California Environmental Protection Agency

Air Resources Board

STAFF REPORT: INITIAL STATEMENT OF REASONS FOR THE PROPOSED ADOPTION OF AIRBORNE TOXIC CONTROL MEASURE AMENDMENTS LIMITING ONBOARD INCINERATION ON CRUISE SHIPS AND OCEANGOING SHIPS

Stationary Source Division
Emissions Assessment Branch

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State of California
AIR RESOURCES BOARD

STAFF REPORT: INITIAL STATEMENT OF REASONS FOR PROPOSED RULEMAKING

Public Hearing to Consider

PROPOSED ADOPTION OF AIRBORNE TOXIC CONTROL MEASURE AMENDMENTS LIMITING ONBOARD INCINERATION ON CRUISE SHIPS AND OCEANGOING SHIPS

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State of California
AIR RESOURCES BOARD

PROPOSED ADOPTION OF AIRBORNE TOXIC CONTROL MEASURE AMENDMENTS LIMITING ONBOARD INCINERATION ON CRUISE SHIPS AND OCEANGOING SHIPS

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Executive Summary

I. INTRODUCTION

In California, there has been growing concern over pollutants being emitted from marine vessels. Marine vessels can be a significant contributor of emissions at California ports and along the coast. The sources of these emissions include the exhaust from the main engines, diesel generators, auxiliary boilers, and incinerators. In an effort to reduce the emissions from incinerators onboard marine vessels, the California Legislature adopted legislation that applies to cruise ships and oceangoing ships which prohibits onboard incineration when they are within three miles of the California coast.

In October 2004, Assembly Bill 471 (AB 471) was passed by the California Legislature and codified in Health and Safety Code (HSC) section 39630 *et seq*. AB 471 prohibits cruise ships from conducting onboard incineration while operating within three (nautical) miles of the California coast. On November 17, 2005, the Air Resources Board (ARB/Board) adopted the Airborne Toxic Control for Measure for Cruise Ship Onboard Incineration (Cruise Ship ATCM). The Cruise Ship ATCM implements AB 471 by clarifying the three nautical mile limit for incineration along the California coast and establishing recordkeeping and reporting requirements.

In October 2005, Senate Bill 771 (SB 771) was passed by the California Legislature and codified in Health and Safety Code (HSC) section 39630 *et seq*. SB 771 expands the requirements of AB 471 to include oceangoing ships of 300 gross registered tons or more. An oceangoing ship is defined as a private, commercial, government, or military vessel of 300 gross registered tons or more calling on California ports or places. This law became effective January 1, 2006.

ARB staff is proposing to amend the Cruise Ship ATCM to incorporate the requirements of SB 771. With the proposed amendments, oceangoing ships will be prohibited from conducting onboard incineration within three nautical miles of the California coast. ARB staff estimates that about one percent of the 1,900 oceangoing ships that called on a California port in 2005 incinerated within three nautical miles of

the California coast (prior to January 1, 2006, the effective date for SB 771). To ensure compliance with the proposed amended ATCM, oceangoing ships must keep incineration records, similar to records already kept under MARPOL Annex V. Due to national security issues, military vessels do not keep records under MARPOL Annex V and the United States Coast Guard has exempted them from these recordkeeping requirements. Additionally, the United States Navy (including Military Sealift Command) has a policy which prohibits incineration within 12 nautical miles from the California coast and the United States Coast Guard has a policy which prohibits incineration within three nautical miles of the California coast. For these reasons, special recordkeeping requirements for owners or operators of military vessels are included in the proposed amended ATCM.

Costs to comply with the proposed amendments are negligible and ARB staff has determined that prohibiting incineration within the three nautical mile limit is sufficiently protective of public health.

The Cruise Ship ATCM and the proposed amendments are expected to reduce public exposure to emissions of toxic air contaminants (TACs) for residents and workers living or working in port communities and along the California coast.

II. BACKGROUND

1. Why is the staff proposing amendments to the ATCM for cruise ship onboard incineration?

Air pollution from oceangoing vessels is a significant and growing concern in California. In 2005, oceangoing ships (non-cruise ships) accounted for approximately 9,900 port calls in California. Emissions from onboard incineration can be a significant source of air pollution. By prohibiting incineration within three nautical miles of the California coast, the potential for adverse public health impacts will be reduced for residents and offsite (i.e., off-ship) workers who live or work near ports and along the coast. AB 471 and SB 771 state that the ARB shall enforce this legislation and may adopt standards, rules, and regulations for this purpose. ARB is proposing to amend the Cruise Ship ATCM to implement SB 771 and to ensure this law is adequately enforced. The proposed amended Cruise Ship ATCM is expected to reduce emissions from TACs such as polychlorinated dibenzo-*p*-dioxins (PCDDs or dioxins), polychlorinated dibenzofurans (PCDFs or furans), and toxic metals.

2. What are the current regulations for oceangoing ship onboard incineration?

Oceangoing ship onboard incinerators are subject to regulations set forth in the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78). In general terms, MARPOL 73/78 is the international treaty regulating disposal of wastes generated by normal operation of vessels. MARPOL 73/78 contains two regulations for onboard cruise ship incinerators:

Regulation 9 of Annex V of MARPOL 73/78 which primarily deals with garbage recordkeeping requirements for onboard incineration; and Annex VI which prohibits the incineration of certain wastes and imposes additional operating requirements for the incinerators. MARPOL 73/78 is implemented in the United States (U.S.) by the Act to Prevent Pollution from Ships (33 U.S.C. section 1901 *et seq*.). The United States Coast Guard (USCG) is responsible for prescribing and enforcing regulations pursuant to MARPOL 73/78.

The United States Department of Agriculture, Animal, and Plant Health Inspection Service (APHIS), is responsible for regulations and policies governing the handling and disposal of regulated garbage to prevent the introduction of foreign animal and plant diseases and pests. Garbage is regulated on oceangoing ships as a result of movements outside of the United States and certain other movements. Regulated garbage includes waste such as: vegetables, meats, food scraps, table refuse, galley refuse, food wrappers or packing materials and other waste material from stores, food preparation areas, passenger or crews quarters, dining rooms and other areas. Regulated garbage within the territorial waters or the territory of the United States is required to be destroyed by incineration to an ash or sterilization by cooking to an internal temperature of 212 degrees Fahrenheit for 30 minutes. Regulated garbage may also be ground and disposed of in an APHIS approved sewer system. Garbage on vessels that have not been outside the U.S. for the previous two years or have gone through an APHIS sanctioned "purging" process is not regulated.

There are currently no California regulations specific to oceangoing ship onboard incineration.

III. PUBLIC OUTREACH

An open public process that involves all parties affected by the proposed amended Cruise Ship ATCM is an important component of all of ARB's actions. As part of ARB's outreach program, staff made personal contacts with industry representatives, as well as other parties, through meetings, telephone calls, and electronic mail. Staff developed a workgroup consisting of industry and environmental group representatives. Staff held two workgroup meetings and conducted one public workshop.

IV. OCEANGOING SHIP ONBOARD INCINERATOR SURVEY

1. <u>What is the Oceangoing Ship Onboard Incinerator Survey and what were the results of the Survey?</u>

In May 2006, ARB sent out the Oceangoing Ship Onboard Incinerator Survey (Survey). The Survey requested oceangoing ship operators to gather and submit information to ARB on incinerator and waste handling practices. Information collected from the Survey included the amount and type of waste incinerated, the operating

schedule of the onboard incinerator(s), control equipment, and alternative waste treatment for onboard incineration.

The Survey results showed that prior to January 1, 2006, the effective date of SB 771, only 3 out of 395 vessels which responded to the Survey incinerated waste within three nautical miles of the California coast. For these three ships, the amount of waste incinerated within three nautical miles of the California coast (prior to January 1, 2006) made up less than 0.01 percent of each of these three ships' total waste.

The Survey also showed that about 56 percent of the oceangoing ships conduct onboard incineration. Although these ships incinerate a variety of wastes, the most common types of incinerated waste include paper products, rags, sludge and waste oil, oil filters, packing materials, and light plastics. On average, oceangoing ships operate their incinerator six hours per day two days per week. The Survey also showed that ships use other means to dispose of waste, such as disposal to port facilities, recycling, and disposal to sea in compliance with MARPOL 73/78 regulations. Incinerators onboard oceangoing ships are not equipped with air pollution control devices.

V. POTENTIAL HEALTH IMPACTS OF SUBSTANCES EMITTED FROM ONBOARD INCINERATION

1. <u>What are the potential health impacts remaining after implementation of the proposed amended Cruise Ship ATCM?</u>

The ARB staff conducted an evaluation of the potential health impacts from the proposed amended Cruise Ship ATCM. Because the standard (i.e., no incineration within three miles of the California coast) was already set forth in AB 471 and SB 771, staff focused its efforts on assessing the potential health risk remaining after implementation to ensure that it was adequately health protective. ARB staff conducted a qualitative assessment for oceangoing ships onboard incineration and compared it to the quantitative assessment conducted for cruise ships as previously evaluated in the *Initial Statement of Reasons for the Proposed Airborne Toxic Control Measure for Cruise Ship Onboard Incineration, September 30, 2005* (Cruise Ship Staff Report) (ARB, 2005a), which is incorporated herein by reference. Based on several factors, such as the significantly lower amounts of waste generated and incinerated onboard, smaller numbers of crew, limited operating times, and prohibitory company policies or military policies, ARB staff has determined that potential health impacts due to incineration onboard oceangoing vessels would be less than the potential health impacts from incineration onboard cruise ships.

In the Cruise Ship Staff Report, staff estimated potential cancer and noncancer health impacts from cruise ship onboard incineration. Based on the risk assessment results, the estimated potential cancer risk ranged from 0.6 to 1.9 chances per million. For noncancer health impacts, the hazard indices for acute and chronic impacts are less

than one. In general, a hazard index less than one is not a concern to public health. Based on this analysis, staff concluded that the three nautical mile limit for onboard incineration is sufficiently protective of public health.

VI. SUMMARY OF THE PROPOSED AMENDED CRUISE SHIP ATCM

1. Who is affected and what does the proposed amended Cruise Ship ATCM require?

The proposed amended Cruise Ship ATCM would affect owners or operators of cruise ships and oceangoing ships calling on California ports or places. An oceangoing ship is defined as a private, commercial, government, or military vessel of 300 gross registered tons or more calling on California ports or places. An oceangoing ship does not include a cruise ship.

Cruise ship owners or operators and oceangoing ship owners and operators are prohibited from conducting onboard incineration within three nautical miles of the California coast. However, onboard incineration within three nautical miles of the California coast may be permitted when operated under the direction and supervision of the USCG.

With the exception of military vessels, cruise ship and oceangoing ship owners or operators are required to keep incineration records while operating in Regulated California Waters (RCW). In Northern and Central California the RCW boundary follows the 24 nautical mile contiguous zone, an internationally recognized boundary. In Southern California, the boundary consists of straight line segments approximately 24 nautical miles offshore of the coastline. Military vessels are required to keep incineration records when operating within three nautical miles of the California coast.

The definition for “within three miles of the California coast” is defined as the Three Nautical Mile Line shown on official National Oceanic and Atmospheric Administration (NOAA) Nautical Charts. These charts have been incorporated by reference into the proposed ATCM.

2. What happens when the NOAA nautical charts are revised?

A nautical chart is a graphic portrayal of the marine environment showing the nature and form of the coast, the general configuration of the sea bottom (including water depths), locations of dangers to navigation, locations and characteristics of man-made aids to navigation, and other features useful to the mariner. NOAA periodically updates its charts to reflect changes to any of these features, including changes unrelated to the Three Nautical Mile Line. Staff is proposing that when NOAA updates its charts, the Executive Officer may revise the definition of “within three miles of the California coast” to incorporate the updated charts by publishing the revision in the California Notice Register, sending an electronic notice out to all subscribers of the oceangoing ship incineration list serve and cruise ship incineration list serve, posting to

the oceangoing ship incineration website at www.arb.ca.gov/toxics/shipincin/shipincin.htm, and notifying potentially affected cruise ship owners or operators at least 30 days before the updates take effect.

3. What are the key issues?

The military expressed concerns with onboard inspections. Currently, the military agencies, which conduct onboard incineration and call on California ports include the United States Navy (including Military Sealift Command) and the United States Coast Guard. Due to heightened national security, significant clearance issues could arise for ARB inspectors to board military vessels. Each military branch has established policies for onboard environmental inspections to preserve national security while not denying legitimate entry for inspection. Prior to onboard inspections, ARB inspectors would follow these policies and procedures for each applicable military branch. ARB staff recognizes that non-military vessels may also have security procedures in place to address onboard inspections. To the extent that these security procedures are necessary to preserve national security while not denying legitimate entry for inspection, ARB inspectors would also follow these procedures.

VII. ECONOMIC AND ENVIRONMENTAL IMPACTS OF THE PROPOSED ATCM

1. What will the proposed amended Cruise Ship ATCM cost?

The proposed amended Cruise Ship ATCM is not expected to result in any significant economic impacts and is not expected to cause a change in employment, business status, or competitiveness. ARB does not expect an impact on the creation or elimination of jobs, or the creation or elimination of oceangoing ships traveling to California.

ARB staff evaluated the cost impacts to local, state, and federal agencies and determined there are no significant economic impacts.

2. Are there any significant adverse environmental impacts associated with the proposed amended Cruise Ship ATCM?

ARB staff evaluated potential water quality impacts, potential increase in diesel emissions, diversion of waste to landfills and land-based municipal waste incinerators, and public health impacts from storing garbage. ARB staff has determined that no significant adverse environmental impacts are expected to occur.

ARB is committed to evaluating community impacts of proposed regulations, including environmental justice concerns. Because some communities experience higher exposure to toxic pollutants, it is a priority of ARB to ensure that full protection is afforded to all Californians. The proposed amended Cruise Ship ATCM will ensure that

Californians who live or work near ports or coastal areas are not negatively impacted by emissions from oceangoing ship onboard incinerators.

VIII. RECOMMENDATION

The ARB staff recommends that the Board adopt the proposed amended Cruise Ship ATCM. In order to implement and interpret State law (AB 471 and SB 771), staff is proposing amendments that prohibit oceangoing ships from incinerating within three nautical miles of the California coast. This proposed amended Cruise Ship ATCM incorporates oceangoing ships into the ATCM, clarifies the definition of "cruise ship," amends the recordkeeping requirements for cruise ships, adds recordkeeping requirements for oceangoing ships, and establishes special recordkeeping requirements for military vessels. Benefits from the proposed amended Cruise Ship ATCM are reduced public exposure to TACs for residents and off-site workers (i.e., off-ship) living or working near ports and along the California coast. Exposure to these TACs can cause cancer and noncancer health impacts.

I. INTRODUCTION

In California, there has been growing concern over pollutants being emitted from marine vessels. Marine vessels can be a significant contributor of emissions at California ports and along the coast. The sources of these emissions include the exhaust from the main engines, diesel generators, auxiliary boilers, and incinerators. In an effort to reduce the emissions from incinerators on marine vessels, the California Legislature has adopted legislation which prohibits incineration within three miles of the California coast.

In 2004, Assembly Bill 471 (AB 471) was passed by the California Legislature and codified in Health and Safety Code (HSC) section 39630 *et seq*. AB 471 prohibits cruise ships from conducting onboard incineration while operating within three (nautical) miles of the California coast. A cruise ship is defined as a commercial vessel that has berths or overnight accommodations for passengers and that has the capacity to carry 250 or more passengers for hire. This law became effective January 1, 2005. On November 17, 2005, the Air Resources Board (ARB/Board) adopted the Airborne Toxic Control for Measure for Cruise Ship Onboard Incineration (Cruise Ship ATCM). The Cruise Ship ATCM implements AB 471 by clarifying the three nautical mile limit for incineration along the California coast and establishing recordkeeping and reporting requirements. The Cruise Ship ATCM can be found on ARB's website at http://www.arb.ca.gov/toxics/shipincin/shipincin.htm.

In October 2005, Senate Bill 771 (SB 771) was passed by the California Legislature and codified in Health and Safety Code (HSC) section 39630 *et seq*. SB 771 expands the requirements of AB 471 to include oceangoing ships of 300 gross registered tons or more. An oceangoing ship is defined as a private, commercial, government, or military vessel of 300 gross registered tons or more calling on California ports or places (see Appendix E for a copy of the legislation). This law became effective January 1, 2006.

With this staff report, ARB staff is proposing to amend the Cruise Ship ATCM to implement SB 771 and to ensure that it is adequately enforced. The Cruise Ship ATCM and the proposed amendments are expected to reduce public exposure to emissions of toxic air contaminants (TACs) for residents and workers living or working in port communities and along the California coast. This report addresses emissions from incinerators onboard oceangoing ships only. If you would like more information on the Cruise Ship ATCM, see the ARB's report entitled *Initial Statement of Reasons for the Proposed Airborne Toxic Control Measure for Cruise Ship Onboard Incineration, September 30, 2005* (Cruise Ship Staff Report) (ARB, 2005a), which can be found on ARB's website at http://www.arb.ca.gov/toxics/shipincin/shipincin.htm and which is incorporated by reference herein.

II. BACKGROUND

As discussed in Chapter I**,** the proposed amendments incorporate oceangoing vessels into the Cruise Ship ATCM; therefore, our analysis in this staff report only considers oceangoing vessels (non-cruise ships). An analysis of cruise ships was conducted in 2005 and can be found in the Cruise Ship Staff Report (ARB, 2005a) on ARB's website at http://www.arb.ca.gov/toxics/shipincin/shipincin.htm.

A. Oceangoing Ship Industry in California

1. Types of Vessels that Call on California Ports

Several different types of vessels call on California ports. The most common types of oceangoing ships making port calls are container vessels. Container vessels carry standardized truck-size containers and account for almost one-half of the port calls in California. Tanker vessels, designed to transport liquids in bulk, have the second largest number of port calls, accounting for 22 percent of the port calls. Bulk carriers which transport dry cargoes, such as mineral ore, fertilizer, grains, and auto carriers account for ten and eight percent, respectively, of the port calls. General/Reefer vessels, accounting for about eight percent of the port calls, transport perishable commodities requiring temperature-controlled transportation, such as fruits, meats, vegetables, etc. Unmanned barges, usually moved by tugboats, account for five percent of port calls and typically transport heavy goods, such as rock. Other vessels, which account for less than one percent of the port calls, include vessels such as research, military, and tug vessels. Table II-1 shows a breakdown of the number of port calls and percentage of port calls by vessel type.

Table II-1.
2005 California Port Calls by Vessel Type[1,2]

Vessel Type	Number of Port Calls[2,3]	Percentage of Total Calls[3]
Container	4570	46
Tank	2140	22
Bulk Carrier	1010	10
Automotive Carrier	830	8
General/Reefer	760	8
Unmanned Barge	520	5
Other	90	<1
Total	9,920	

1. Source: California State Lands Commission, 2005.
2. Does not include cruise ship vessels.
3. Numbers are rounded.

2. Oceangoing Ship Port Calls to California

The California State Lands Commission (CSLC) maintains a database of all ships entering California ports. For 2005, the database showed that approximately

1,900 different oceangoing ships (excluding cruise ships) of 300 gross registered tons or more entered California ports, for a total of approximately 9,900 port calls (CSLC, 2005). Table II-1 shows a breakdown of the locations of the California port calls.

Table II-2.
Oceangoing Ship Port Calls to California Ports in 2005[1,2]

Port Name	Number of Port Calls
Carquinez	680
El Segundo	230
Hueneme	410
Humboldt	20
Los Angeles & Long Beach[3]	5080
Oakland	1940
Redwood	50
Richmond	650
Sacramento	60
San Diego	390
San Francisco	180
Stockton	170
Other	60
Total	9920

1. Source: CSLC, 2005.
2. Numbers are rounded.
3. Port calls to Los Angeles and Long Beach are reported as a total and are not separated out.

B. Oceangoing Ship Onboard Incineration

Oceangoing ship onboard incineration is the combustion or burning of any materials or wastes for the purpose of volume reduction, destruction, sanitation, or sterilization. In general, oceangoing ship incinerators burn a variety of wastes. Although discussed further in Chapter IV, the most common waste streams incinerated aboard oceangoing ships, which call on California ports, include paper products and rags.

1. Toxic Air Contaminants Associated with Waste Incineration

There is a wide variety of toxic air contaminants (TACs) commonly associated with waste incineration. On a national level, municipal and medical waste incineration are associated with emissions of TACs. These types of sources are commonly identified in emission inventories as the largest group of emitters of polychlorinated dibenzo-*p*-dioxins (PCDDs or dioxins) and polychlorinated dibenzofurans (PCDFs or furans), a group of highly toxic compounds. However, in California, the number of medical waste incinerators has dropped sharply since the 1990's. Additionally, there are only three land-based municipal waste incinerator facilities currently operating in California, all of which are equipped with air pollution control devices.

Emissions of TACs can vary depending on the characteristics of the incinerator, the waste stream, and control equipment. However, the following TACs are generally associated with waste incineration.

- Heavy metals: arsenic, beryllium, cadmium, chromium, lead, mercury, and nickel;
- Hydrochloric acid; and
- Organic compounds (including dioxins and furans) and polycyclic aromatic hydrocarbons.

Additional information on these compounds can be found in Appendix F. Note that criteria pollutants, such as oxides of nitrogen (NOx), oxides of sulfur (SOx), and particulate matter (PM) can also be emitted from waste incineration.

2. Oceangoing Ship Waste Stream

Waste management onboard oceangoing ships is generally handled by a variety of processes depending on the waste stream. Wastes are incinerated onboard, or disposed of at port facilities or at sea. ARB staff conducted a survey to get a better understanding of oceangoing ship incinerator practices (detailed results of the survey can be found in Chapter IV). Table II-3 shows the types of waste that can be generated onboard an oceangoing ship based on the survey results.

Table II-3. Types of Waste Generated Onboard an Oceangoing Ship

Types of Waste	
Food wastes	Hazardous waste
Glassware, metal, bottles, and crockery	Batteries
Miscellaneous garbage	Printer cartridges
Rags	Medical waste
Graywater	Miscellaneous spray cans
Sewage or blackwater	Paint and solvents
Bilge water	Florescent light bulbs
Cardboard and paper products	Oil sludge and slops
Floating dunnage, lining, or packing material	Oily Waste
Plastics	Oil filters
Incinerator residue (ash)	Used oil
	Scrap metals

C. International and Federal Regulations for Onboard Incinerators

1. MARPOL 73/78 and Implementing Regulations

The International Maritime Organization (IMO) is a specialized agency of the United Nations which is responsible for measures to improve the safety and security of international shipping and to prevent marine pollution from ships. The IMO, along with other maritime nations, has developed standards which are set forth in the International

Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78), which has been updated by amendments over the years. MARPOL 73/78 includes six technical annexes, which include regulations aimed at preventing and minimizing pollution from ships.

Compliance with MARPOL is mandatory, with the exception of certain government vessels. Specifically, Article 3 of MARPOL 73 states that "the present Convention shall not apply to any warship, naval auxiliary or other ship owned or operated by a State and used, for the time being, only on government non-commercial service. However, each Party shall ensure adoption of appropriate measures not impairing the operations or operational capabilities of such ships owned or operated by it, that such ships act in a manner consistent, so far as is reasonable and practicable with the present Convention." Some government agencies maintain records with respect to onboard incineration. However, military agencies do not maintain records for onboard incineration.

MARPOL 73/78 contains two regulations for onboard oceangoing ship incinerators. Regulation 9 of Annex V of MARPOL 73/78 primarily deals with garbage recordkeeping requirements for onboard incineration. Annex VI prohibits the incineration of certain wastes and imposes additional operating requirements for incinerators.

a. Annex V

Annex V became effective December 31, 1988. In 1995, amendments were introduced that included the requirements for garbage management plans and garbage recordkeeping. These amendments became effective July 1, 1997. Specifically, ships of 400 gross registered tons or more must keep a record of each discharge operation or completed incineration. This includes discharges at sea, to reception facilities, or to other ships. The following information is required to be recorded when garbage is incinerated:

- Date and time of start and stop of incineration;
- Position of the ship (in latitude and longitude);
- Estimated amount incinerated in cubic meters; and
- Signature of the officer in charge of the operation.

For the purpose of recordkeeping requirements under Annex V, oceangoing ships are required to group garbage into the following categories:

- Plastics;
- Floating dunnage, lining, or packing material;
- Ground-down paper products, rags, glass, metal, bottles, crockery, etc.;
- Paper products, rags, glass, metal bottles, crockery, etc.; and
- Food waste.

Entries are required in the garbage record book when any of the following occur:

- When garbage is discharged into the sea;
- When garbage is discharged to reception facilities ashore or to other ships;
- When garbage is incinerated; and
- Accidental or other exceptional discharges of garbage.

The garbage record book is required to be kept onboard the ship for two years. The garbage record book requirements are contained in an Appendix to Annex V (see Appendix B of this report).

Ships less than 400 gross tons and certified to carry less than 15 people are not required to maintain records under MARRPOL 73/78. However, as specified in HSC 39631-39632, the requirements apply to oceangoing vessels 300 gross registered tons or more, regardless of the number of crew or passengers. The CSLC provided ARB staff a list of vessels which showed that three vessels fell between 300 and 400 gross registered tons. None of these three vessels made port calls to California in 2005, but may have made port calls in previous years. ARB staff could not verify whether or not any of these three ships conduct onboard incineration. Under the proposed amendments, oceangoing ships between 300 and 400 gross tons, as well as those at or above 400 gross tons, calling on California port or places would be subject to the proposed amendments.

b. Annex VI

Annex VI was adopted on September 26, 1997, and became effective May 19, 2005. Regulation 16 of Annex VI (Regulation 16) pertains to operating requirements and the prohibition of certain wastes for incineration. Regulation 16 requires incinerators installed after January 1, 2000, to meet certain requirements as specified in Appendix IV of Regulation 16 (Appendix IV). Onboard incinerators are required to possess an IMO Type Approval Certificate. To obtain the certificate, the incinerator must be designed and built such that it meets the standard specified in Regulation 16, section 2. Section 2 specifies that incinerators operate within certain limits. Some of the limits include operating at 6 to 12 percent oxygen in the combustion chamber and operating at 850 to 1200 degrees Celsius as the outlet combustion flue gas temperature range.

Under Annex VI the following types of waste are prohibited:

- Annex I, II, and III cargo residues and related contaminated packing materials;
- Polychlorinated biphenyls;
- Garbage, as defined in Annex V, containing more than traces of heavy metals; and
- Refined petroleum products containing halogen compounds.

Other prohibitory requirements for waste include polyvinyl chlorides except in incinerators for which IMO Type Approval Certificates have been issued. If sewage sludge and sludge oil is incinerated in the main or auxiliary power plant or boilers, it may not take place while the vessel is at ports, harbors, or estuaries.

Other requirements under Regulation 16 include regulations for monitoring flue gas outlet temperatures and operator and manual requirements. A copy of Regulation 16 and Appendix IV is provided in Appendix C.

c. Article 3 of MARPOL 73

Article 3 of MARPOL 73 states that "the present Convention shall not apply to any warship, naval auxiliary or other ship owned or operated by a State and used, for the time being, only on government non-commercial service. However, each Party shall ensure adoption of appropriate measures not impairing the operations or operational capabilities of such ships owned or operated by it, that such ships act in a manner consistent, so far as is reasonable and practicable with the present Convention."

d. Act to Prevent Pollution from Ships

MARPOL 73/78 is implemented in the United States (U.S.) by the Act to Prevent Pollution from Ships (33 U.S.C. section 1901 *et seq*.). The U.S. Coast Guard is responsible for prescribing and enforcing regulations pursuant to MARPOL 73/78 in U.S. waters.

e. U.S. Coast Guard Regulations

The U.S. Coast Guard regulations implementing MARPOL 73/78 and the Act to Prevent Pollution from Ships are found at title 33, Code of Federal Regulations (CFR), section 151. In particular, subsection 151.55 requires the master or person in charge of the ship to maintain written records of the date and time of incineration (if incineration was conducted at a port), the name of the port, the latitude and longitude of the location where incineration was conducted and the estimated distance of that location from shore, and the amount of garbage incinerated. The records must be prepared at the time of incineration, certified by the master or person in charge of the ship, maintained on the ship for two years, and made available for inspection by the U.S. Coast Guard. Most oceangoing ships are required to follow these regulations; however, under title 33, CFR, section 151.51(b), warships, naval auxiliary, or other ships owned or operated by the United States when engaged in noncommercial services; and other ships specifically excluded by MARPOL 73/78 are not required to maintain records of incineration practices.

2. Animal and Plant Health Inspection Service Regulations

The U.S. Department of Agriculture, Animal, and Plant Health Inspection Service (APHIS), is responsible for regulations and policies governing the handling and disposal of regulated garbage to prevent the introduction of foreign animal and plant diseases and pests. These regulations are contained in the Code of Federal Regulations (CFR), title 7, section 330.400 and title 9, section 94.5.

Regulated garbage, as defined in the CFR, is derived in whole or in part from fruits, vegetables, meats, or other plants or animal material, and other refuse associated with the material onboard including food scraps, table refuse, galley refuse, food wrappers or packing materials and other waste material from stores, food preparation areas, passenger or crews quarters, dining rooms and other areas (ARB, 2005b). Most of the regulated garbage onboard oceangoing ships is subject to APHIS regulations.

Regulated garbage within the territorial waters or the territory of the U.S. is required to be destroyed by incineration to an ash or sterilization by cooking to an internal temperature of 212 degrees Fahrenheit for 30 minutes. Regulated garbage may also be ground and disposed of in an APHIS approved sewer system. Garbage on vessels that have not been outside the U.S. for the previous two years or have gone through an APHIS sanctioned “purging” process is not regulated.

III. PUBLIC OUTREACH AND REPORT PREPARATION

An open public process that involves all parties affected by the proposed amended Cruise Ship ATCM is an important component of ARB's actions. As part of ARB's outreach program, staff made personal contacts with industry representatives, as well as other parties, through meetings, telephone calls, and electronic mail. Staff developed a workgroup consisting of industry and environmental group representatives. Staff held two workgroup meetings and conducted one public workshop.

A. Public Involvement

As described below, affected industries, other government agencies, and organizations interested in minimizing public health impacts from oceangoing ship onboard incineration have been involved in the development of the proposed amended Cruise Ship ATCM. All members of the public were invited to join the workgroup. ARB staff also conducted a public workshop. Additionally, to further increase the general public's participation in this assessment, staff made information available via ARB's web site (*www.arb.ca.gov/toxics/shipincin/shipincin.htm*).

1. Industry Involvement

Industry representatives have participated in the rule development process providing technical information on many aspects of oceangoing ship onboard incineration. They have provided comments and suggestions on the recordkeeping and reporting requirements, definitions, and other issues related to the proposed amendments to the ATCM. Staff also received input from the United States Coast Guard and United States Navy (including Military Sealift Command), representing the military branches. The workgroup meetings have provided a forum to discuss and resolve many of the issues associated with the proposed amended Cruise Ship ATCM.

2. Government Agency Involvement

Other local, state, and federal agencies have provided input on certain aspects of the proposed amended Cruise Ship ATCM. Participating federal agencies include: United States military representatives, and the United States Department of Commerce's National Oceanic and Atmospheric Administration. Staff also had discussions with State agencies such as the California State Lands Commission, and the Department of Fish and Game. Additional discussions were held with the United States Department of Food and Agriculture regarding existing regulations for garbage generated onboard an oceangoing ship.

Local air districts have also been apprised of the regulatory process through the California Air Pollution Control Officers Association's Toxics and Risk Managers Committee. Some of the air district staff have provided additional information to ARB staff related to oceangoing ships and port activities.

B. Data Collection Tool Used to Assist in Report Preparation

In 2006, ARB staff developed a survey to gather information for onboard incineration garbage practices. The survey requested information on the amount and types of waste incinerated, the operating schedule of the incinerator, the air pollution control equipment, and other information related to onboard garbage incineration. See Chapter IV for a detailed discussion on the survey.

C. Issues

The military expressed concerns with onboard inspections. Military agencies which conduct onboard incineration and call on California ports include the United States Navy (including Military Sealift Command) and the United States Coast Guard (USCG). Due to heightened national security, clearance issues could arise for ARB inspectors to board military vessels. Each military branch has established policies to preserve national security while not denying legitimate entry for inspections. Prior to onboard inspections, ARB inspectors would follow these policies and procedures for each applicable military branch. ARB staff recognizes that non-military vessels may also have security procedures in place to address onboard inspections. To the extent that these security procedures are necessary to preserve national security while not denying legitimate entry for inspection, ARB inspectors would also follow these procedures.

D. Public Outreach after Office of Administrative Law Adoption of the Proposed Amended ATCM

If the Board adopts, and the Office of Administrative Law approves, the proposed amended ATCM, oceangoing ships and cruise ships will be notified of the new regulation through ARB's website and list serve. In addition, staff will work with other agencies, such as NOAA and the IMO, to determine other means of notifying oceangoing ships and cruise ships of the new regulation. NOAA's Office of Coast Survey has indicated that the final regulation could be published in the Coast Pilot. The Coast Pilot is a document used by mariners that includes applicable federal and state regulations for a given location.

In addition to the three nautical mile incineration prohibition, oceangoing ships between 300 and 400 gross registered tons will also need to be notified of the recordkeeping requirements. This is because these oceangoing ships are not required to maintain a garbage record log book as specified in Annex V of MARPOL 73/78. Recordkeeping will be a new requirement for these oceangoing ships, whereas ships of 400 gross registered tons or more are already keeping the required records under Annex V of MARPOL 73/78. ARB staff will notify subscribers of the list serve, and will also work with agencies, such as NOAA, IMO, and the CSLC, to determine other means of notifying oceangoing vessels between 300 and 400 gross registered tons of the new regulation.

IV. OCEANGOING SHIP ONBOARD INCINERATOR SURVEY

In May 2006, ARB staff sent out the Oceangoing Ship Onboard Incinerator Survey (Survey). The purpose of the Survey was to collect information on oceangoing ship onboard incineration and waste handling practices. Specifically, the Survey asked for information on the amount and type of waste burned, operating schedule, control equipment, and alternative waste treatment to onboard incineration. Appendix D contains a copy of the Survey.

With the exception of cruise ships, oceangoing ships of 300 gross tons or more calling on California ports or places were required to fill out the Survey. Cruise ships were not required to fill out the Survey because they completed a similar survey in 2005. Approximately 395 ship operators responded to the survey. Staff compared that number to the California State Lands Commission (CSLC) database that showed that in 2005 approximately 1,900 ships (not including cruise ships) made one or more calls to California ports. Our survey responses accounted for about 20 percent of the vessels calling on California ports.

A. Incinerators Onboard Oceangoing Ships

Unlike the cruise ship industry, not all oceangoing ships have incinerators onboard their vessels. Of the 395 vessels that responded to the Survey, 173 vessels (44 percent) indicated that they do not have onboard incinerators. One ship indicated that it had two onboard incinerators. Table IV-1 summarizes the number of incinerators onboard oceangoing vessels.

Table IV-1. Number of Oceangoing Ships with Onboard Incinerators

Number of Incinerators	Number and Percentage of Survey Responses
No Incinerators	173 (44 percent)
One Incinerator	221 (56 percent)
Two Incinerators	1 (< 0.01 percent)

B. Type of Waste Incinerated

The Survey was designed to obtain general information on the type of waste commonly incinerated onboard oceangoing ships. The Survey asked the oceangoing ship operators to specify which type of waste they incinerated similar to the categories in the Garbage Record Book required by Regulation 9 of Annex V of MARPOL 73/78. More information on waste categories specified under Annex V can be found in Chapter II. The Survey specified seven categories of garbage from which to choose.

Table IV-2 shows the type of waste and percentage of ships that incinerate the waste. The results show that the most commonly incinerated waste is paper products and rags.

Table IV-2. Type of Waste and Percentage of Survey Responses Incinerating this Waste

Type of Waste	Number of Ships Incinerating this Type of Waste	Percentage of Ships Incinerating this Type of Waste
Plastics (including light plastic)	33	15
Floating dunnage, lining, or packing material	36	16
Paper products	183	82
Rags	198	89
Glass, metal, bottles, crockery, etc.	4	2
Food waste	6	3
Other[1]	83	37

1. Most common other wastes include sludge oil, waste oil, oil filters, and cardboard.

C. Amount of Waste Incinerated

The Survey requested the total amount of waste burned in either cubic meters (m^3) per year or in tons per year (tpy). Under Annex V, oceangoing ships are only required to report the amount of waste incinerated in cubic meters per year; therefore, most oceangoing ships provided the amount of garbage in cubic meters per year. Without knowing the densities of the individual waste streams, it is difficult to convert from cubic meters to tons. Therefore, Table IV-3 shows the minimum, maximum, average, amount of waste incinerated per oceangoing ship in m^3 per year and in tpy. The total amount is the summation of all ships' incinerated waste reported from the Survey.

Table IV-3. Waste Incinerated per Year[1,2]

	Minimum	Maximum	Average	Total
Total waste burned per year per ship (m^3/year) (172 ships reporting)	0	2,300	70	12,100
Total waste burned per year per ship (tons/year) (30 ships reporting)	0.05	2,600	110	3,300

1. The total waste burned is the sum of the oceangoing ship's total waste (not just within three nautical miles of California coast).
2. Numbers are rounded.

The Survey results showed that prior to January 1, 2006, the effective date of SB 771, three of the 222 vessels (one percent) with incinerators incinerated within three

nautical miles of the California coast. This is consistent with discussions with several companies who indicated that their ships did not incinerate waste while at port or within three nautical miles of land. Some of the larger companies indicated they have policies which prohibit incineration further out then three nautical miles, such as 12 or 25 nautical miles off-shore. Table IV-4 summarizes the amount of waste incinerated in 2005 within three nautical miles of the California coast reported by three oceangoing ships.

Table IV-4. Waste Incinerated within Three Nautical Miles of the California Coast in 2005[1]

Oceangoing Ships	Waste Incinerated (m^3)
Ship One (Bulk Carrier)	0.04
Ship Two (Auto Carrier)	0.06
Ship Three(Auto Carrier)	0.45
Total	0.55

1. Amount reported was for incineration prior to January 1, 2006, the effective date of SB 771.

For the three ships listed in Table IV-4, the waste they incinerated within three miles of the California coast makes up less than 0.01 percent of each of their total waste incinerated.

D. Operating Schedule

The Survey asked oceangoing ship operators to include information about the incinerator operating schedule. Table IV-5 shows the minimum, maximum, and average for the hours per day of operation, and days per week of operation.

Table IV-5. Incinerator Operating Schedule

	Minimum	Maximum	Average
Hours per day of operation	0	24	6
Days per week of operation	0	7	2

E. Alternatives to Onboard incineration

In addition to onboard incineration, oceangoing vessels use other means to dispose of wastes generated onboard the ship. Almost all oceangoing ships indicated that a portion of their waste is disposed of at port. Waste most commonly disposed of at port include: plastics, batteries, incinerator ash, sludge and waste oil, and hazardous waste. Some indicated that whenever possible, items such as cans, cardboard, glass and metal are separated out for recycling at the port.

Most ships reported that food waste is disposed of at sea. Some ships reported that other types of garbage, such as packing materials, paper, rags, glass, metal and bottles are also disposed of at sea. With the exception of plastics, the disposal of items out to sea is allowed in most areas under MARPOL regulations. Note however, that a ship must be a certain distance from land (ranges from three to 25 miles) to discharge certain types of waste to sea.

F. Other Survey Information

1. Control Equipment

Based on the Survey responses, oceangoing ships do not have air pollution control devices on their incinerators.

2. Garbage Record Log

With the exception of most military vessels, all ships reported that they maintain a garbage record log as specified by Annex V of MARPOL 73/78.

3. Number of Crew

The average number of crew onboard oceangoing ships is 19.

G. Military Ships

Military ships of 300 gross registered tons or more calling on California ports or places are also subject to SB 771. Because of security concerns, the military requested that the information be categorized and summarized to include the number and class of vessels and incinerator manufacturer and model.

Overall, the Navy (including Military Sealift Command) and USCG have approximately 20 vessels, which have onboard incinerators. One of those ships has two incinerators onboard. The military has indicated that their ships do not incinerate within 3 nautical miles of the California coast and in most instances do not incinerate within 12 nautical miles of the California coast. Specifically, the Navy (including Military Sealift Command) has a policy which prohibits onboard incineration within 12 nautical miles of the California coast, and the USCG has a policy that prohibits incineration within 3 nautical miles of the California coast.

H. Survey Conclusions

By extrapolating from the Survey, staff estimates that approximately 1,060 (56 percent) of the 1,900 oceangoing ships have onboard incinerators. Of those 1,060 oceangoing ships, staff estimated that about 11 (one percent) of those oceangoing ships conducted onboard incineration within three miles of the California coast prior to January 1, 2006, the effective date of SB 771. Based on the Survey information from

the three ships that incinerated waste within three nautical miles of the California coast, the amount of waste incinerated within the three nautical mile zone was negligible, less than 0.01 percent of each of their total waste incinerated.

V. POTENTIAL HEALTH IMPACTS OF SUBSTANCES EMITTED FROM ONBOARD INCINERATION

A. Health Impacts Associated from Waste Incineration

As presented in Chapter II, toxic air contaminants that can be emitted from waste incineration include heavy metals such as arsenic, beryllium, cadmium, chromium, lead, mercury and nickel. Organic compounds such as dioxins, furans, and polycyclic aromatic hydrocarbons can also be emitted along with hydrochloric acid. Many of these substances have been identified by state, federal, and international agencies as known or probable human carcinogens. Noncancer effects can range from skin and lung irritation to disorders of the developmental and central nervous systems. For a summary of some of the cancer and noncancer health effects that can occur due to short or long-term exposure to these compounds, see Appendix F.

B. Potential Health Impacts Remaining after Implementation of the Proposed Amendments

The ARB staff conducted an evaluation of the potential health impacts from the proposed amended Cruise Ship ATCM. Because the standard (i.e., no incineration within three miles of the California coast) was already set forth in AB 471 and SB 771, staff focused its efforts on assessing the potential health risk remaining after implementation to ensure that it was adequately health protective. ARB staff conducted a qualitative assessment for oceangoing ships onboard incineration and compared it to the quantitative assessment conducted for cruise ships as previously evaluated in the Cruise Ship Staff Report (ARB, 2005a). Based on several factors, such as the significantly lower amounts of waste generated and incinerated onboard, smaller numbers of crew, limited operating times, prohibitory company policies, and military policies, ARB staff has determined that potential health impacts due to incineration onboard oceangoing vessels would be less than the potential health impacts from incineration onboard cruise ships.

In the Cruise Ship Staff Report, staff estimated potential cancer and noncancer health impacts from cruise ship onboard incineration. For that analysis, the incineration of waste was assumed to be taking place from three nautical miles to 30 nautical miles out to sea. Based on the risk assessment results, the estimated potential cancer risk ranged from 0.6 to 1.9 chances per million. For noncancer chronic health impacts, the hazard index for both the resident and the on-shore worker is less than 0.1. For acute health impacts the hazard index is less than 0.3. In general, a hazard index less than one is not a concern to public health. For more information on cruise ship risk assessment results, see Chapter V of the Cruise Ship Staff Report (ARB, 2005a). Based on this analysis, staff concluded that the three nautical mile limit for onboard incineration is sufficiently protective of public health.

In 2005, Approximately 1,900 oceangoing (non-cruise ship) ships entered California ports one or more times. Based on the Survey, approximately 56 percent of

the oceangoing ships reported having onboard incinerators. By assuming 56 percent of the 1,900 oceangoing ships have incinerators, then approximately 1,100 oceangoing ships have incinerators. The Survey also showed that each oceangoing ship incinerates about 70 m^3 of waste per year. Based on this, the total waste incinerated onboard oceangoing vessels would be approximately 77,000 m^3 per year. This is less than the total amount reported for cruise ships, which was estimated to be about 95,000 m^3 per year in 2004 (ARB, 2005c).

ARB staff also evaluated the Port of Los Angeles and Long Beach (LA/LB) where approximately 5,000 (non-cruise ship) port visits occurred in 2005. Staff evaluated this port because it has significantly more port visits then any other port in the State. Approximately 1,500 (non-cruise ship) oceangoing vessels accounted for the LA/LB port visits. If we assume that 56 percent of these ships have incinerators and each oceangoing ship incinerates 70 m^3 of waste, then approximately 840 oceangoing ships would incinerate about 59,000 m^3 of waste. As a comparison, 32 cruise ships visited the LA/LB ports in 2005. Based on ARB's 2004 cruise ship survey, on average each ship incinerates approximately 4,300 m^3 of waste per year. Therefore, about 138,000 m^3 of waste are incinerated by cruise ships. Based on staff estimates, oceangoing ships incinerate about one-half of the waste incinerated by cruise ships.

In addition to the amount of waste generated onboard the average number of people onboard the oceangoing vessels is significantly lower than onboard a cruise ship. On oceangoing ships, the average number of crew is 19, as compared to several thousands of crew and passengers aboard a cruise ship.

The amount of incinerator operation time is significantly lower for oceangoing ships than for cruise ships. The cruise ships reported operating their incinerator on average 5.5 days per week for 12 hours per day. The Survey showed the oceangoing vessels operate their incinerators on average two days per week for six hours per day.

Several of the large shipping companies indicated that they have formal and informal policies which prohibit or discourage incineration beyond three nautical miles from the coast. Some companies indicated that they do not incinerate or have policies which discourage incineration within 25 or 50 miles from the coast. Additionally, the military has policies which prohibit onboard incineration within 12 nautical miles of the California coast (United States Navy and Military Sealift Command) and within 3 nautical miles of the California coast (USCG).

VI. SUMMARY OF THE PROPOSED AMENDED CONTROL MEASURE

This chapter contains a summary of the proposed amended Cruise Ship Airborne Toxic Control Measure (ATCM). It also reviews the basis and rationale for selecting the provisions being proposed. A copy of the proposed amended Cruise Ship ATCM regulation is located in Appendix A.

The proposed amended Cruise Ship ATCM incorporates oceangoing ships into the ATCM, clarifies the definition of "cruise ship," amends the recordkeeping requirements for cruise ships, adds recordkeeping requirements for oceangoing ships, and establishes special recordkeeping requirements for military vessels. The proposed regulation is expected to reduce potential health impacts for residents and off-site (i.e., off-ship) workers living or working near ports or along the California coast.

A. Summary of the Proposed Amended Control Measure

1. Affected Sources

In addition to cruise ships already subject to the ATCM, the proposed amended Cruise Ship ATCM would also apply to oceangoing ships calling on California ports or places. Oceangoing ships are defined as a private, commercial, government, or military vessel of 300 gross registered tons or more calling on California ports or places. An oceangoing ship does not include a cruise ship. Based on 2005 vessel data from the California State Lands Commission database, ARB staff estimated that approximately 1,900 different oceangoing ships (excluding cruise ships) entered California ports, for a total of approximately 9,850 port calls (CSLC, 2005).

2. Requirements for Cruise Ship and Oceangoing Ship Owners or Operators

In addition to the prohibition for cruise ships, oceangoing ship owners or operators are prohibited from conducting onboard incineration within three nautical miles of the California coast. However, onboard incineration within three nautical miles of the California coast may be permitted when operated under the direction of the United States Coast Guard (USCG). Although it is not common practice, the USCG may require an operational test of the incinerator during in-port inspections. For example, this may be required if USCG personnel expect illegal oil discharge has occurred.

"Within three miles of the California coast" is defined as between the coast and the Three Nautical Mile Line as shown on the following National Oceanic and Atmospheric Administration (NOAA) Nautical Charts, as authored by the NOAA Office of Coast Survey.

- Chart 18600, Trinidad Head to Cape Blanco (January 2002);
- Chart 18620, Point Arena to Trinidad Head (June 2002);
- Chart 18640, San Francisco to Point Arena (August 2005);
- Chart 18680, Point Sur to San Francisco (June 2005);
- Chart 18700, Point Conception to Point Sur (July 2003);
- Chart 18720, Point Dume to Purisima Point (January 2005); and
- Chart 18740, San Diego to Santa Rosa Island (April 2005).

a. Use of the NOAA Nautical Charts for Determining the Baseline (Coast)

ARB staff recognizes that other California agencies use different baselines for various purposes, including for determining the coastal zone, state waters, coastal waters, and California's territorial boundaries. In most cases, these baselines broaden the agencies' jurisdictional authority. However, ARB staff interprets "within three miles of the California coast, to the extent allowed by federal law," as provided in AB 471, SB 771, and Health and Safety Code (HSC) section 39632, to mean within the Three Nautical Mile Line recognized by federal law which is depicted on NOAA nautical charts.

b. Updates to the NOAA Charts

NOAA routinely updates its nautical charts to update hazards to navigation and other information considered essential for safe navigation, and any changes made to the baseline by the United States Baseline Committee. It is anticipated that NOAA will be updating the charts for the California coast in the near future. As the NOAA charts are recognized by federal law and mandated by State law for purposes of this proposed amended Cruise Ship ATCM, the Three Nautical Mile Line will be as depicted on the current NOAA charts, as updated by NOAA from time to time. This is because HSC section 39632 prohibits incineration "…within three miles of the California coast…" That location, i.e., three miles of the California coast, is a geographical fact independent of whether NOAA has a nautical chart for the area or whether the chart has been updated. In other words the NOAA nautical chart is merely a physical depiction at any given time. The NOAA nautical charts are used for convenience and consistency.

However, when the NOAA nautical charts are updated by NOAA, the Executive Officer may revise the definition of "within three miles of the California coast" to incorporate the updated charts. This particular change does not materially alter any requirement, right, responsibility, condition, prescription or other regulatory element of the ATCM because HSC 39632 prohibits incineration within three miles of the California coast and the NOAA nautical charts are used as tools to graphically depict the location of the three nautical mile limit. Cruise ship and oceangoing ship owners and operators will be notified at least 30 days before the updates take effect. Notifications to oceangoing ship owners or operators will be sent in the following ways: a notice will be published in the California Notice Register; an electronic notice which will be sent to all subscribers of the oceangoing ship incineration list serve and cruise ship incineration list

serve; and a notice will also be posted to the oceangoing ship incineration website at www.arb.ca.gov/toxics/shipincin/shipincin.htm.

c. Availability of NOAA Nautical Charts

For information on obtaining copies of the NOAA nautical charts, please visit NOAA's website at http://chartmaker.ncd.noaa.gov.

3. Recordkeeping and Reporting Requirements

With the exception of military vessels, cruise ship and oceangoing ship owners or operators are required to record the following information while operating in Regulated California Waters (RCW).

- The date and time of start and stop of incineration (in local time);
- The position of the ship in latitude and longitude for each start and stop time of incineration;
- The estimated amount incinerated in cubic meters (m^3);
- The name or signature of officer in charge of the operation; and
- When operation of the incinerator is required by the USCG, the name, unit, and phone number of USCG personnel who directed that the incinerator be operated.

This information is required when operating within RCW, which is approximately 24 nautical miles from the California coast.

Records are to be maintained in English and kept onboard the cruise ship or oceangoing ship for two years. During an onboard inspection, these records are to be made available to ARB personnel or their delegates. In addition, upon written request by the Executive Officer of ARB, the owner or operator of the cruise ship or oceangoing ship shall provide copies of the records within 30 calendar days of the request. Records may be kept electronically, if desired.

Except for information required when the incinerator is operated at the direction of the USCG, the recordkeeping requirements in the proposed amended Cruise Ship ATCM are also required under Regulation 9 of Annex V of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (Annex V) (see Appendix B). Oceangoing ships of 400 gross registered tons or more are required to maintain this information in a garbage record log book. Under the proposed amendments, ships between 300 and 400 gross tons will also need to maintain the same records that are required by MARPOL 73/78. Although ARB staff did not identify any oceangoing vessels between 300 and 400 gross registered tons, which call on California ports or places and conduct onboard incineration, they would be subject to the recordkeeping requirements in the proposed amended Cruise Ship ATCM.

4. Recordkeeping Requirements for Military Vessels

Military agencies are exempt from recordkeeping requirements under USCG regulations. As specified in MARPOL 73, Article 3, in certain situations, MARPOL 73 requirements do not apply to military vessels. However, owners or operators of military vessels are required to "…ensure by the adoption of appropriate measures not impairing the operations or operational capabilities of such ships owned or operated by it, that such ships act in a manner consistent, so far as is reasonable and practicable, with the present Convention." The military currently has formal policies limiting onboard incineration; however, there are no incineration recordkeeping requirements in the policies. Under the proposed amended Cruise Ship ATCM records for military vessels are required to be kept when the incinerator is operating within three nautical miles of the California coast.

5. Definitions

Several definitions have been included in subsection (c) of the proposed amended Cruise Ship ATCM to ensure clarity. These definitions were taken from HSC 39631, Bureau of Customs and Border Protection regulations, marine vessel industry documents, and prior ARB rulemakings.

6. Other Changes Affecting Cruise Ships

The proposed amended Cruise Ship ATCM adds a requirement for cruise ships to record additional information when the incinerator is operated under the direction of the USCG. Although not a common occurrence, the USCG can require the owner or operator of the vessel to operate the incinerator during an inspection. This can occur, for example, if the USCG suspects that illegal oil discharge has occurred. Costs for this additional recordkeeping requirement are negligible.

In the Cruise Ship ATCM, cruise ships are required to keep records for each segment of a voyage if, during any portion of that segment, the cruise ship travels within three miles of the California coast. The segment of the voyage is defined as from the last port of call to the next port of call. In the proposed amended ATCM, records are required when traveling in Regulated California Waters (RCW). In Northern and Central California the RCW boundary follows the 24 nautical mile contiguous zone, an internationally recognized boundary. In Southern California the boundary consists of straight line segments approximately 24 nautical miles offshore of the coastline. Staff has limited the recordkeeping requirement to the RCW since we are primarily concerned with emissions occurring near California's coastline. Additionally, RCW has been introduced in several other marine regulations developed by the ARB and will provide for a consistent definition for the marine industry. Impacts to the cruise ship industry are negligible since these records are already kept under MARPOL Annex V.

The proposed amended Cruise Ship ATCM also clarifies the definition of "cruise ship" to mean those cruise ships calling on California ports or places. This proposed modification was made to avoid the inclusion of cruise ships traveling in innocent passage.

B. Basis and Rationale for the Control Measure

Effective January 1, 2006, SB 771 prohibited oceangoing ships from conducting onboard incineration within three (nautical) miles of the California coast. The purpose of the proposed amended Cruise Ship ATCM is to ensure that this legislation is implemented and adequately enforced. The proposed regulation amends the existing Cruise Ship ATCM.

On a national level, land-based garbage and municipal waste incineration have been associated with emissions of large amounts of toxic air contaminants (TACs). Incineration of waste is associated with emissions of various air pollutants, including polychlorinated dibenzodioxins (PCDDs or dioxins), polychlorinated dibenzofurans (PCDFs or furans), and toxic metals which can cause cancer and noncancer health impacts. ARB has previously identified and developed regulations for dioxins, furans, and certain metal compounds as TACs and these compounds are listed as hazardous air pollutants by the United States Environmental Protection Agency (U.S. EPA). PCDDs and PCDFs are the most toxic compounds which have been identified by the ARB. These toxic substances can be inhaled directly or can contaminate vegetation and be consumed by animals and humans. PCDDs and PCDFs then accumulate in the body. Many studies, including U.S. EPA's Dioxin Reassessment, have shown that PCDDs and PCDFs can cause cancer and other health problems including birth defects and liver damage.

Regulations are currently in place for existing land-based waste incinerators in California. Waste incinerators, such as medical and municipal waste incinerators, are subject to local air district air permitting requirements, district prohibitory rules, the Medical Waste Incinerator ATCM (Title 17, CCR section 93104), the Outdoor Residential Waste Burning ATCM (Title 17, CCR section 93113), and the Assembly Bill 2588 "Hot Spots" program (HSC 44300 *et seq*.). These programs limit the amount of land-based incinerator emissions that may be released into the environment. Additionally, there are federal requirements for municipal and medical waste incinerators.

Currently there are no incinerator emission limits or control requirements for oceangoing ship onboard incinerators, which call on California ports or places. In 2005, at the Port of Los Angeles, there were approximately 5,075 oceangoing ship port calls. In the absence of SB 771 and the proposed amended Cruise Ship ATCM, oceangoing ships could incinerate waste while entering the port, at the port, and leaving the port. This amounts to substantial periods of time that oceangoing ships could be incinerating near the coast. In addition, there are many berths at the port which can be used simultaneously and where onboard incineration could occur if SB 771 and the proposed

amended Cruise Ship ATCM were not implemented and enforced. Thus, in the absence of SB 771, adverse public health impacts could occur to residents and off-site workers who live or work near the coast. In recognition of the potential for adverse health impacts from incineration near shore, most oceangoing ship owners/operators discontinued incineration near shore prior to January 1, 2006. In fact, staff identified only a small number of ships which incinerated within three nautical miles of the California coast prior to January 1, 2006, the effective date of SB 771.

With the exception of military and government agencies**,** the recordkeeping requirements are similar to recordkeeping requirements under Annex V of MARPOL. The only additional requirement under the proposed amended Cruise Ship ATCM is the name, unit, and phone number of USCG personnel when operation of the incinerator is required by USCG personnel and is within three nautical miles of the California coast. This requirement is necessary so that ARB inspectors can verify that incineration was under the direction of the USCG. Overall, this is a cost-effective approach, which, along with onboard inspections, will allow ARB inspectors to determine compliance with the proposed amended Cruise Ship ATCM.

C. Alternatives Considered

1. No Action

One alternative is to forego the development of the proposed amended Cruise Ship ATCM. This alternative is not recommended. Oceangoing ships are equipped with incinerators that burn a variety of wastes such as plastics, packing materials, paper, cardboard, rags, food, oil filters, and oily sludge. The emissions from onboard incineration can include TACs such as dioxins, furans, hydrogen chloride, hydrocarbons, manganese, and toxic metals such as lead, cadmium, chromium, arsenic, beryllium, nickel and mercury. Criteria pollutants such as nitrogen oxide, sulfur oxide, carbon monoxide, carbon dioxide, and particulate matter can also be emitted.

If ARB did not develop this control measure, then incineration recordkeeping and reporting would not be required by the State. Without these requirements it would be difficult to determine compliance with SB 771. Therefore, the proposed amended Cruise Ship ATCM is critical to determine compliance and to meet the legislative mandate.

2. Eliminating Certain Recordkeeping Requirements

ARB staff considered deleting the requirement for recording the amount of waste incinerated. However, staff has determined that this is not a feasible alternative. If an oceangoing ship owner or operator conducted onboard incineration within three nautical miles of the California coast, then knowing the amount incinerated is necessary to assess any penalties involved. In addition, reporting the amount of waste incinerated is already required under Annex V, for most of the vessels, so it is not expected to be an additional burden for the industry.

3. Extending the Prohibition Zone

ARB staff considered extending, beyond three nautical miles, the zone in which onboard incineration is prohibited. However, based on Survey information and the qualitative assessment of potential health impacts presented in Chapter V, ARB staff determined that the three nautical mile limit for onboard incineration is sufficiently health protective.

4. Other Prescriptive Standards

Staff did not consider other prescriptive standards because the standard was set forth in SB 771 (i.e., no onboard incineration is permitted within three nautical miles of the California coast).

D. Concerns Regarding the Proposed Amended Cruise Ship ATCM

1. Military Issues

The military expressed concerns with onboard inspections. Military agencies, which conduct onboard incineration and call on California ports include the United States Navy (including Military Sealift Command) and the USCG. Due to heightened national security, clearance issues could arise for ARB inspectors to board military vessels. Each military branch has established policies to preserve national security while not denying legitimate entry for onboard environmental inspections. Prior to onboard inspections, ARB inspectors would follow these policies and procedures for each applicable military branch.

E. Differences between the Proposed Amended ATCM and State and Federal Regulations

1. U.S. Coast Guard Regulations

MARPOL 73/78 is implemented in the United States by the Act to Prevent Pollution from Ships (33 U.S.C. section 1901 *et seq*.). The USCG is responsible for prescribing and enforcing regulations pursuant to MARPOL 73/78 in U.S. waters. The USCG regulations implementing MARPOL 73/78 and the Act to Prevent Pollution from Ships are found at title 33, Code of Federal Regulations (CFR), section 151. In particular, subsection 151.55 requires the master or person in charge of the ship to maintain written records of the date and time of incineration (if incineration was conducted at a port), the name of the port, the latitude and longitude of the location where incineration was conducted and the estimated distance of that location from shore, and the amount of garbage incinerated. The records must be prepared at the time of incineration, certified by the master or the person in charge of the ship, maintained on the ship for two years, and made available for inspection by the USCG.

Most oceangoing ships are required to follow the USCG regulations; however, under section 151.51, warships, naval auxiliary, or other ships owned or operated by the United States when engaged in noncommercial services; and other ships specifically excluded by MARPOL 73/78 are not required to maintain records of incineration practices. While the USCG regulations exempt the military from maintaining records of incineration, the proposed amended ATCM requires recordkeeping within three nautical miles of the California coast. However, recordkeeping in this zone is necessary to verify compliance with the proposed amended ATCM. Military policy prohibits incineration within three nautical miles (USCG) and Navy (12 nautical miles), so records would only be required if they are out of compliance with the proposed amended ATCM (unless operation of the incinerator is required by the USCG). Therefore, recordkeeping costs should be negligible. Furthermore, this recordkeeping is necessary, because, if incineration is occurring within three nautical miles of the California coast, adverse health impacts could occur to nearby communities.

The proposed amended Cruise Ship ATCM expressly requires owners or operators of oceangoing ships and cruise ships subject to the requirements of the regulation, to maintain records when the incinerator is operating in RCW. While the USCG regulations only require the records to be made available for inspection by the USCG, the proposed amended Cruise Ship ATCM requires that the records be made available to ARB personnel, or their delegates. Access to these records by ARB personnel, or their delegates is necessary to adequately enforce the proposed amended Cruise Ship ATCM, to reduce emissions of toxic air contaminants (TACs), such as dioxins, furans, and toxic metals along the coast, and to reduce the potential for adverse health impacts to residents and offsite workers who live or work near ports and along the coast.

The records required by the proposed amended Cruise Ship ATCM are substantially similar to the records required by the USCG regulations, with two exceptions. USCG regulations require the signature of the officer in charge of the operation. However, the proposed amended Cruise Ship ATCM allows either the name or signature of the officer in charge of the operation. This difference, allowing the name or the signature, was incorporated into the proposed amended Cruise Ship ATCM at the request of the industry. During workgroup discussions, the industry commented that allowing the name rather than the signature in the records facilitated electronic recordkeeping. The other difference is the recordkeeping requirement to include USCG personnel information when operation is required under the direction of the USCG. The name, phone number, and unit of the USCG personnel are required. This is necessary so that ARB inspectors can verify that incinerator operation within three nautical miles was required by the USCG. Incinerator operation required by the USCG is not common, but can be necessary, for example, if illegal waste dumping is suspected. The cost of recording this additional information will be negligible, but will assist in enforcing the regulation.

For the foregoing reasons, in accordance with Government Code section 11346.2(b)(5)(B), the Executive Officer has determined that the cost of this differing

state regulation is justified by the benefit to human health, public safety, public welfare, or the environment.

2. Animal and Plant Health Inspection Service Regulations

The U.S. Department of Agriculture, Animal, and Plant Health Inspection Service (APHIS) regulations require regulated garbage within the territorial waters or the territory of the U.S. to be destroyed by incineration to an ash or sterilization by cooking to an internal temperature of 212 degrees Fahrenheit for 30 minutes in order to prevent the introduction of foreign animal and plant disease and pests. Regulated garbage may also be ground and disposed of in an APHIS approved sewer system. Garbage on vessels that have not been outside the U.S. for the previous two years or have gone through an APHIS sanctioned "purging" process is not regulated. "Regulated garbage" is defined as garbage derived in whole or in part from fruits, vegetables, meats, or other plants or animal material, and other refuse associated with the material onboard including food scraps, table refuse, galley refuse, food wrappers or packing materials and other waste material from stores, food preparation areas, passenger or crews quarters, dining rooms and other areas. Most of the regulated garbage onboard oceangoing ships and cruise ships are subject to APHIS regulations.

While the APHIS regulations allow incineration of regulated garbage within the territorial waters (12 nautical miles of the coast), the proposed amended Cruise Ship ATCM expressly prohibits incineration within three nautical miles of the California coast. APHIS regulations do, however, provide alternative means of managing regulated garbage while the oceangoing ship or cruise ship is within three nautical miles of the California coast (i.e., sterilization or disposal in an APHIS approved sewer system). Oceangoing ship and cruise ship operators can also keep international regulated garbage in leakproof, covered containers during the time they are traveling within three nautical miles or while at port.

By prohibiting incineration within three nautical miles of the California coast, the potential for adverse health impacts will be reduced for residents and offsite workers who live or work near ports and along the coast. The proposed amended Cruise Ship ATCM is expected to reduce emissions from TACs, such as polychlorinated dibenzo-p-dioxins (PCDDs or dioxins), polychlorinated dibenzofurans (PCDFs or furans), and toxic metals. Moreover, the benefit to human health, public safety, public welfare, and the environment as a result of the proposed amended Cruise Ship ATCM is anticipated to increase dramatically as the oceangoing ship and cruise ship industries in California are fast growing industries.

AB 471 and SB 771 were passed by the California Legislature and signed by the Governor in 2004 and 2005, respectively. Effective January 2005 and 2006 (respectively), cruise ships and oceangoing ships were prohibited from conducting onboard incineration while operating within three miles of the California coast. The proposed amended Cruise Ship ATCM implements AB 471 and SB 771 and ensures that this law is adequately enforced.

Finally, in accordance with Government Code section 11346.2(b)(5)(B), the Executive Officer has determined that the cost of differing state regulations is justified by the benefit to human health, public safety, public welfare, or the environment.

VII. ECONOMIC IMPACTS OF THE PROPOSED AMENDMENTS TO THE CRUISE SHIP ATCM

This chapter discusses the impacts of the proposed amendments to the oceangoing ship and cruise ship industries and costs to local, state, and federal agencies. Information on the economic impacts to the cruise ship industry can be found in the Cruise Ship Staff Report. Overall, the proposed amendments to the Cruise Ship ATCM are not expected to result in any significant economic impacts. The costs to the oceangoing ship and cruise ship industries are negligible.

The proposed amended Cruise Ship ATCM is not expected to have an impact on the creation or elimination of jobs and businesses, or the competitiveness of oceangoing ships traveling to California ports.

Negligible costs were identified for public agencies.

A. Legal Requirements

Section 11346.3 of the Government Code requires State agencies to assess the potential for adverse economic impacts on California business enterprises and individuals when proposing to adopt or amend any administrative regulation. The assessment shall include a consideration of the impact of the proposed regulation on California jobs, business expansion, elimination or creation, and the ability of California business to compete with businesses in other states.

Also, State agencies are required to estimate the cost or savings to any State or local agency and school district in accordance with instructions adopted by the Department of Finance. The estimate shall include any non-discretionary cost or savings to local agencies and the cost or savings in federal funding to the State.

Health and Safety Code section 57005 requires ARB to perform an economic impact analysis of submitted alternatives to a proposed regulation before adopting any major regulation. A major regulation is defined as a regulation that will have a potential cost to California business enterprises in an amount exceeding ten million dollars in any single year. The proposed amended Cruise Ship ATCM is not a major regulation.

B. Affected Businesses

Approximately 1,400 oceangoing ship companies traveled into California ports during 2005. None of these companies are small businesses. These 1,400 companies accounted for about 1,900 different vessels entering California ports. Most of these vessels are foreign-flagged. ARB staff conducted the Oceangoing Ship Onboard Incinerator Survey (Survey) to get information on oceangoing ship waste incineration practices. Responses from that Survey showed that prior to January 1, 2006, when SB 771 took effect, only three out of 395 (<1 percent) of oceangoing ships, which responded to the survey incinerated within three nautical miles of the California coast.

For these oceangoing ships, a change in operating schedule of the incinerator was necessary to ensure that incineration stopped before the oceangoing ship arrived within three nautical miles of the California coast. Some of the larger companies indicated they have policies, which prohibit or discourage incineration within 25 or 50 miles from the California coast.

With the exception of the military and government owned or operated vessels, the recordkeeping requirements for the proposed amended Cruise Ship ATCM are similar to the current recordkeeping requirements under Regulation 9 of Annex V of the International Convention of the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78 or Annex V). Annex V requires each oceangoing ship to maintain garbage record logs indicating the date and time of start and stop of incineration, the position of the ship, the estimated amount of garbage incinerated, and the signature of officer in charge. Because oceangoing ship operators are already required to keep these records, recordkeeping costs from this regulation would be negligible. The proposed amended Cruise Ship ATCM adds a requirement for cruise ships and oceangoing ships to record additional information when the incinerator is operated under the direction of the USCG. Although not a common occurrence, the USCG can require the owner or operator of the vessel to operate the incinerator during an inspection. This can occur, for example, if the USCG suspects that illegal oil discharge has occurred. Costs for this additional recordkeeping requirement are negligible.

Ships between 300 and 400 gross tons are not required to maintain records under MARPOL 73/78. However, as specified in HSC 39631-39632, the proposed amended Cruise Ship ATCM will apply to oceangoing vessels 300 gross registered tons or more. ARB staff did not identify any oceangoing vessels between 300 and 400 gross registered tons, which conduct onboard incineration. However, under the proposed amendments, ships between 300 and 400 gross tons conducting onboard incineration could incur negligible costs for recordkeeping during the time the oceangoing ship is traveling in Regulated California Waters.

Reviewing the garbage record logs will assist ARB in ensuring compliance with SB 771. Under the proposed amended ATCM, inspectors are permitted to inspect and copy the garbage record logs to ensure that onboard incineration has not occurred within three nautical miles of the California coast. Copying costs for these records would be negligible. In addition, there could be minimal costs for the oceangoing ship officer's staff time to be present during onboard inspections. It is not expected that an onboard inspection would take longer than one hour.

Although many oceangoing ships already carry the specified National Oceanic and Atmospheric Administration (NOAA) Nautical Charts incorporated by reference in the proposed amended Cruise Ship ATCM, there may be some oceangoing ships, which use different nautical charts. In this situation, although not a requirement, an oceangoing ship may wish to purchase the NOAA nautical charts to ensure that they

know the location of the Three Nautical Mile Line. A set of NOAA charts can be purchased for about $100.

No additional cost impacts were identified for the other changes affecting cruise ships as specified in Section A, part 6 of Chapter VI.

C. Potential Impact on Employment

The proposed amendments to the ATCM are not expected to cause a change in California employment because, based on ARB's Survey, prior to the effective date of SB 771, only three out of 395 (0.75 percent) oceangoing ships incinerated waste within three nautical miles of the California coast. If we assume that 0.75 percent of the 1,900 oceangoing ships that came to California in 2005 incinerated within three miles of the California coast then we can estimate that 14 ships incinerated within three miles of the California coast prior to the effective date of SB 771 (January 1, 2006). For these 14 oceangoing ships, a change in incinerator operating schedule is not expected to impose significant costs; therefore, it is unlikely to have any impact on employment. Additionally, since the garbage records are already required under Annex V, there is no impact expected on employment due to recordkeeping and reporting requirements of the proposed amended ATCM.

No impact on employment was identified for the other changes affecting cruise ships as specified in Section A, part 6 of Chapter VI.

D. Potential Impact on Business Creation, Elimination, or Expansion

Because costs for the proposed amendments are negligible, the proposed amended Cruise Ship ATCM is not expected to have an impact on the creation, elimination, or expansion of businesses and jobs in California.

E. Potential Impact on Business Competitiveness

The proposed amended Cruise Ship ATCM is not expected to have an impact on business competitiveness. The proposed amended Cruise Ship ATCM is consistent with current industry practices and the requirements are identical across all cruise ships and oceangoing ships, which travel to California ports.

F. Costs to Public Agencies

ARB staff evaluated the cost impacts to local, state, and federal agencies and determined there are no significant economic impacts.

1. Local Agencies

ARB staff did not identify any cruise ships or oceangoing vessels owned or operated by local agencies that meet the definition in the proposed regulation and conduct onboard incineration.

We do not expect significant fiscal impacts on local air pollution control agencies because ARB will enforce the proposed amended Cruise Ship ATCM.

2. State Agencies

In order to promote statewide consistency, ARB will have the responsibility for enforcing the proposed amended Cruise Ship ATCM. The ARB expects to be able to enforce the proposed amended Cruise Ship ATCM with existing resources in the current fiscal year. However, additional resources may be necessary in the future. To minimize costs, inspections may be conducted in conjunction with other ARB enforced marine vessel regulations such as the proposed regulation for auxiliary diesel engines and diesel electric engines.

The only other affected state agency or program identified was the California Maritime Academy (CMA) in Vallejo. The CMA operates the “Golden Bear” training vessel on an annual voyage. This vessel does not incinerate within three nautical miles of the California coast and it currently maintains garbage records as specified under MARPOL. Therefore, impact to this agency is minimal.

3. Federal Agencies

Military agencies (i.e., Navy and Coast Guard) operate a total of approximately 20 oceangoing vessels that call on California ports and conduct onboard incineration. USCG policy prohibits operation of incinerators within three nautical miles of the California coast, and the Navy prohibits incineration within 12 nautical miles of the California coast. In the proposed amended Cruise Ship ATCM military agencies are required to keep incineration records within three nautical miles of the California coast. It is expected that these costs would be negligible, since the proposed regulation prohibits onboard incineration within this zone, and military policy also prohibits incinerator use in this zone.

VIII. ENVIRONMENTAL IMPACTS OF THE PROPOSED AMENDED CRUISE SHIP ATCM

The intent of the proposed amended Cruise Ship ATCM is to protect the public health by reducing the public's exposure to toxic air contaminants (TACs) from incineration onboard oceangoing ships. ARB staff evaluated potential water quality impacts, potential increase in diesel emissions, diversion of waste to landfills or land-based municipal waste incinerators, and public health impacts from storing garbage. ARB staff has determined that no significant adverse environmental impacts are expected to occur.

A. Legal Requirements Applicable to the Analysis

The California Environmental Quality Act (CEQA) and ARB policy require an analysis to determine the potential adverse environmental impacts of proposed regulations. The ARB's program involving the adoption of regulations has been certified by the Secretary of Resources (see Public Resources Code section 21080.5). Therefore, the CEQA environmental analysis requirements may be included in the Initial Statement of Reasons for a rulemaking in lieu of preparing an environmental impact report or negative declaration. In addition, ARB will respond in writing to all significant environmental issues raised by the public during the public review period or at the Board hearing. These responses will be contained in the Final Statement of Reasons for the proposed amended Cruise Ship ATCM.

Public Resources Code section 21159 requires that the environmental impact analysis conducted by ARB include the following: (1) an analysis of the reasonably foreseeable environmental impacts of the methods of compliance; (2) an analysis of reasonably foreseeable feasible mitigation methods; and, (3) an analysis of reasonably foreseeable alternative means of compliance with the proposed revisions to the ATCM. Regarding reasonably foreseeable mitigation measures, CEQA requires an agency to identify and adopt feasible mitigation measures that would minimize any significant adverse environmental impacts described in the environmental analysis.

B. Potential Ocean Water Quality Impacts

Since oceangoing ships would be prohibited from incinerating waste within three nautical miles of the California Coast, we do not expect any impact to the ocean water quality close to shore. Oceangoing ships are already prohibited from dumping wastes within three nautical miles of the coast (IMO, 1997). A prohibition against incineration in this same zone would not impact ocean water quality.

As cruise ships are already prohibited from dumping wastes within three nautical miles of the coast (IMO, 1997), amending the definition of "cruise ship," to mean those cruise ships calling on California ports or places, is not expected to impact ocean water quality.

C. Diesel Emissions

A negligible increase in diesel emissions could occur. By extrapolating from our Survey, we assume that 14 (0.75 percent) of the 1,900 oceangoing ships that came to California in 2005 incinerated within three nautical miles of the California coast prior to the effective date of SB 771 (January 1, 2006). If these 14 oceangoing ships chose to have all or a portion of that waste picked up by solid waste collection vehicles which operate on diesel fuel, then, in this scenario, diesel emissions could occur from additional miles traveled by these vehicles. However, it is expected that incinerator operating schedules would be adjusted (e.g., oceangoing ships would incinerate after they were outside of the three nautical mile line) rather than having their waste picked up by solid waste collection vehicles. This is because onshore waste pick up may incur additional costs, whereas adjusting the incinerator operating schedules would most likely not.

Amending the definition of "cruise ship," to mean those cruise ships calling on California ports or places, is not expected to impact diesel emissions since cruise ships are currently prohibited from incinerating within three nautical miles of the California coast.

D. Landfills and Land-Based Municipal Waste Incinerators

A negligible increase in solid waste to landfills or land-based municipal waste incinerators could occur if the small number of oceangoing ships which incinerated within three nautical miles of the California coast prior to January 1, 2006, chose to have that portion of their waste go to landfills or get picked up at a port for incineration at a land-based municipal waste incineration facility. For the three ships which reported incinerating within three nautical miles of the California coast, the waste they incinerated within three nautical miles of the California coast makes up less than 0.01 percent of each of their total waste incinerated.

Based on our extrapolation from Survey data, we estimate that 14 oceangoing ships could have incinerated waste within three nautical miles of the California coast prior the effective date of SB 771. Any additional waste going to landfills or land-based municipal waste incinerators would be negligible compared to the large volume received from local residents and businesses. Additionally, the nearest land-based municipal waste incinerators to the heaviest traveled ports of Los Angeles and Long Beach are equipped with sophisticated air pollution control devices. However, it is expected that incinerator operating schedules would be adjusted (e.g., oceangoing ships would incinerate after they were outside of the three nautical mile line) rather than have an additional portion of the waste diverted to landfills or land-based municipal waste incinerators.

Amending the definition of "cruise ship," to mean those cruise ships calling on California ports or places, is not expected to increase the amount of solid waste sent to

landfills or land-based municipal waste incinerators since cruise ships are currently prohibited from incinerating within three nautical miles of the California coast.

E. Waste Storage

Because the proposed amended Cruise Ship ATCM limits when oceangoing ship owners or operators may conduct onboard incineration, ARB staff evaluated whether this would result in infestation of plant and animal pests and diseases due to holding or stockpiling regulated garbage. Regulated garbage is defined in Code of Federal Regulations (CFR), Title 7 CFR, section 330.400 and Title 9 CFR, section 94.5. Some examples of regulated garbage onboard an oceangoing ship would include food scraps, table refuse, galley refuse, food wrappers or packaging materials, and other waste material from stores and food preparation. All regulated international garbage within the territories of the United States must be in leak-proof, covered containers to prevent the dissemination of plant and animal pests and diseases (ARB, 2005b).

Although there are no requirements on how long regulated garbage may be stored on an oceangoing ship, the United States Department of Agriculture (USDA) has requirements for regulated garbage on land. In California and other similar climates and agricultural areas, USDA has allowed up to 72 hours (based on the life cycles of various plant pests in those climates) for storing garbage. Additional holding times are granted on a case by case basis (ARB, 2005b).

ARB staff does not expect negative environmental impacts due to the potential for garbage storage from the proposed amended Cruise Ship ATCM. In addition, it is not expected that a large amount of regulated garbage would be generated while coming into port, hoteling, or leaving the port. While at port, oceangoing ships may either send their wastes to landfills, land-based municipal waste incinerators, or can store their international regulated waste in leak-proof, covered containers. Many ships reported that a portion of their waste is disposed of at port facilities.

Amending the definition of “cruise ship,” to mean those cruise ships calling on California ports or places, is not expected to impact waste storage since cruise ships are currently prohibited from incinerating within three nautical miles of the California coast.

F. Reasonably Foreseeable Alternative Means of Compliance with the Proposed Amended Cruise Ship ATCM

ARB is required to do an analysis of reasonably foreseeable alternative means of compliance with the proposed amended Cruise Ship ATCM. Alternatives to the proposed amended Cruise Ship ATCM are discussed in Chapter VI. ARB staff has concluded that the proposed amended Cruise Ship ATCM provides clarity in implementing SB 771 and AB 771. The ATCM is enforceable with the least burdensome approach to reducing public health impacts from oceangoing ship and cruise ship onboard incineration.

G. Environmental Justice

The ARB is committed to evaluating community impacts of proposed regulations including environmental justice concerns. Because some communities experience higher exposure to toxic pollutants, it is a priority of ARB to ensure that full protection is afforded to all Californians. The proposed amended Cruise Ship ATCM is not expected to result in significant negative impacts in any community. The proposed amended Cruise Ship ATCM is designed to reduce emissions of TACs, such as polychlorinated dibenzo-*p*-dioxins (dioxins), polychlorinated dibenzofurans (furans), and metals to residents and off-site workers living or working along the California coast and near California ports.

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- Chart 18640, San Francisco to Point Arena (August 2005);
- Chart 18680, Point Sur to San Francisco (June 2005);
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Appendix A

Proposed Amended Regulation Order

Airborne Toxic Control Measure
for Cruise Ship and Oceangoing Ship Onboard Incineration

PROPOSED REGULATION ORDER

AIRBORNE TOXIC CONTROL MEASURE AMENDMENTS LIMITING ONBOARD INCINERATION ON CRUISE SHIPS AND OCEANGOING SHIPS

Amend ~~Adopt new~~ section 93119, title 17, California Code of Regulations, to read as follows:

Section 93119. Airborne Toxic Control Measure Limiting Onboard Incineration ~~for~~ on Cruise Ships and Oceangoing Ships ~~Onboard Incineration~~.

(a) Purpose.

The purpose of this control measure is to reduce emissions of toxic air contaminants from the use of incinerators aboard cruise ships and oceangoing ships. Specifically, this regulation prohibits cruise ships and oceangoing ships from conducting onboard incineration while operating within three miles of the California coast. This control measure is expected to reduce exposure to toxic air contaminants for residents living near ports and along the California coast.

(b) Applicability.

~~Except as provided in subsection (c),~~ T~~t~~his section applies to any person who owns or operates a cruise ship, as defined in subsection (c)~~(d)~~(2), including foreign flagged cruise ships~~,. which travel within three miles of the California coast or visit California ports or terminals.~~

This section also applies to any person who owns or operates an oceangoing ship as defined in subsection (c)(6), including foreign flagged oceangoing ships.

~~**(c) Exemptions.**~~

~~(1) This section does not apply to vessels without berths or overnight accommodations for passengers.~~

~~(2) This section does not apply to noncommercial vessels, warships, vessels operated by nonprofit entities as determined by the Internal Revenue Service, and vessels operated by the State of California, the United States, or a federal government.~~

(c~~d~~) Definitions. For the purposes of this section, the following definitions apply:

~~(1) "Air Pollution Control Officer" or "APCO" means the air pollution control or executive officer of a district, or his or her delegate~~.

(1) "Calling on California ports or places" means bound for or leaving a port or terminal located in California.

(2) "Cruise ship" means a commercial vessel which has berths or overnight accommodations for passengers and ~~that~~ which has the capacity to carry 250 or more passengers for hire, calling on California ports or places. Cruise ship does not include an oceangoing ship, noncommercial vessels, warships, vessels operated by nonprofit entities as determined by the Internal Revenue Service, and vessels operated by the State of California, the United States, or a foreign government.

~~(3) "District" means an air pollution control or air quality management district as defined in Health and Safety Code section 39025.~~

(3) "Estuarine Waters" means an arm of the sea or ocean that extends inland to meet the mouth of a river.

(4) "Executive Officer of the Air Resources Board" means the executive officer of the California Air Resources Board or his or her delegate.

(5) "Incinerator" means any device used to conduct onboard incineration.

(6) "Oceangoing Ship" means a private, commercial, government, or military vessel of 300 gross registered tons or more calling on California ports or places. An oceangoing ship does not include a cruise ship.

(~~6~~7) "Onboard incineration" means the combustion or burning of any materials or wastes for the purpose of volume reduction, destruction, sanitation, or sterilization, aboard a cruise ship or oceangoing ship. Onboard incineration does not include incinerators which are only burning fuels including, but not limited to, natural gas, gas oil, marine gas oil, marine diesel fuel, fuel oil, or residual fuel oil for the specific purpose of maintaining a minimum temperature in the incinerator to minimize thermal cycling.

(~~7~~8) "Owner or Operator" means a person who owns or operates a cruise ship or oceangoing ship.

(~~8~~9) "Person" shall have the same meaning as defined in Health and Safety Code section 39047.

(10) "Regulated California Waters" means all of the following:

(A) all California internal waters;
(B) all California estuarine waters;

(C) all California ports, roadsteads, and terminal facilities (collectively "ports");

(D) all waters within 3 nautical miles of the California baseline, starting at the California-Oregon border and ending at the California-Mexico border at the Pacific Ocean, inclusive;

(E) all waters within 12 nautical miles of the California baseline, starting at the California-Oregon border and ending at the California-Mexico border at the Pacific Ocean, inclusive;

(F) all waters within 24 nautical miles of the California baseline, starting at the California-Oregon border to 34.43 degrees North, 121.12 degrees West; inclusive; and

(G) all waters within the area, not including any islands, between the California baseline and a line starting at 34.43 degrees North, 121.12 degrees West; thence to 33.50 degrees North, 118.58 degrees West; thence to 32.48 degrees North, 117.67 degrees West; and ending at the California-Mexico border at the Pacific Ocean, inclusive.

~~(9) "Segment" means that portion of the cruise ship's voyage from the last port of call to the next port of call.~~

(~~10~~11) "Within three miles of the California coast" means between the California coast and the Three Nautical Mile Line as shown on the following National Oceanic and Atmospheric Administration (NOAA) Nautical Charts as authored by the NOAA Office of Coast Survey, which are incorporated herein by reference:

(A) Chart 18600, Trinidad Head to Cape Blanco (January 2002);
(B) Chart 18620, Point Arena to Trinidad Head (June 2002);
(C) Chart 18640, San Francisco to Point Arena (August 2005);
(D) Chart 18680, Point Sur to San Francisco (June 2005);
(E) Chart 18700, Point Conception to Point Sur (July 2003);
(F) Chart 18720, Point Dume to Purisima Point (January 2005); and
(G) Chart 18740, San Diego to Santa Rosa Island (April 2005).

(d~~e~~) Requirements.

(1) Notwithstanding sections 93104 and 93113 of title 17, California Code of Regulations, no cruise ship or oceangoing ship owner or operator, agent, representative, or employee shall conduct onboard incineration within three miles of the California coast, except when required to be operated under the direction or supervision of the United States Coast Guard.

(2) *Recordkeeping and Reporting Requirements*

(A) *Recordkeeping Requirements*

1. Except as provided in subsection (d)(2)(A)4a, ~~Owners~~ owners or operators of cruise ships or oceangoing ships subject to the requirements of this section shall ~~maintain~~ record the following ~~records~~ information while the incinerator is operating in Regulated California Waters: ~~for each segment of a voyage if, during any portion of that segment, the cruise ship travels within three miles of the California coast~~.

    a. The date and time of start and stop of incineration (in local time);
    b. The position of the ship in latitude and longitude for each start and stop time of incineration;
    c. The estimated amount incinerated in cubic meters (m^3); ~~and~~
    d. The name or signature of officer in charge of the operation~~.~~; and
    e. When operation of the incinerator is required by the United States Coast Guard, the name, unit, and phone number of United States Coast Guard personnel who directed that the incinerator be operated.

2. Records shall be maintained in English and shall be kept and maintained onboard the respective cruise ship or oceangoing ship for two years.

3. During an onboard inspection, records shall be made available to Air Resources Board personnel, ~~District personnel,~~ or their delegates.

4. Recordkeeping Requirements for Military Vessels.

    a. Military agencies owning or operating an oceangoing ship subject to the requirements of this section shall record the information listed in subsection (d)(2)(A)1a-e while the incinerator is operating within three miles of the California coast.

(B) *Reporting Requirements*

1. Owners or operators of cruise ships and oceangoing ships that are subject to this section, shall, upon written request by the Executive Officer of the Air Resources Board ~~or the Air~~

~~Pollution Control Officer from a District~~, provide copies of the records as specified in subsection (d)~~(e)~~(2)(A) within 30 calendar days of the request.

2. Owners or operators of oceangoing ships owned or operated by a military agency, that are subject to this section, shall, upon written request by the Executive Officer of the Air Resources Board provide copies of the records as specified in subsection (d)(2)(A)4a within 30 calendar days of the request.

(e~~f~~) Updates to NOAA Charts.

The Executive Officer shall publish in the California Regulatory Notice Register, send an electronic notice out to all subscribers of the oceangoing ship incineration list serve and cruise ship incineration list serve, post to the oceangoing ship incineration website at www.arb.ca.gov/toxics/shipincin/shipincin.htm, and notify potentially affected cruise ship owners or operators, regarding revisions to subsection (c)~~(d)~~(~~10~~11) with regard to Nautical Charts updated by NOAA, at least 30 days before the updates take effect in the following situations:

(1) The Executive Officer may revise subsection (c)~~(d)~~(~~10~~11) when there is a change in the chart number or name; or

(2) The Executive Officer may revise subsection (c)~~(d)~~(~~10~~11) when NOAA revises the Three Nautical Mile Line, as shown on the respective charts.

(f~~g~~) Severability.

Each part of this section shall be deemed severable, and in the event that any part of this section is held to be invalid, the remainder of this section shall continue in full force and effect.

NOTE: Authority cited: Sections 39516, 39600, 39601, 39631, 39632, 39650, 39656, 39658, 39659, ~~and~~ 39666, and 41510 Health and Safety Code. Reference: Sections 39630, 39631, 39632, 39650, 39656, 39659, 39666, ~~and~~ 41700, and 41806 Health and Safety Code.

Appendix B

Appendix to Annex V of MARPOL 73/78

Appendix to Annex V

Form of Garbage Record Book

Name of ship: _____

Distinctive number or letters: _____

IMO No.: _____

Period: From: _____ To: _____

1 *Introduction*

In accordance with regulation 9 of Annex V of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78), a record is to be kept of each discharge operation or completed incineration. This includes discharges at sea, to reception facilities, or to other ships.

2 *Garbage and garbage management*

Garbage includes all kinds of food, domestic and operational waste excluding fresh fish and parts thereof, generated during the normal operation of the vessel and liable to be disposed of continuously or periodically except those substances which are defined or listed in other annexes to MARPOL 73/78 (such as oil, sewage or noxious liquid substances).

The Guidelines for the Implementation of Annex V of MARPOL 73/78* should also be referred to for relevant information.

3 *Description of the garbage*

The garbage is to be grouped into categories for the purposes of this record book as follows:

1 Plastics

2 Floating dunnage, lining, or packing material

3 Ground-down paper products, rags, glass, metal, bottles, crockery, etc.

4 Paper products, rags, glass, metal, bottles, crockery, etc.

5 Food waste

* Refer to the Guidelines for the Implementation of Annex V of MARPOL 73/78; see IMO sales publication IMO-656E.

6 Incinerator ash.

4 *Entries in the Garbage Record Book*

4.1 Entries in the Garbage Record Book shall be made on each of the following occasions:

(a) When garbage is discharged into the sea:
  (i) Date and time of discharge
  (ii) Position of the ship (latitude and longitude)
  (iii) Category of garbage discharged
  (iv) Estimated amount discharged for each category in cubic metres
  (v) Signature of the officer in charge of the operation.

(b) When garbage is discharged to reception facilities ashore or to other ships:
  (i) Date and time of discharge
  (ii) Port or facility, or name of ship
  (iii) Category of garbage discharged
  (iv) Estimated amount discharged for each category in cubic metres
  (v) Signature of officer in charge of the operation.

(c) When garbage is incinerated:
  (i) Date and time of start and stop of incineration
  (ii) Position of the ship (latitude and longitude)
  (iii) Estimated amount incinerated in cubic metres
  (iv) Signature of the officer in charge of the operation.

(d) Accidental or other exceptional discharges of garbage
  (i) Time of occurrence
  (ii) Port or position of the ship at time of occurrence
  (iii) Estimated amount and category of garbage
  (iv) Circumstances of disposal, escape or loss, the reason therefor and general remarks.

4.2 Receipts

The master should obtain from the operator of port reception facilities, or from the master of the ship receiving the garbage, a receipt or certificate specifying the estimated amount of garbage transferred. The receipts or certificates must be kept on board the ship with the Garbage Record Book for two years.

4.3 Amount of garbage

The amount of garbage on board should be estimated in cubic metres, if possible separately according to category. The Garbage Record Book contains many references to estimated amount of garbage. It is recognized

that the accuracy of estimating amounts of garbage is left to interpretation. Volume estimates will differ before and after processing. Some processing procedures may not allow for a usable estimate of volume, e.g. the continuous processing of food waste. Such factors should be taken into consideration when making and interpreting entries made in a record.

RECORD OF GARBAGE DISCHARGES

Ship's name: _____ Distinctive No., or letters: _____ IMO No.: _____

Garbage categories:

1: Plastic.
2: Floating dunnage, lining, or packing materials.
3: Ground paper products, rags, glass, metal, bottles, crockery, etc.
4: Paper products, rags, glass, metal, bottles, crockery, etc.
5: Food waste.
6: Incinerator ash.

NOTE: THE DISCHARGE OF ANY GARBAGE OTHER THAN FOOD WASTE IS PROHIBITED IN SPECIAL AREAS. ONLY GARBAGE DISCHARGED INTO THE SEA MUST BE CATEGORIZED. GARBAGE OTHER THAN CATEGORY 1 DISCHARGED TO RECEPTION FACILITIES NEED ONLY BE LISTED AS A TOTAL ESTIMATED AMOUNT.

Date/time	Position of the ship	Estimated amount discharged into sea (m^3)					Estimated amount discharged to reception facilities or to other ship (m^3)		Estimated amount incinerated (m^3)	Certification/ Signature
		CAT. 2	CAT. 3	CAT. 4	CAT. 5	CAT. 6	CAT. 1	Other		

Master's signature: _____ Date: _____

Appendix C

Annex VI of MARPOL 73/78 – Regulation 16 and Appendix IV

Regulation 16
Shipboard incineration

(1) Except as provided in paragraph (5), shipboard incineration shall be allowed only in a shipboard incinerator.

(2) (a) Except as provided in sub-paragraph (b) of this paragraph, each incinerator installed on board a ship on or after 1 January 2000 shall meet the requirements contained in appendix IV to this Annex. Each incinerator shall be approved by the Administration taking into account the standard specifications for shipboard incinerators developed by the Organization.*

(b) The Administration may allow exclusion from the application of sub-paragraph (a) of this paragraph to any incinerator which is installed on board a ship before the date of entry into force of the Protocol of 1997, provided that the ship is solely engaged in voyages within waters subject to the sovereignty or jurisdiction of the State the flag of which the ship is entitled to fly.

(3) Nothing in this regulation affects the prohibition in, or other requirements of, the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972, as amended, and the 1996 Protocol thereto.

(4) Shipboard incineration of the following substances shall be prohibited:

(a) Annex I, II and III cargo residues of the present convention and related contaminated packing materials;

(b) polychlorinated biphenyls (PCBs);

* Refer to resolution MEPC 76(40), Standard specification for shipboard incinerators.

(c) garbage, as defined in Annex V of the present Convention, containing more than traces of heavy metals; and

(d) refined petroleum products containing halogen compounds.

(5) Shipboard incineration of sewage sludge and sludge oil generated during the normal operation of a ship may also take place in the main or auxiliary power plant or boilers, but in those cases, shall not take place inside ports, harbours and estuaries.

(6) Shipboard incineration of polyvinyl chlorides (PVCs) shall be prohibited, except in shipboard incinerators for which IMO Type Approval Certificates have been issued.

(7) All ships with incinerators subject to this regulation shall possess a manufacturer's operating manual which shall specify how to operate the incinerator within the limits described in paragraph 2 of appendix IV to this Annex.

(8) Personnel responsible for operation of any incinerator shall be trained and capable of implementing the guidance provided in the manufacturer's operating manual.

(9) Monitoring of combustion flue gas outlet temperature shall be required at all times and waste shall not be fed into a continuous-feed shipboard incinerator when the temperature is below the minimum allowed temperature of 850°C. For batch-loaded shipboard incinerators, the unit shall be designed so that the temperature in the combustion chamber shall reach 600°C within five minutes after start-up.

(10) Nothing in this regulation precludes the development, installation and operation of alternative design shipboard thermal waste treatment devices that meet or exceed the requirements of this regulation.

Appendix IV

Type approval and operating limits for shipboard incinerators (Regulation 16)

(1) Shipboard incinerators described in regulation 16(2) shall possess an IMO type approval certificate for each incinerator. In order to obtain such certificate, the incinerator shall be designed and built to an approved standard as described in regulation 16(2). Each model shall be subject to a specified type approval test operation at the factory or an approved test facility, and under the responsibility of the Administration, using the following standard fuel/waste specification for the type approval test for determining whether the incinerator operates within the limits specified in paragraph (2) of this appendix:

Sludge oil consisting of:	75% Sludge oil from HFO; 5% waste lubricating oil; and 20% emulsified water
Solid waste consisting of:	50% food waste 50% rubbish containing approx. 30% paper, " 40% cardboard, " 10% rags, " 20% plastic The mixture will have up to 50% moisture and 7% incombustible solids.

(2) Incinerators described in regulation 16(2) shall operate within the following limits:

O_2 in combustion chamber:	6–12%
CO in flue gas maximum average:	200 mg/MJ
Soot number maximum average:	Bacharach 3 or Ringelman 1 (20% opacity) (A higher soot number is acceptable only during very short periods such as starting up)
Unburned components in ash residues:	maximum 10% by weight
Combustion chamber flue gas outlet temperature range:	850–1200°C

Appendix D

Oceangoing Ship Onboard Incinerator Survey

California Environmental Protection Agency

Air Resources Board

Oceangoing Ship Onboard Incinerator Survey

(Please type or print legibly in ink)

A. Company Information

A.1. Company Name:_____

A.2. Mailing Address: _____

_____

_____

A.3. Contact person: _____

A.4. Phone number with area code:_____

A.5. E-mail address_____A.6. fax number_____

A.7. Certification: I am an officer of the company listed above and hereby certify that all information entered by my company on this "Oceangoing Ship Onboard Incineration Survey" is complete and accurate to the best of my knowledge and belief.	
Print Name:	Title:
Signature:	Date:

B. Oceangoing Ship Information

B.1. Vessel Name_____ B.2. IMO or Official Number_____

B.3. Vessel Type (circle one) **Auto Bulk Container General Military Tanker Unmanned Barge Other**_____

B.4. Country Flag:_____ B.5. Gross Tonnage (Metric Ton) _____

B.6. Typical or required number of crew_____

B.7. Number of incinerators onboard this vessel ____

If there are no incinerators onboard this vessel then place a "0" or write "none" in the space above (do not leave blank). You do not need to complete the remainder of the Survey. You are only required to complete and return page 1 of the Survey.

NOTE: IF THERE IS MORE THAN ONE ONBOARD INCINERATOR FOR THIS OCEANGOING SHIP PLEASE PHOTOCOPY THE REMAINDER OF THIS SURVEY AND FILL OUT THE INFORMATION FOR EACH INCINERATOR.

C. Waste and Incinerator Information

C.1. Incinerator manufacturer and model _____
(Please attach manufacturer specifications, if available)

C.2. Please check the type of fuel that is used to run the incinerator?

- ❑ Marine Diesel Oil
- ❑ Marine Gas Oil
- ❑ Heavy Fuel Oil (IFO 180, 380)
- ❑ Sludge Oil
- ❑ Other_____

C.3. Estimate the fuel use during incineration _____(specify units, e.g. gallons/hr)

C.4. Is the incinerator kept on when it is not burning waste?

- ❑ Yes
- ❑ No (if No, skip to C.6.)

C.5. If you answered yes to C.4., estimate the fuel use when the incinerator is not burning waste but is kept on (for the purpose of minimizing start-up and shut-down).
_____(specify units, e.g., gallons/hour)

C.6. Please check below the types of waste that are incinerated onboard this vessel (check all that apply).

- ❑ Plastics (including light plastics)
- ❑ Floating dunnage, lining, or packing material
- ❑ Paper products
- ❑ Rags
- ❑ Glass, metal, bottles, crockery, etc.
- ❑ Food waste
- ❑ Other_____

C.7. For the year 2005, approximately how much waste was burned in this incinerator?
_____tons/year OR _____ cubic meters/year (m^3/yr)

C.8. For the year 2005, estimate the amount of waste that was incinerated within three miles of the California Coast (including while at California ports).
_____ tons/year OR _____ m^3/year

C.9. Do you currently maintain a garbage record log as specified by Annex V of MARPOL 73/78?

- ❑ Yes
- ❑ No

C.10. During what hours do you typically burn waste in the incinerator?

- ❑ Daytime
- ❑ Nighttime
- ❑ Anytime

C.11. Manufacturer waste and/or material capacity for this incinerator. (If available, include manufacturer literature)

_____pounds/hour
_____other, specify units

C.12. What is the stack gas temperature during incineration? _____ (specify units, e.g., °K, °C)

C.13. What is the inside diameter of the incinerator stack?_____ (specify units, e.g., meters, inches)

C.14. What is the approximate distance from the design draft water line of the ship to the top of the incinerator stack? _____(specify units, e.g., meters, feet)

C.15. What is the stack velocity or the stack flow rate during incineration?
_____(specify units, e.g. m/s, ft/s, m^3/hr)

C.16. Does the incinerator have any of the following air pollution add-on controls (check all that apply)? (If available, please include manufacturer specifications or literature)

- ❑ None
- ❑ Wet collectors (scrubbers, e.g. spray towers, venturi scrubbers)
- ❑ Dry scrubber
- ❑ Baghouse
- ❑ Electrostatic precipitator
- ❑ Carbon adsorption
- ❑ Cyclone
- ❑ Other (please list)_____

C.17. Has emissions testing ever been conducted on your incinerator?

- ❑ Yes (please provide this information)
- ❑ No

C.18. Is the incinerator a batch, continuous, or intermittent incinerator according to the definitions below?

- ❑ Batch: an incinerator that is designed such that neither waste charging nor ash removal can occur during combustion. (skip to C.21)
- ❑ Continuous: an incinerator that is designed to allow waste charging and ash removal during combustion. (proceed to C.19)
- ❑ Intermittent: an incinerator that is designed to allow waste charging, but not ash removal, during combustion. (proceed to C.19)

CONTINUOUS OR INTERMITTENT OPERATION QUESTIONS

C.19. How many pounds (lbs) or cubic meters (m^3) of waste do you typically burn per hour?
_____pounds/hour (lbs/hr); or _____cubic meters/hour (m^3/hr)

C.20. How many hours do you burn waste in the incinerator per day?_____hours/day

****Skip to D.**

BATCH OPERATION QUESTIONS

C.21. How many pounds (lbs) or cubic meters (m^3) of waste do you burn in the incinerator per batch? _____ pounds/batch (lbs/batch); or _____cubic meters/batch (m^3/batch)

C.22. How long (in minutes or hours) does it take to burn the waste of the batch specified in your answer for question C.21?_____(specify units, e.g. hours, minutes)

C.23. What is the maximum number of batches incinerated per day?_____batches/day

C.24. How many days per week do you incinerate batches of waste?_____days/week

D. Other Waste Treatment

D.1 Besides incineration, briefly describe any other methods of waste treatment or disposal you do either in or out of port (e.g., recycling, disposal to port facilities, discharge to sea, etc.)

_____

_____

_____

_____

_____

_____

_____

_____

****END OF SURVEY****

****IF AVAILABLE, PLEASE ATTACH A COPY OF YOUR INCINERATOR SPECIFICATIONS, CONTROL EQUIPMENT, AND EMISSIONS TESTING, IF APPLICABLE****

Thank you for filling out this survey.
Submit completed form by email, fax, or mail by **June 12, 2006.** For email submittals send to mkomleni@arb.ca.gov, by fax to **(916) 327-6251 OR mail the survey back to the following address:**

Michelle Komlenic
Air Resources Board
Stationary Source Division
P.O. Box 2815
Sacramento, California 95812-2815

Additional copies of the survey can be found on our website at **www.arb.ca.gov/toxics/shipincin/shipincin.htm** or have any questions, please contact Ms. Michelle Komlenic, at (916) 322-3926 or via email at mkomleni@arb.ca.gov

Appendix E

Senate Bill 771

Senate Bill No. 771

CHAPTER 588

An act to amend Sections 39630, 39631, and 39632 of, and to amend the heading of Chapter 3.3 (commencing with Section 39630) of Part 2 of Division 26 of, the Health and Safety Code, and to amend Sections 72410, 72420, 72440, and 72441 of, to amend the heading of Division 38 (commencing with Section 72400) of, to amend and repeal Sections 72400 and 72430 of, to add Sections 72420.2, 72423, and 72440.1 to, to add and repeal Sections 72401 and 72420.1 of, to repeal Division 39 (commencing with Section 72500) of, and to repeal and add Sections 72421 and 72425 to, the Public Resources Code, relating to vessels.

[Approved by Governor October 6, 2005. Filed with Secretary of State October 6, 2005.]

LEGISLATIVE COUNSEL'S DIGEST

SB 771, Simitian. Oceangoing ships.

(1) Existing law prohibits a cruise ship, as defined, from conducting onboard incineration while operating within 3 miles of the California coast.

This bill would also prohibit an oceangoing ship, as defined, from conducting onboard incineration while operating within 3 miles of the California coast.

(2) Existing law regulates the release of graywater, sewage sludge, oily bilgewater, hazardous waste, or other waste by large passenger vessels into the marine waters of the state and marine sanctuaries. Existing law also regulates, until January 1, 2010, the release of sewage by large passenger vessels into the marine waters of the state.

This bill would also regulate the release of graywater, sewage, sewage sludge, oily bilgewater, hazardous waste, or other waste by oceangoing ships, as defined, into the marine waters of the state and marine sanctuaries.

The bill would require the master, owner, operator, agent, or person in charge of an oceangoing ship who has operated, or has caused to be operated, the oceangoing ship in the marine waters of the state during 2006, to provide certain information relating to ports of call and sewage, graywater, and blackwater discharge, in electronic or written form to the State Lands Commission upon the vessel's departure from its first port or place of call in California beginning in 2006. The bill would require the commission to submit the reported information to the State Water Resources Control Board on or before February 1, 2007. The bill would require the board to submit the reported information to the Legislature on or beforeOctober 1, 2007.

This bill would also consolidate the provisions regulating the release of these substances from large passenger vessels and oceangoing ships.

The people of the State of California do enact as follows:

SECTION 1. This act shall be known and may be cited as the California Clean Coast Act.

SEC. 1.5. The heading of Chapter 3.3 (commencing with Section 39630) of Part 2 of Division 26 of the Health and Safety Code is amended to read:

CHAPTER 3.3. CRUISE SHIPS AND OCEANGOING SHIPS

SEC. 2. Section 39630 of the Health and Safety Code is amended to read:

39630. The Legislature finds and declares that it is in the interests of all Californians to protect the air quality from increasing volumes of cruise ship engine and oceangoing ship engine emissions.

SEC. 3. Section 39631 of the Health and Safety Code is amended to read:

39631. (a) The state board shall enforce this chapter, and may adopt standards, rules, and regulations for that purpose pursuant to Section 39601.

(b) As used in this division, "cruise ship" means a commercial vessel that has the capacity to carry 250 or more passengers for hire. "Cruise ship" does not include the following:

(1) Vessels without berths or overnight accommodations for passengers.

(2) Noncommercial vessels, warships, vessels operated by nonprofit entities as determined by the Internal Revenue Service, and vessels operated by the state, United States, or a foreign government.

(3) Oceangoing ships, as defined in subdivision (c).

(c) As used in this division, "oceangoing ship" means a private, commercial, government, or military vessel of 300 gross registered tons or more calling on California ports or places.

SEC. 4. Section 39632 of the Health and Safety Code is amended to read:

39632. Commencing on January 1, 2005, a cruise ship, and commencing on January 1, 2006, an oceangoing ship, shall not conduct onboard incineration while operating within three miles of the California coast, to the extent allowed by federal law.

SEC. 5. The heading of Division 38 (commencing with Section 72400) of the Public Resources Code is amended to read:

DIVISION 38. CALIFORNIA CLEAN COAST ACT

SEC. 6. Section 72400 of the Public Resources Code, as amended by Section 1 of Chapter 764 of the Statutes of 2004, is amended to read:

72400. The Legislature finds and declares both of the following:

(a) California is home to four of the 13 national marine sanctuaries. These areas support some of the world's most diverse marine ecosystems and are home to numerous mammals, seabirds, fish, invertebrates, and plants.

(b) The protection and enhancement of the quality of the marine waters of the state and marine sanctuaries, and the protection of public health and the environment, requires that the release from large passenger vessels and oceangoing ships of hazardous waste, other waste, sewage sludge, and oily bilgewater, into the marine waters of the state and marine sanctuaries, and the release of graywater by large passenger ships into the marine waters of the state, should be prohibited.

SEC. 7. Section 72400 of the Public Resources Code, as added by Chapter 764 of the Statutes of 2004, is repealed.

SEC. 8. Section 72401 is added to the Public Resources Code, to read:

72401. (a) The Legislature finds and declares that the protection and enhancement of the quality of the marine waters of the state requires that the release of sewage from large passenger vessels, and the release of sewage and graywater from oceangoing ships with sufficient holding tank capacity, into the marine waters of the state should be prohibited.

(b) The Legislature intends to request the Congress of the United States to amend the Federal Water Pollution Control Act (33 U.S.C. Sec. 1251 and following) to provide California with authority similar to that granted to the State of Alaska by Public Law 106-554, to regulate the release of sewage from large passenger vessels and oceangoing ships in the marine waters of the state.

(c) This section shall remain in effect only until January 1, 2010, and as of that date is repealed, unless a later enacted statute, that is enacted before January 1, 2010, deletes or extends that date.

SEC. 9. Section 72410 of the Public Resources Code is amended to read:

72410. (a) Unless the context otherwise requires, the definitions set forth in this section govern this division.

(b) "Board" means the State Water Resources Control Board.

(c) "Commission" means the State Lands Commission.

(d) "Graywater" means drainage from dishwasher, shower, laundry, bath, and washbasin drains, but does not include drainage from toilets, urinals, hospitals, or cargo spaces.

(e) "Hazardous waste" has the meaning set forth in Section 25117 of the Health and Safety Code, but does not include sewage.

(f) "Large passenger vessel" or "vessel" means a vessel of 300 gross registered tons or greater that is engaged in the carrying of passengers for hire, excluding all of the following vessels:

(1) Vessels without berths or overnight accommodations for passengers.

(2) Noncommercial vessels, warships, vessels operated by nonprofit entities as determined by the Internal Revenue Service, and vessels operated by the state, the United States, or a foreign government.

(3) Oceangoing ships, as defined in subdivision (j).

(g) "Marine waters of the state" means "coastal waters" as defined in Section 13181 of the Water Code.

(h) "Marine sanctuary" means marine waters of the state in the Channel Islands National Marine Sanctuary, Cordell Bank National Marine Sanctuary, Gulf of the Farallones National Marine Sanctuary, or Monterey Bay National Marine Sanctuary.

(i) "Medical waste" means medical waste subject to regulation pursuant to Part 14 (commencing with Section 117600) of Division 104 of the Health and Safety Code.

(j) "Oceangoing ship" means a private, commercial, government, or military vessel of 300 gross registered tons or more calling on California ports or places.

(k) "Oil" has the meaning set forth in Section 8750.

(*l*) "Oily bilgewater" includes bilgewater that contains used lubrication oils, oil sludge and slops, fuel and oil sludge, used oil, used fuel and fuel filters, and oily waste.

(m) "Operator" has the meaning set forth in Section 651 of the Harbors and Navigation Code.

(n) "Other waste" means photography laboratory chemicals, dry cleaning chemicals, or medical waste.

(o) "Owner" has the meaning set forth in Section 651 of the Harbors and Navigation Code.

(p) "Release" means discharging or disposing of wastes into the environment.

(q) "Sewage" has the meaning set forth in Section 775.5 of the Harbors and Navigation Code, including material that has been collected or treated through a marine sanitation device as that term is used in Section 312 of the Clean Water Act (33 U.S.C. Sec. 1322) or material that is a byproduct of sewage treatment.

(r) "Sewage sludge" has the meaning set forth in Section 122.2 of Title 40 of the Code of Federal Regulations.

(s) "Sufficient holding tank capacity" means a holding tank of sufficient capacity to contain sewage and graywater while the oceangoing ship is within the marine waters of the state.

(t) "Waste" means hazardous waste and other waste.

SEC. 10. Section 72420 of the Public Resources Code is amended to read:

72420. (a) If the appropriate federal agencies approve an application made pursuant to subdivision (a) of Section 72440, or if the board determines that an application is not required, an owner or operator of a large passenger vessel or oceangoing ship may not release, or permit anyone to release, any sewage sludge from the vessel into the marine waters of the state or a marine sanctuary.

(b) If the Administrator of the United States Environmental Protection Agency approves the application for sewage release made pursuant to subdivision (a) of Section 72440, or if the board determines that an application is not required, an owner or operator of an oceangoing ship with sufficient holding tank capacity may not release, or permit anyone to release, any sewage from the vessel into the marine waters of the state.

SEC. 11. Section 72420.1 is added to the Public Resources Code, to read:

72420.1. (a) If the Administrator of the United States Environmental Protection Agency approves the application for sewage release made pursuant to subdivision (a) of Section 72440, or if the board determines that an application is not required, an owner or operator of a large passenger vessel may not release, or permit anyone to release, any sewage from the vessel into the marine waters of the state.

(b) This section shall remain in effect only until January 1, 2010, and as of that date is repealed, unless a later enacted statute, that is enacted before January 1, 2010, deletes or extends that date.

SEC. 12. Section 72420.2 is added to the Public Resources Code, to read:

72420.2. (a) An owner or operator of a large passenger vessel shall not release, or permit anyone to release, from the vessel, graywater into the marine waters of the state.

(b) An owner or operator of a large passenger vessel or oceangoing ship shall not release, or permit anyone to release, from the vessel, hazardous waste, other waste, or oily bilgewater into the marine waters of the state or a marine sanctuary.

(c) An owner or operator of an oceangoing ship with sufficient holding tank capacity shall not release, or permit anyone to release, from the vessel, graywater into the marine waters of the state.

SEC. 13. Section 72421 of the Public Resources Code, as amended by Section 3 of Chapter 764 of the Statutes of 2004, is repealed.

SEC. 14. Section 72421 of the Public Resources Code, as added by Section 4 of Chapter 764 of the Statutes of 2004, is repealed.

SEC. 15. Section 72421 is added to the Public Resources Code, to read:

72421. (a) The owner or operator shall immediately, but no later than 24 hours after a release, notify the board of any of the following:

(1) A large passenger vessel release of graywater into the marine waters of the state.

(2) Until January 1, 2010, a large passenger vessel release of sewage into the marine waters of the state or a marine sanctuary.

(3) A large passenger vessel or ocean going ship release of hazardous waste, other waste, sewage sludge, or oily bilgewater into the marine waters of the state or a marine sanctuary.

(4) An oceangoing ship with sufficient holding tank capacity release of sewage or graywater into the marine waters of the state or a marine sanctuary.

(b) The owner or operator shall include all of the following in the notification required pursuant to subdivision (a):

(1) Date of the release.

(2) Time of the release.

(3) Location of the release.

(4) Volume of the release.

(5) Source of the release.

(6) Remedial action taken to prevent future releases.

SEC. 16. Section 72423 is added to the Public Resources Code, to read:

72423. An oceangoing ship with sufficient holding tank capacity and capability for transfer shall either hold on board or shall transfer sewage and graywater to a pumpout facility, if that facility is available and accessible for the oceangoing ship where the ship is docked, and shall not discharge sewage or graywater within California's waters.

SEC. 17. Section 72425 of the Public Resources Code is repealed.

SEC. 18. Section 72425 is added to the Public Resources Code, to read:

72425. (a) (1) If the master, owner, operator, agent, or person in charge of an oceangoing ship has operated, or has caused to be operated, the oceangoing ship in the marine waters of the state during 2006, that master, owner, operator, agent, or person in charge shall provide the information described in subdivision (b) in electronic or written form to the commission upon the vessel's departure from its first port or place of call in California beginning in 2006.

(2) The information described in subdivision (b) shall be submitted on a form developed by the commission.

(b) The master, owner, operator, or person in charge of the oceangoing vessel shall maintain on board the vessel, in written or electronic form, records that include all of the following information:

(1) Vessel information, including all of the following:

(A) Name.

(B) International Maritime Organization number or official number if the International Maritime Organization number has not been assigned.

(C) Vessel type.

(D) Owner or operator.

(E) Gross tonnage.

(F) Keel laid date.

(G) Port of registry.

(H) Typical or required number of crew.

(2) Graywater information, including the vessel's ability to store graywater while in California waters and size and capacity of any graywater holding tanks, as measured in metric tons.

(3) Blackwater information, including the vessel's ability to store blackwater while in California waters and size and capacity of any blackwater holding tanks, as measured in metric tons.

(4) Marine sanitation devices information, including number, size, and nature of devices on the vessel treating sewage prior to discharge.

(5) Connections to ensure transfer of sewage and graywater to pumpout facilities.

(6) California port of call information, including expected number of calls, in days, in ports within the state during 2006.

(7) Certification of accurate information, including the printed name, title, and signature of the master, owner, operator, or person in charge, or responsible officer attesting to the accuracy of the information provided.

(c) The commission shall submit the reported information to the board on or before February 1, 2007. The board shall submit the reported information to the Legislature on or before October 1, 2007. The board may submit the report to the Legislature in an electronic form.

SEC. 19. Section 72430 of the Public Resources Code, as amended by Section 6 of Chapter 764 of the Statutes of 2004, is amended to read:

72430. (a) A person who violates Section 72420 or 72420.2, or until January 1, 2010, Section 72420.1, is subject to a civil penalty of not more than twenty-five thousand dollars ($25,000) for each violation.

(b) The civil penalty imposed for each separate violation pursuant to this section is separate from, and in addition to, any other civil penalty imposed for a separate violation pursuant to this section or any other provision of law.

(c) In determining the amount of a civil penalty imposed pursuant to this section, the court shall take into consideration all relevant circumstances, including, but not limited to, the nature, circumstance, extent, and gravity of the violation. In making this determination, the court shall consider the degree of toxicity and volume of the release, the extent of harm caused by the violation, whether the effects of the violation may be reversed or mitigated, and with respect to the defendant, the ability to pay, the effect of a civil penalty on the ability to continue in business, all voluntary cleanup efforts undertaken, the prior history of violations, the gravity of the behavior, the economic benefit, if any, resulting from the violation, and all other matters the court determines justice may require.

(d) (1) A civil action brought under this section may only be brought in accordance with this subdivision. That civil action may be brought by the Attorney General upon complaint or request by the Department of Fish and Game or the appropriate California regional water quality control board, or by a district attorney or city attorney.

(2) Notwithstanding Section 13223 of the Water Code, a regional water quality control board may delegate to its executive officer authority to request the Attorney General for judicial enforcement under this section.

(3) If a district attorney or city attorney brings an action under this section, the action shall be in the name of the people of the State of California.

(4) An action relating to the same violation may be joined or consolidated.

SEC. 20. Section 72430 of the Public Resources Code, as added by Section 7 of Chapter 764 of the Statutes of 2004, is repealed.

SEC. 21. Section 72440 of the Public Resources Code, as amended by Section 8 of Chapter 764 of the Statutes of 2004, is amended to read:

72440. (a) (1) The board shall determine whether it is necessary to apply to the federal government for the state to prohibit the release of sewage or sewage sludge from large passenger vessels, and oceangoing ships with sufficient holding tank capacity, into the marine waters of the state or to prohibit the release of sewage sludge from large passenger vessels and oceangoing ships into marine sanctuaries, as described in subdivision (a) of Section 72420, subdivision (a) of Section 72420.1, and Section 72420.2. If the board determines that application is necessary for either sewage or sewage sludge, or both, it shall apply to the appropriate federal agencies, as determined by the board, to authorize the state to prohibit the release of sewage or sewage sludge, or both, as necessary, from large passenger vessels, and oceangoing ships with sufficient holding tank capacity, into the marine waters of the state and, if necessary, to authorize the state to prohibit the release of sewage sludge from large passenger vessels and oceangoing ships into marine sanctuaries.

(2) It is not the Legislature's intent to establish for the marine waters of the state a no discharge zone for sewage from all vessels, but only for a class of vessels.

(b) The board shall request the appropriate federal agencies, as determined by the board, to prohibit the release of sewage sludge and oily bilgewater, except under the circumstances specified in Section 72441, by large passenger vessels and oceangoing ships, in all of the waters that are in the Channel Islands National Marine Sanctuary, Cordell Bank National Marine Sanctuary, Gulf of the Farallones National Marine Sanctuary, and Monterey Bay National Marine Sanctuary, that are not in the state waters.

(c) This section shall remain in effect only until January 1, 2010, and as of that date is repealed, unless a later enacted statute, that is enacted before January 1, 2010, deletes or extends that date.

SEC. 22. Section 72440.1 is added to the Public Resources Code, to read:

72440.1. The board shall request the appropriate federal agencies, as determined by the board, to prohibit the release of waste by large passenger vessels or oceangoing ships in all of the waters in the Channel Islands National Marine Sanctuary, Cordell Bank National Marine Sanctuary, Gulf of the Farallones National Marine Sanctuary, and Monterey Bay National Marine Sanctuary; and, request, if necessary, approval of the state's prohibition of the release of waste in the marine sanctuaries.

SEC. 23. Section 72441 of the Public Resources Code is amended to read:

72441. (a) This division does not apply to either of the following:

(1) A large passenger vessel or oceangoing ship that operates in the marine waters of the state solely in innocent passage.

(2) Discharges made for the purpose of securing the safety of the large passenger vessel or oceangoing ship or saving life at sea, if reasonable precautions are taken for the purpose of preventing or minimizing the discharge.

(b) For the purposes of this section, a vessel is engaged in innocent passage if its operation in state waters would constitute innocent passage under either the Convention on the Territorial Sea and Contiguous Zone, dated April 29, 1958, or the United Nations Convention on the Law of the Sea, dated December 10, 1982.

SEC. 24. Division 39 (commencing with Section 72500) of the Public Resources Code is repealed.

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Appendix F

Potential Health Effects of Pollutants Emitted from Cruise Ship Onboard Incineration

Appendix F

Potential Health Effects of Pollutants Emitted from Oceangoing Ship Onboard Incineration

This section summarizes the cancer and noncancer health impacts that can result from exposure to pollutants emitted from oceangoing ship onboard incineration.

A. Arsenic (Inorganic)

Exposure to inorganic arsenic may result in both cancer and noncancer health effects. The probable route of human exposure to arsenic is by ingestion, inhalation, and permeation of skin or mucous membranes (ARB, 1997b).

1. Cancer

Evidence for carcinogenicity in humans due to inhaled arsenic is strong. Studies of workers in smelters and in the pesticide manufacturing industry have found strong, consistent associations between respiratory cancer and arsenic exposure. The effect on respiratory cancer rates of combining smoking and arsenic exposure appears to be greater than additive and at low doses may be as high as multiplicative (ARB, 1997b). Chronic exposure to high levels of arsenic in drinking water has been identified as increasing skin cancer incidence in humans (OEHHA, 2002).

The Office of Environmental Health Hazard Assessment (OEHHA) staff has performed an extensive assessment of the potential health effects of arsenic, reviewing available carcinogenicity data. OEHHA concluded that arsenic is a potential human carcinogen with no identifiable threshold below which no carcinogenic effects are likely to occur. The Air Resources Board (ARB/Board) formally identified arsenic as a toxic air contaminant (TAC) in July 1990 (ARB, 1990). Arsenic (inorganic arsenic compounds) was listed by the State of California under Proposition 65 as a carcinogen in February 1987 (OEHHA, 2005).

In 1990, the United States (U.S.) Congress listed arsenic as a hazardous air pollutant (HAP) in subsection (b) of Section 112 of the Federal Clean Air Act (42 U.S.C. 7412). The United States Environmental Protection Agency (U.S. EPA) has classified inorganic arsenic as Group A, human carcinogen, based on sufficient epidemiological evidence (U.S. EPA, 2005). The International Agency for Research on Cancer (IARC) has classified inorganic arsenic and arsenic compounds as Group 1: Human carcinogen based on sufficient evidence in humans (IARC, 2005). Arsenic in drinking-water is carcinogenic to humans (Group 1).

2. Noncancer

Acute inhalation exposure may result in severe irritation of the mucous membranes of the upper and lower respiratory tract with symptoms of cough, dyspnea, and chest pain. These may be followed by garlicky breath and gastrointestinal symptoms including vomiting and diarrhea. Signs of acute poisoning are dermatitis, nasal mucosal irritation, laryngitis, mild bronchitis, and conjunctivitis. The acute toxic symptoms of trivalent arsenic poisoning are due to severe inflammation of the mucous membranes and increased permeability of the capillaries. Inorganic arsenic compounds are easily absorbed through the skin; the trivalent is more rapidly absorbed than the pentavalent. Ingestion of two grams of arsenic trioxide was fatal to an adult male (OEHHA, 1999).

Persons with skin or respiratory conditions, including allergies, may be more sensitive to the toxic effects of arsenic. Persons with higher than normal intakes of arsenic, including smokers and fish and shellfish eaters, may be more sensitive to toxic effects following arsenic exposure (OEHHA, 1999).

Chronic inhalation exposure to inorganic arsenic in humans is associated with irritation of the skin and mucous membranes, while chronic oral exposure has resulted in gastrointestinal effects, anemia, peripheral neuropathy, skin lesions, and liver or kidney damage (ARB, 1997b).

Reports of human inhalation exposure to arsenic compounds, primarily epidemiological studies of smelter workers, indicate that adverse health effects occur as a result of chronic exposure. Among the targets of arsenic toxicity are the respiratory system, the circulatory system, the skin, the nervous system, and the reproductive system. Studies in experimental animals show that inhalation exposure to arsenic compounds can produce immunological suppression, developmental defects, and histological or biochemical effects on the nervous system and lung (OEHHA, 2000).

The oxidation state of arsenic determines the teratogenic potential of its inorganic compounds; trivalent (III) arsenic compounds possess greater teratogenic potential than pentavalent (V) compounds. Chronic exposure to arsenic has been associated with decreased birth weight and an increased rate of spontaneous abortion in female smelter workers. However, this association is confounded by the presence of other toxicants in the smelting process, including lead (OEHHA, 1999). Arsenic (inorganic oxides) was listed by the State of California under Proposition 65 as developmental toxicants in May 1997 (OEHHA, 2005).

B. Beryllium

Exposure to beryllium may result in both cancer and noncancer health effects. The probable routes of human exposure to beryllium are inhalation ingestion, and dermal contact (ARB, 1997b).

1. Cancer

Several studies found increased incidences of lung cancer in beryllium processing workers (OEHHA, 2002). Beryllium is a federal HAP and was identified as a toxic air contaminant by the Board in April 1993 under AB 2728 (ARB, 1993). The OEHHA staff has performed an extensive assessment of the potential health effects of beryllium, reviewing available carcinogenicity data. OEHHA concluded that beryllium is a potential human carcinogen with no identifiable threshold below which no carcinogenic effects are likely to occur. Beryllium and beryllium compounds were listed by the State of California under Proposition 65 as carcinogens in October 1987 (OEHHA, 2005).

In 1990, the U.S. Congress listed beryllium compounds as HAPs in subsection (b) of Section 112 of the Federal Clean Air Act (42 U.S.C. 7412). The U.S. EPA has classified beryllium as Group B1; probable human carcinogen (U.S. EPA, 2005). The International Agency for Research on Cancer has classified beryllium and beryllium compounds as Group 1: Human carcinogen (IARC, 2005).

2. Noncancer

Acute inhalation of high levels of beryllium can cause inflammation of the lungs in humans; these symptoms may be reversible after exposure ends (ARB, 1997b). The respiratory tract is the major target organ system in humans following the inhalation of beryllium. The common symptoms of chronic beryllium disease (CBD) include shortness of breath upon exertion, weight loss, cough, fatigue, chest pain, anorexia, and overall weakness. Most studies reporting adverse respiratory effects in humans involve occupational exposure to beryllium. Exposure to soluble beryllium compounds is associated with acute beryllium pneumonitis. Exposure to either soluble or insoluble beryllium compounds may result in obstructive and restrictive diseases of the lung, called chronic beryllium disease (berylliosis). The total number of beryllium-related disease cases has declined since the adoption of industrial standards (OEHHA, 2000).

C. Cadmium

Exposure to cadmium may result in both cancer and noncancer health effects. The probable routes of human exposure to cadmium are inhalation and ingestion (ARB, 1997b).

1. Cancer

Epidemiological evidence strongly supports an association between cadmium exposure and neoplasia, including respiratory and renal cancers. Cancer resulting from inhalation exposure to several forms of cadmium has been reported in animal studies (ARB, 1997b).

OEHHA staff has performed an extensive assessment of the potential health effects of cadmium and compounds, reviewing available carcinogenicity data. OEHHA concluded that cadmium and compounds are potential human carcinogens with no identifiable threshold below which no carcinogenic effects are likely to occur. The Board formally identified cadmium and cadmium compounds as a TAC in January 1987 (ARB, 1986b). Cadmium and cadmium compounds were listed by the State of California under Proposition 65 as carcinogens in October 1987 (OEHHA, 2005).

In 1990, the U.S. Congress listed cadmium compounds as HAPs in subsection (b) of Section 112 of the Federal Clean Air Act (42 U.S.C. 7412). The U.S. EPA classified cadmium in Group B1: Probable human carcinogen, based on human and animal studies showing an increase of lung cancer (U.S. EPA, 2005). The International Agency for Research on Cancer classified cadmium and cadmium compounds in Group 1: Human carcinogen based on epidemiological evidence of carcinogenicity in humans and carcinogenic effects observed in animals (IARC, 2005). There is limited evidence in experimental animals for the carcinogenicity of cadmium metal (ARB, 1997b).

2. Noncancer

Although ingestion is the major source of exposure, only one to ten percent of ingested cadmium appears to be absorbed systemically. Pulmonary absorption of inhaled cadmium is estimated to range from 10 to 50 percent of deposited cadmium. The biological half-life of cadmium in humans has been estimated to range from 10 to 30 years. Cadmium has moderate acute toxicity, producing gastrointestinal or pulmonary irritation effects from ingestion or inhalation, respectively. Subchronic and chronic exposures to cadmium have been associated with renal, cardiovascular, endocrine, hepatic, bone, hematological, and immunological effects. Respiratory conditions include bronchiolitis and emphysema. The U.S. EPA's Office of Air Quality Planning and Standards, for a hazard ranking under Section 112(g) of the Clean Air Act Amendments, considers cadmium oxide to be a “high concern” pollutant based on severe acute toxicity (ARB, 1997b).

Human developmental studies are limited, although there is some evidence to suggest that maternal cadmium exposure may result in decreased birth weights. Cadmium oral exposure induces testicular necrosis in experimental animals, ovarian damage, infertility, placental toxicity and embryo and fetotoxicity and teratogenicity. Developmental effects such as decreased weight gain and neurobehavioral deficits have been reported in animal studies (ARB, 1997b). Cadmium was listed by the State of California under Proposition 65 as a male reproductive and developmental toxicant in May 1997 (OEHHA, 2005).

D. Chromium

Exposure to chromium and chromium compounds may result in both cancer and noncancer health effects. The probable routes of human exposure to chromium compounds are inhalation, ingestion, and dermal contact (OEHHA, 2000).

1. Cancer

There are a number of human occupational studies that have demonstrated that inhalation exposure to chromium results in an increased risk of lung cancer mortality in humans. An oral chromium carcinogenicity bioassay study also shows that there is a significantly increased incidence of stomach carcinomas in female mice and benign tumors (papillomas and hyperkeratomas) in both male and female mice (OEHHA, 2002).

The OEHHA staff has performed an extensive assessment of the potential health effects of chromium (hexavalent), reviewing available carcinogenicity data. OEHHA concluded that chromium and chromium compounds are potential human carcinogens with no identifiable threshold below which no carcinogenic effects are likely to occur. The Board formally identified hexavalent chromium as a TAC in January 1986 (ARB, 1985). Chromium (hexavalent compounds) was listed by the State of California under Proposition 65 as carcinogens in February 1987 (OEHHA, 2005).

In 1990, the U.S. Congress listed chromium compounds as HAPs in subsection (b) of Section 112 of the Federal Clean Air Act (42 U.S.C. 7412). The U.S. EPA has classified chromium (VI) in Group A: Human carcinogen and chromium (III) in Group D: Not classifiable as to carcinogenicity in humans (U.S. EPA, 2005). The International Agency for Research on Cancer has classified chromium (VI) compounds in Group 1: Human carcinogen, and metallic chromium and chromium (III) in Group 3: Not classifiable (IARC, 2005).

2. Noncancer

The principal chronic effect of chromium (VI) exposure is that Cr(VI) forms oxyanions at physiological pH ($CrO4^{-2}$), which are quite similar to sulfate ($SO4^{-2}$) and phosphate ($HPO4^{-3}$) anions. Therefore, it is able to penetrate virtually every cell in the body because all cells transport sulfate and phosphate. Harmful effects are speculated to be related to the reduction of Cr(VI) to Cr(III) intracellularly when it crosses the cell membrane and forms complexes with intracellular macromolecules. Thus, Cr(VI) compounds have the potential to injure numerous organ systems. Toxicity following chronic Cr(VI) exposure has been reported in the respiratory tract, gastrointestinal system, eyes and conjunctiva, kidney, and hematopoietic system. Cr(VI) is corrosive and exposure to chromic acid mists may cause chronic skin ulcerations and upper respiratory lesions. In addition, allergic skin and respiratory reactions can occur with no relation to dose (OEHHA, 2000).

Nasal tissue damage has been frequently observed in chromium plating workers exposed chronically to chromic acid mists. However, workers in the chromate extraction and ferrochromium industry, exposed to particulates containing soluble Cr(VI) compounds, have also reported nasal lesions. Nasal lesions include perforated septum, ulcerated septum, nasal atrophy, nosebleed, and inflamed mucosa (OEHHA, 2000).

E. Hydrochloric Acid

Exposure to hydrochloric acid (HCl) may result noncancer health effects. The probable routes of human exposure to hydrochloric acid are inhalation and dermal contact (ARB, 1997b).

1. Cancer

Hydrochloric acid is a federal HAP and was identified as a TAC in April 1993 under AB 2728. No information is available on the carcinogenic effects of hydrochloric acid in humans. In one study, no carcinogenic response was observed in rats exposed by inhalation. The U.S. EPA has not classified hydrochloric acid as to its human carcinogenicity (U.S. EPA, 2005). The International Agency for Research on Cancer has classified hydrochloric acid in Group 3: Not classifiable as to its potential human carcinogenicity (IARC, 2005).

2. Noncancer

Inhalation exposure to high concentrations of HCl fumes may result in coughing, a choking sensation, burning of the respiratory tract, and pulmonary edema. Dental erosion has been reported in workers chronically exposed to low levels of gaseous hydrogen chloride. Reactive Airway Dysfunction Syndrome (RADS; acute, irritant-induced asthma) was reported in three male police officers (36 to 45 years old) who responded to a roadside chemical spill. Other reports of RADS include individual occupational cases (OEHHA, 1999).

Persons with preexisting skin, eye, gastrointestinal tract (including ulcers) or respiratory conditions or underlying cardiopulmonary disease may be more sensitive to the effects of HCl exposure. Persons also exposed to formaldehyde might be at increased risk for developing cancer (OEHHA, 1999).

The reproductive hazard of hydrogen chloride to humans is unknown. Few studies on the reproductive effects of HCl exposure were found in the literature. Maternal exposure to a high concentration of a strong acid could result in metabolic acidosis and subsequent fetal acidemia which has been linked with low Apgar scores, neonatal death, and seizures. However, there is no evidence linking HCl exposure to fetal academia (OEHHA, 1999).

F. Lead (Inorganic)

Exposure to lead may result in cancer health effects. The probable routes of human exposure to lead are inhalation and ingestion (ARB, 1997b).

1. Cancer

There are several inconclusive epidemiological studies of exposed workers which provided limited evidence of cancers of the kidney, stomach, and respiratory tract. Rodent studies have found increased kidney cancers following the oral administration of lead (ARB, 1997b).

OEHHA staff has performed an extensive assessment of the potential health effects of lead and lead compounds, reviewing available carcinogenicity data. OEHHA concluded that lead and lead compounds (inorganic) are a potential human carcinogen with no identifiable threshold below which no carcinogenic effects are likely to occur. The Board formally identified inorganic lead as a TAC in April 1997 (ARB, 1997a). Lead and lead compounds, lead acetate, lead phosphate, and lead subacetate were listed by the State of California under Proposition 65 as carcinogens in October 1992, January 1988, April 1988, and October 1989, respectively (OEHHA, 2005).

In 1990, the U.S. Congress listed lead compounds (including inorganic lead) as HAPs in subsection (b) of Section 112 of the Federal Clean Air Act (42 U.S.C. 7412). U.S. EPA has classified lead in Group B2: Probable human carcinogen (U.S. EPA, 2005). The International Agency for Research on Cancer has classified lead and inorganic lead compounds in Group 2B: Possibly carcinogenic to humans, and organic lead in Group 3: Not classifiable (IARC, 2005).

2. Noncancer

Lead salts (e.g., lead acetate, lead subacetate) are considered to be forms of inorganic lead. Most significant non-workplace, outdoor air exposure to lead in California is expected to be to inorganic lead particulate. Although different lead species (e.g., lead oxide, lead sulfide, etc.) are absorbed to varying degrees following inhalation, all are capable of causing adverse health effects once they reach sensitive tissues (ARB, 1997b).

Lead is slowly excreted by the body. Exposures to small amounts of lead over a long time can slowly accumulate to reach harmful levels. Harmful effects may therefore develop gradually without warning. Short-term exposure to high levels of lead may also cause harm. Lead can adversely affect the nervous, reproductive, digestive, cardiovascular blood-forming systems, and the kidney. Symptoms of nervous system effects include fatigue and headaches. More serious symptoms include feeling anxious or irritable and difficulty sleeping or concentrating. Severe symptoms include loss of short-term memory, depression, and confusion. More severe exposures can prove

fatal. Lead can also injure the peripheral nerves to cause weakness in the extremities. Children are a sensitive population as they absorb lead more readily and the developing nervous system puts them at increased risk for lead-related harm, including learning disabilities. Effects on the gastrointestinal tract include nausea, constipation, and loss of appetite. Recovery from severe effects on the nervous system or kidneys is not always complete. Other ill effects include hypertension and anemia. The toxicological endpoints considered for chronic toxicity are the kidney, cardiovascular or blood system, immune, reproductive, and central or peripheral nervous systems (ARB, 1997b).

In men, adverse reproductive effects include reduced sperm count and abnormal sperm. In women, adverse reproductive effects include reduced fertility. Still-birth, miscarriage, low birth weight, and neurobehavioral deficits may be more likely (ARB, 1997b). Lead was listed by the State of California under Proposition 65 as developmental toxicant and a male and female reproductive toxicant in February 1987 (OEHHA, 2005).

G. Manganese

Exposure to manganese and compounds may result in noncancer health effects. The probable route of human exposure to manganese and compounds is by ingestion and inhalation (ARB, 1997b).

1. Cancer

No studies are available regarding the carcinogenic effects of manganese and manganese compounds in humans or animals (ARB, 1997b).

In 1990, the U.S. Congress listed manganese compounds as HAPs in subsection (b) of Section 112 of the Federal Clean Air Act (42 U.S.C. 7412). Manganese compounds were identified as TACs by the Board in April 1993 under AB 2728 (ARB, 1993). The U.S. EPA has classified manganese in Group D: Not classifiable as to human carcinogenicity (U.S. EPA, 2005). The International Agency for Research on Cancer has not classified manganese as to its carcinogenicity (IARC, 2005).

2. Noncancer

Short-term exposure to manganese may cause irritation to the eyes, nose, throat, and respiratory tract. Long-term exposure to manganese may affect the central nervous system, causing a psychosis which may include symptoms similar to Parkinson's disease. Respiratory effects may also be seen (ARB, 1997b).

I. Mercury (Inorganic)

Exposure to mercury and mercury compounds may result in noncancer health effects. The probable routes of human exposure to mercury and mercury compounds are inhalation, ingestion, and dermal contact (ARB, 1997b).

1. Cancer

The human studies available regarding elemental mercury and cancer are inconclusive due to lack of valid exposure data and confounding factors. No studies are available on the carcinogenic effects of methyl mercury in humans. One available animal study reported renal tumors in mice. A chronic study on mercuric chloride in rats and mice reported an increased incidence of forestomach and thyroid tumors in rats, and an increased incidence of renal tumors in mice (ARB, 1997b).

In 1990, the U.S. Congress listed mercury compounds as HAPs in subsection (b) of Section 112 of the Federal Clean Air Act (42 U.S.C. 7412). The Board formally identified mercury as a TAC in April 1993 under AB 2728 (ARB, 1993). Methyl mercury compounds were listed by the State of California under Proposition 65 as carcinogens in May 1996 (OEHHA, 2005). The U.S. EPA has classified inorganic and methyl mercury in Group C: Possible human carcinogen; and elemental mercury in Group D: Not classifiable as a carcinogen (U.S. EPA, 2005). The International Agency for Research on Cancer has classified methyl mercury compounds in Group 2B: Possible human carcinogen, and metallic mercury and inorganic mercury compounds in Group 3: Not classifiable (IARC, 2005).

2. Noncancer

The respiratory tract is the first organ system affected in the case of acute inhalation poisonings. Acute exposure to mercury can lead to shortness of breath within 24 hours and a rapidly deteriorating course leading to death due to respiratory failure (OEHHA, 1999).

Central nervous system (CNS) effects such as tremors or increased excitability are sometimes seen in cases of acute accidental exposures. Long-term effects from a single exposure to mercury have been reported in six male workers exposed to an estimated concentration of 44 mg Hg/m^3 for a period of several hours. Long-term CNS effects included nervousness, irritability, lack of ambition, and loss of sexual drive for several years. Shortness of breath also persisted for years in all cases. Similar cases of CNS disturbances, including irritability, insomnia, malaise, anorexia, fatigue, ataxia, and headache have been reported in children exposed to vapor from spilled elemental mercury in their home (OEHHA, 1999).

Persons with preexisting allergies, skin conditions, chronic respiratory disease, nervous system disorders, or kidney diseases might have increased toxicity. Persons exposed to other neurotoxicants might have increased sensitivity. People who

consume significant amounts of fish from areas with advisories for daily fish intake due to mercury contamination may be more susceptible to the acute toxicity of airborne mercury (OEHHA, 1999).

The primary effects of chronic exposure to mercury vapor are on the central nervous system. Chronic duration exposures to elemental mercury have resulted in tremors (mild or severe), unsteady walking, irritability, poor concentration, short-term memory deficits, tremulous speech, blurred vision, performance decrements, paresthesia, and decreased nerve conduction. Motor system disturbance can be reversible upon cessation of exposure; however, memory deficits may be permanent. Studies have shown effects such as tremor and decreased cognitive skills in workers exposed to approximately 25 $\mu g/m^3$ mercury vapor (OEHHA, 2000).

The kidney is also a sensitive target organ of mercury toxicity. Effects such as proteinuria, proximal tubular and glomular changes, albuminuria, glomerulosclerosis, and increased urinary N-acetyl-β-glucosaminidase have been seen in workers exposed to approximately 25 to 60 $\mu g/m^3$ mercury vapor. Chronic exposure to mercury vapors has also resulted in cardiovascular effects such as increased heart and blood pressure and in leukocytosis and neutrophilia (OEHHA, 2000).

In rats, elemental mercury readily crosses the placental barrier and accumulates in the placenta following inhalation. One study reported decreased crown-rump length and increased incidence of edema in hamster fetuses following single subcutaneous administration of 4 mg/kg Hg as mercuric acetate on day 8 of gestation. Exposure to 2.5 mg/kg Hg resulted in no significant developmental defects in these hamsters. This study later showed that the most common manifestations of mercury-induced embryotoxicity in hamsters were resorption, edema, and cardiac abnormalities. Pregnant rats exposed by inhalation to 1.8 mg/m^3 of metallic mercury for 1 hour or 3 hours/day during gestation (days 11 through 14 plus days 17 through 20) bore pups that displayed significant dose-dependent deficits in behavioral measurements three to seven months after birth compared to unexposed controls. Behaviors measured included spontaneous motor activity, performance of a spatial learning task, and habituation to the automated test chamber. The pups also showed dose-dependent, increased mercury levels in their brains, livers, and kidneys two to three days after birth (OEHHA, 1999). Mercury and mercury compounds were listed by the State of California under Proposition 65 as developmental toxicants in July 1987 (OEHHA, 2005).

J. Nickel

Exposure to nickel and nickel compounds may result in both cancer and noncancer health effects. The probable route of human exposure to nickel is by ingestion, inhalation, and dermal (ARB, 1997b).

1. Cancer

Inhalation exposure to nickel refinery dust and nickel subsulfide has been shown to cause nasal and lung cancer in refinery workers. Nickel carbonyl has been reported to cause lung tumors in animal studies. OEHHA staff concluded that based on available genotoxicity and carcinogenicity data and physiochemical properties of nickel compounds, all nickel compounds should be considered potentially carcinogenic to humans by inhalation, and total nickel should be considered when evaluating the risk by inhalation (ARB, 1997b).

OEHHA staff has performed an extensive assessment of the potential health effects of nickel, reviewing available carcinogenicity data. OEHHA concluded that nickel and compounds are potential human carcinogen with no identifiable threshold below which no carcinogenic effects are likely to occur. The Board formally identified nickel and nickel compounds as TACs in August 1991 (ARB, 1991). Nickel and certain nickel compounds (nickel acetate, nickel carbonate, nickel carbonyl, nickel refinery dust from the pyrometallurgical process, nickel subsulfide) were listed by the State of California under Proposition 65 as carcinogens in October 1987, October 1989, and May 2004 (OEHHA, 2005).

In 1990, the U.S. Congress listed nickel compounds as HAPs in subsection (b) of Section 112 of the Federal Clean Air Act (42 U.S.C. 7412). The U.S. EPA has classified nickel refinery dusts and nickel subsulfide in Group A: Human carcinogen and nickel carbonyl in Group B2: Probable human carcinogen (U.S. EPA, 2005).

The International Agency for Research on Cancer (IARC) reviewed nickel and nickel compounds in 1990 and concluded that there is sufficient evidence in humans for the carcinogenicity of nickel sulfate, and of the combinations of nickel sulfides and oxides encountered in the nickel refining industry; there is inadequate evidence in humans for the carcinogenicity of metallic nickel and nickel alloys; there is sufficient evidence in experimental animals for the carcinogenicity of metallic nickel, nickel monoxides, nickel hydroxides and crystalline nickel sulfides; there is limited evidence in experimental animals for the carcinogenicity of nickel alloys, nickelocene, nickel carbonyl, nickel salts, nickel arsenides, nickel antimonide, nickel selenides, and nickel telluride; and there is inadequate evidence in experimental animals for the carcinogenicity of nickel trioxide, amorphous nickel sulfide and nickel titanate. IARC concluded that nickel compounds are carcinogenic to humans, classifying them in Group 1: Human carcinogen; and classified metallic nickel in Group 2B: Possible human carcinogen (ARB, 1997b).

The International Committee on Nickel Carcinogenesis in Man indicated that the epidemiological evidence points to insoluble and soluble nickel compounds as contributing to the cancers seen in occupationally exposed persons. Both insoluble and soluble nickel compounds have produced tumors in animals by a variety of routes, primarily by injection. Both soluble and insoluble nickel compounds are genotoxic in a wide variety of assays. Evidence is available indicating that the Ni^{2+} ion is probably the carcinogenic agent (ARB, 1997b). IARC has classified inorganic arsenic and arsenic compounds as Group 1: Human carcinogen based on sufficient evidence in humans (IARC, 2005).

2. Noncancer

Soluble nickel compounds appear to be the greatest concern for acute health effects. The soluble forms of nickel are absorbed as Ni^{2+}. Divalent nickel competes with copper for binding to serum albumin and is systemically transported in this way. The kidneys, lungs, and placenta are the principal organs for systemic accumulation of nickel. In contrast to the long half-life of the insoluble forms of nickel in the nasal mucosa, the elimination half-life of Ni^{2+} in the plasma is one to two days in mice (OEHHA, 1999).

The effects from long-term exposure to nickel include respiratory tract irritation and immune alterations such as dermatitis (“nickel itch”) and asthma. Acute exposure to nickel and nickel compound fumes may cause irritation of the respiratory tract, skin, and eyes. A daily requirement of 50 micrograms of nickel has been estimated to be an essential element in human nutrition. Nickel carbonyl is the most acutely toxic form of nickel. Exposure to nickel carbonyl can cause irritation of the lower respiratory tract and delayed pulmonary edema. It may also injure the liver and central nervous system (ARB, 1997b).

Although there are insufficient data to assess nickel's effect on reproductive functions in humans, all forms of nickel examined to date in laboratory animals have exhibited adverse effects on male reproductive function. Animal studies also demonstrate that nickel adversely affects spermatogenesis, litter size and pup body weight; however, no teratogenic effects have been clearly demonstrated for compounds other than nickel carbonyl (ARB, 1997b). Nickel carbonyl was listed by the State of California under Proposition 65 as developmental toxicants in September 1996 (OEHHA, 2005).

K. Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans

There are 210 polychlorinated dibenzo-*p*-dioxin (PCDD) and dibenzofuran (PCDF) isomers. The various isomers are not equally toxic nor are they considered equally potent as carcinogens or non-carcinogens. For the purpose of assessing cancer and noncancer risk associated with these chemicals, OEHHA has adopted the World Health Organization 1997 ($WHO\text{-}_{97}$) Toxicity Equivalency Factor scheme for evaluating the cancer and noncancer risk due to exposure to samples containing mixtures of PCDD and PCDF (OEHHA, 2003). In cases where speciation of PCDDs and PCDFs has not been performed, then 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) serves as the surrogate for PCDD and PCDF emissions (OEHHA, 2003).

Exposure to PCDDs and PCDFs may result in both cancer and noncancer health effects. The probable route of human exposure to TCDD is by ingestion, inhalation, and dermal exposure through contact with contaminated soils (ARB, 1997b).

1. Cancer

Mother's milk may expose a nursing baby to 4 to 12 percent of the estimated lifetime dose. Once dioxin enters the human body, a small amount is metabolized and eliminated, while the rest bioaccumulates in body fat. As fat is metabolized, stored dioxin is released and excreted primarily in feces. The body's concentration is dependent on the rates of ingestion, elimination, and storage capacity of dioxin. The approximate half-life of dioxin in humans was estimated to range from six to ten years (ARB, 1997b).

Human studies which have reported cancer increases are inconclusive because of inadequate data. There is adequate evidence to support a conclusion that TCDD is carcinogenic in rodents and should be considered a potential carcinogen to humans. Ingestion studies in rodents have shown increases in tumors of the liver, lung, squamous cell, nasal turbinates, and hard palate (ARB, 1986a).

OEHHA staff has performed an extensive assessment of the potential health effects of PCDDs and PCDFs, reviewing available carcinogenicity data. OEHHA concluded that PCDDs and PCDFs are potential human carcinogens with no identifiable threshold below which no carcinogenic effects are likely to occur. The Board formally identified PCDDs and PCDFs as TACs in July 1986 (ARB, 1986a). PCDDs and PCDFs were listed by the State of California under Proposition 65 as carcinogens in October 1992 (OEHHA, 2005).

In 1990, the U.S. Congress listed TCDD as a HAP in subsection (b) of Section 112 of the Federal Clean Air Act (42 U.S.C. 7412). U.S. EPA has classified hexachlorodibenzo-*p*-dioxin (HxCDD), mixture of 1,2,3,6,7,8-HxCDD and 1,2,3,7,8,9-HxCDD as B2; probable human carcinogen (U.S. EPA, 2005). The International Agency for Research on Cancer has classified TCDD as Group 1: Human carcinogen, based on sufficient evidence in humans (IARC, 2005).

2. Noncancer

Acute exposure of humans to dioxins has caused chloracne, liver toxicity, skin rashes, nausea, vomiting, and muscular aches and pains. A severe weight loss in animals has been observed following acute exposure to dioxin as have hyperkeratosis, facial alopecia, inflammation of the eyelids, and loss of fingernails and eyelashes. The immune system appears to be very sensitive to dioxin toxicity. Thymic atrophy is a prominent finding in exposed animals and has been observed in all laboratory species examined. Other lymphoid tissues such as the spleen, lymph nodes, and bone marrow are also affected. Symptoms of chronic exposure to dioxins include splenic and testicular atrophy, elevated gamma-glutamyl transpeptidase levels, elevated cholesterol levels, and abnormal neurological findings. Other effects may include risk of enzyme induction, diabetes, and endocrine changes (ARB, 1997b).

Potential effects of a toxicant on normal fetal development include fetal death, growth retardation, structural malformations and organ system dysfunction. Evidence for all four of these responses has been seen in human populations exposed to dioxin-like compounds. In these poisoning episodes populations were exposed to a complex mixture of halogenated aromatic hydrocarbons contained within PCBs, PCDFs and PCDDs mixtures thus limiting the conclusions that could be drawn from the data (OEHHA, 2000). Animal studies have shown TCDD to be both teratogenic and fetotoxic. Reproductive and teratogenic effects observed in animals are cleft palate, kidney abnormalities, decreased fetal weight and survival, hydrocephalus, open eye, edema, resorptions, petechiae, and infertility (ARB, 1997b). TCDD was listed by the State of California under Proposition 65 as developmental toxicants in January 1988 (OEHHA, 2005).

L. Polycyclic Aromatic Hydrocarbons (PAHs)

Polycyclic organic matter (POM) consists of over 100 compounds and is defined by the Federal Clean Air Act as organic compounds with more than one benzene ring that have a boiling point greater than or equal to 100^{o}C. POM can be divided into the subgroups of polycyclic aromatic hydrocarbons (PAHs) and PAH-derivatives. PAHs are organic compounds which include only carbon and hydrogen with a fused ring structure containing at least two benzene (six-sided) rings. PAHs may also contain additional fused rings that are not six-sided. PAH-derivatives also have at least two benzene rings and may contain additional fused rings that are not six-sided rings. However, PAH-derivatives contain other elements in addition to carbon and hydrogen (ARB, 1997b).

Health values and potency equivalency factors (PEFs) have been developed for approximately 26 PAHs. When speciation of PAHs has been performed on facility emissions, these health values and PEFs should be used. In those cases where speciation of PAHs has not been performed, then benzo(a)pyrene [B(a)P] serves as the surrogate carcinogen for all PAH emissions (OEHHA, 2003).

Exposure to PAHs may result in both cancer and noncancer health effects. The probable route of human exposure to PAHs is by ingestion, inhalation, and dermal contact (ARB, 1997b).

1. Cancer

Available epidemiological information is from persons exposed to mixtures such as tobacco smoke, diesel exhaust, air pollutants, synthetic fuels, or other similar materials. Several IARC publications have been dedicated to the analysis of cancer in processes which involve exposure to polynuclear aromatic compounds (PAHs). The types of cancer reported are often consistent with the exposure pathway: scrotal cancer and lung cancer in chimney sweeps exposed to soot; skin cancer (including scrotal cancer) where shale oils are used; and lung cancer where airborne exposure of PAHs occurs, such as in iron and steel foundries. In animal studies, B(a)P is carcinogenic by intratracheal, inhalation, dermal exposure, intraperitoneal injection, and when given in the diet (OEHHA, 2002).

OEHHA staff has performed an extensive assessment of the potential health effects of PAHs, reviewing available carcinogenicity data. OEHHA concluded that PAHs are potential human carcinogens with no identifiable threshold below which no carcinogenic effects are likely to occur. POM is a federal HAP and was identified as a TAC in April 1993 under AB 2728. The Board formally identified B(a)P as a TAC in April 1994 (ARB, 1994). Several POM compounds (including benzo(a)pyrene) were listed by the State of California under Proposition 65 as carcinogens in July 1987 (OEHHA, 2005).

In 1990, the U.S. Congress listed POM as a HAP in subsection (b) of Section 112 of the Federal Clean Air Act (42 U.S.C. 7412). U.S. EPA has classified benzo[a]pyrene in Group B2: Probable human carcinogen, based on sufficient evidence of carcinogenicity in animals (U.S. EPA, 2005). The International Agency for Research on Cancer has classified benzo[a]pyrene in Group 2A: Probable human carcinogen based on sufficient evidence in animals and limited evidence in humans (IARC, 2005).

2. Noncancer

No information is available on the acute effects of POM in humans. Enzyme alterations in the mucosa of the gastrointestinal tract and increased liver weights have been reported in animals exposed orally to several PAHs. Chronic exposure to benzo(a)pyrene in humans has resulted in dermatitis, photosensitization in sunlight, eye irritation and cataracts. Animal studies have reported effects on the blood and liver from oral exposure to benzo(a)pyrene and effects on the immune system from dermal exposure to benzo(a)pyrene (ARB, 1997b).

No information is available on adverse reproductive or developmental effects of POM in humans. Oral exposure to benzo(a)pyrene in animals has been reported to result in adverse reproductive effects, including reduced incidence of pregnancy and

decreased fertility; and developmental effects such as reduced viability of litters and reduced mean pup weight, and decreased fertility in offspring. Benzo(a)pyrene has been demonstrated to cause transplacental carcinogenesis in animals (ARB, 1997b).

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Appendix G

Glossary of Definitions, Selected Terms, and Acronyms

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Glossary of Definitions, Selected Terms, and Acronyms

Definitions

Acute Exposure: One or a series of short-term exposures generally lasting less than 24 hours.

Acute Health Effects: A health effect that occurs over a relatively short period of time (e.g., minutes or hours). The term is used to describe brief exposures and effects which appear promptly after exposure.

Adverse Health Effect: A health effect from exposure to air contaminants that may range from relatively mild temporary conditions, such as eye or throat irritation, shortness of breath, or headaches, to permanent and serious conditions, such as birth defects, cancer or damage to lungs, nerves, liver, heart, or other organs.

Air District or District: The Air Pollution Control and Air Quality Management Districts, as defined in Health and Safety Code section 39025, are the political bodies responsible for managing air quality on a regional or county basis. California is currently divided into 35 air districts.

Airborne Toxic Control Measure: Section 39655 of the Health and Safety Code, defines an "Airborne Toxic Control Measure" means either of the following:

1) Recommended methods, and, where appropriate, a range of methods, that reduce, avoid, or eliminate the emissions of a toxic air contaminant. Airborne toxic control measures include, but are not limited to, emission limitations, control technologies, the use of operational and maintenance conditions, closed system engineering, design equipment, or work practice standards, and the reduction, avoidance, or elimination of emissions through process changes, substitution of materials, or other modifications.
2) Emission standards adopted by the U.S. Environmental Protection Agency pursuant to section 112 of the federal act (42 U.S.C. Sec. 7412).

Asthma: A chronic inflammatory disorder of the lungs characterized by wheezing, breathlessness, chest tightness, and cough.

Bioaccumulation: The concentration of a substance in a body or part of a body or other living tissue in a concentration higher than that of the surrounding environment.

California Air Resources Board (ARB): The State's lead air quality management agency consisting of an eleven-member board appointed by the

Governor. The ARB is responsible for attainment and maintenance of the state and federal air quality standards, and is fully responsible for motor vehicle pollution control. It oversees county and regional air pollution management programs.

California Air Pollution Control Officers Association (CAPCOA): A non-profit association of the air pollution control officers from all 35 air quality districts throughout California. CAPCOA was formed in 1975 to promote clean air and to provide a forum for sharing knowledge, experience, and information among the air quality regulatory agencies around the state.

CCR: California Code of Regulations

Chronic Exposure: Long-term exposure, usually lasting one year to a lifetime.

Chronic Health Effect: An adverse non-cancer health effect that develops and persists (e.g., months or years) over time after long-term exposure to a substance.

Cruise Ship: A commercial vessel that has the capacity to carry 250 or more passengers for hire and has berths or overnight accommodations for passengers.

Developmental Toxicity: Adverse effects on the developing organism that may result from exposure prior to conception (either parent), during prenatal development, or postnatally to the time of sexual maturation. Adverse developmental effects may be detected at any point in the life span of the organism. Major manifestations of developmental toxicity include: death of the developing organism; induction of structural birth defects; altered growth; and functional deficiency.

Dose: A calculated amount of a substance estimated to be received by the subject, whether human or animal, as a result of exposure. Doses are generally expressed in terms of amount of chemical per unit body weight; typical units are mg/kg-day.

Dose-response Assessment: The process of characterizing the relationship between the exposure to an agent and the incidence of an adverse health effect in exposed populations.

Endpoint: An observable or measurable biological or biochemical event including cancer used as an index of the effect of a chemical on a cell, tissue, organ, organism, etc.

Epidemiology: The study of the occurrence and distribution of a disease or physiological condition in human populations and of the factors that influence this distribution.

Exposure: Contact of an organism with a chemical, physical, or biological agent. Exposure is quantified as the amount of the agent available at the exchange boundaries of the organism (e.g., skin, lungs, digestive tract) and available for absorption.

Exposure Pathway: A route of exposure by which xenobiotics enter the human body (e.g., inhalation, ingestion, dermal absorption).

HSC: Health and Safety Code of the State of California.

Hazardous Air Pollutant (HAP): A substance that the U.S. Environmental Protection Agency has listed in, or pursuant to, section 112 subsection (b) of the federal Clean Air Act Amendments of 1990 (42 U.S. Code, section 7412(b)).

Health Risk Assessment: A health risk assessment (HRA) is an evaluation or report that a risk assessor (e.g., Air Resources Board, district, consultant, or facility operator) develops to describe the potential a person or population may have of developing adverse health effects from exposure to a facility's emissions. Some health effects that are evaluated could include cancer, developmental effects, or respiratory illness. The pathways that can be included in an HRA depend on the toxic air pollutants that a person (receptor) may be exposed to, and can include inhalation (breathing), the ingestion of soil, water, crops, fish, meat, milk, and eggs, and dermal exposure.

Hazard Index (HI): The sum of individual acute or chronic hazard quotients (HQs) for each substance affecting a particular toxicological endpoint.

Incinerator: Any device used to conduct onboard incineration.

International Maritime Organization (IMO): A specialized agency of the United Nations which is responsible for measures to improve the safety and security of international shipping and to prevent marine pollution from ships. The IMO, along with other maritime nations, has developed standards which are set forth in the International Convention for the Prevention of Pollution from Ships (MARPOL).

MARPOL: A combination of two treaties adopted in 1973 and 1978 that has been updated by amendments over the years. MARPOL includes six technical annexes which include regulations aimed at preventing and minimizing pollution from ships.

Multipathway Substance: A substance or chemical that once airborne from an emission source can, under environmental conditions, be taken into a human receptor by inhalation and by other exposure routes such as after deposition on skin or after ingestion of soil contaminated by the emission.

Noncarcinogenic Effects: Noncancer health effects which may include birth defects, organ damage, morbidity, and death.

Oceangoing Ship: A private, commercial, government, or military vessel of 300 gross registered tons or more calling on California ports or places.

Office of Environmental Health Hazard Assessment (OEHHA): An office within the California Environmental Protection Agency that is responsible for evaluating chemicals for adverse health impacts and establishing safe exposure levels. OEHHA also assists in performing health risk assessments and developing risk assessment procedures for air quality management purposes.

Onboard Incineration: The combustion or burning of any materials or wastes for the purpose of volume reduction, destruction, sanitation, or sterilization, aboard a cruise ship. Onboard incineration does not include incinerators which are only burning gas oil, marine gas oil, marine diesel fuel, fuel oil, or residual fuel oil for the specific purpose of maintaining a minimum temperature in the incinerator to minimize thermal cycling.

Potency: The relative effectiveness, or risk, of a standard amount of a substance to cause a toxic response.

Proposition 65: The Safe Drinking Water and Toxic Enforcement Act of 1986, also known as Proposition 65. This Act is codified in California Health and Safety Code Section 25249.5, et seq. No person in the course of doing business shall knowingly discharge or release a chemical known to the state to cause cancer or reproductive toxicity into water or into land where such chemical passes or probably will pass into any source of drinking water, without first giving clear and reasonable warning to such individual.

Reference Exposure Level (REL): An exposure level at or below which no noncancer adverse health effect is anticipated to occur in a human population exposed for a specific duration. An REL is virtually the same as the terms Reference Concentration (RfC) for inhalation or Reference Dose (RFD) used by U.S. EPA, only it may be for varying amounts of time rather than lifetime only. It has been given a different name so that the values estimated by the State Office of Environmental Health Hazard Assessment can easily be distinguished from those developed by the U.S. EPA. RELs are used to evaluate toxicity endpoints other than cancer.

Reproductive Toxicity: Harmful effects on fertility, gestation, or offspring, caused by exposure of either parent to a substance.

Risk: The (characterization of the) probability of potentially adverse effects to human health, in this instance from the exposure to environmental hazards.

Risk Assessment: The characterization (in the present context) of the probability of potentially adverse health effects to people from exposure to environmental chemical hazards.

Threshold, Nonthreshold: A threshold dose is the minimally effective dose of any chemical that is observed to produce a response (e.g., enzyme change, liver toxicity, death). For most toxic effects, except carcinogenesis, there appear to be threshold doses. Nonthreshold substances are those substances, including

nearly all carcinogens, that are known or assumed to have some risk of response at any dose above zero.

Toxic Air Contaminant (TAC): An air pollutant which may cause or contribute to an increase in mortality or in serious illness, or which may pose a present or potential hazard to human health (HSC Section 39655(a)). Substances, which have been identified by the United States Environmental Protection Agency as hazardous air pollutants are also identified by the Board as toxic air contaminants.

United States Environmental Protection Agency (U.S. EPA): The Federal agency charged with setting policy and guidelines, carrying out legal mandates, for the protection, and national interests in environmental resources.

Variability: The ability to have different numerical values of a parameter, such as height or weight.

Acronyms

AB	Assembly Bill
ARB	Air Resources Board
Annex V	Regulation 9 of Annex V of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978
Annex VI	Protocol of 1997, Annex VI – Regulations for the Prevention of Air Pollution from Ships
APHIS	U.S. Department of Agriculture, Animal and Plant Health Inspection Service
ATCM	Airborne Toxic Control Measure
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CSLC	California State Lands Commission
HAP	Hazardous Air Pollutant
HSC	Health and Safety Code
IARC	International Agency for Research on Cancer
IMO	International Maritime Organization
OEHHA	Office of Environmental Health Hazard Assessment
MARPOL	International Convention for the Prevention of Pollution from Ships
NOAA	National Oceanic and Atmospheric Administration
PAHs	Polycyclic Aromatic Hydrocarbons
PCDD	Polychlorinated Dibenzodioxin (dioxin)
PCDF	Polychlorinated Dibenzofuran (furan)
PM	Particulate Matter
SB	Senate Bill
SRP	Scientific Review Panel on Toxic Air Contaminants
Survey	Oceangoing Ship Onboard Incinerator Survey
TAC	Toxic Air Contaminant
USDA	United States Department of Agriculture
U.S. EPA	United States Environmental Protection Agency