. Reports and Correspondence

This section provides the names and addresses of U.S. Coast Guard and EPA Officials who receive the reports, data and related correspondence specified in the Permit.

APPENDIX 1

POHC CASE EXAMPLES

The following examples demonstrate the application of the POHC selection criteria:

EXAMPLE 1

HAZARDOUS CONSTITUENT	% CONCENTRATION	HEAT OF COMBUSTION
Chloroform	3	.75
Dichloroethane	14	3.00
Dichlorobenzene	8	4.57
Chlorophenol	12	6.89

In this case, chloroform should be designated a POHC because of its low heat of combustion. The most abundant constituent, dichloroethane, should also be designated a POHC.

EXAMPLE 2

HAZARDOUS CONSTITUENT	% CONCENTRATION	HEAT OF COMBUSTION
Chlorobenzene	6	6.60
Phenol	4	7.78
Benzene	4	10.03
Toluene	25	10.14

Chlorobenzene, the least incinerable constituent, should be designated a POHC in this case. Toluene should also be designated a POHC on the basis of its high concentration. Phenol might also be designated a POHC, both to compensate for possible discrepancies in the hierarchy and to compensate in the event that 99.99 percent destruction efficiency is not achieve for chlorobenzene.

EXAMPLE 3

HAZARDOUS CONSTITUENT	% CONCENTRATION	HEAT OF COMBUSTION
Tetrachloromethane	.001	.24
Chloromethane	8	3.25
Dichloropropene	8	3.44

In this case, the least incinerable constituent, tetrachloromethane, is present in such a low concentration that detection in the stack gas would be difficult. If, difficulties preclude tetrachloromethane from being designated as a POHC, both chloromethane and dichloropropene should be designated as POHCs because their heat of combustion values show little difference in incinerability.

If chloromethane and dichloropropene are incinerated to a 99.99 percent destruction efficiency during the trial burn, the permit could allow inclusion of all hazardous constituents more easily incinerated than chloromethane. Waste eligibility would not be as flexible, however, if tetrachloromethane was selected as a POHC and a DE of 99.99 percent or greater demonstrated. The applicant might therefore wish to employ a more sensitive analytical methodology (lower detection limits) to be able to demonstrate that a destruction efficiency of greater than 99.99 percent for tetrachloromethane could be attained. As an alternative, the concentration of tetrachloromethane in the waste feed might be increased for purposes of conducting the trial burn. If the alternative approach is used successfully, the permit could be written with tetrachloromethane as the least incinerable POHC.

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