



California Environmental Protection Agency
Air Resources Board

**STAFF REPORT: INITIAL STATEMENT OF
REASONS FOR THE PROPOSED AIRBORNE
TOXIC CONTROL MEASURE FOR CRUISE SHIP
ONBOARD INCINERATION**

**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

**ADOPTION OF THE PROPOSED AIRBORNE TOXIC CONTROL MEASURE
FOR CRUISE SHIP ONBOARD INCINERATION**

To be considered by the Air Resources Board on November 17, 2005, at:

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Byron Sher Auditorium
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Air Resources Board
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**State of California
AIR RESOURCES BOARD**

**PROPOSED AIRBORNE TOXIC CONTROL MEASURE
FOR CRUISE SHIP ONBOARD INCINERATION**

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**Staff Report: Initial Statement of Reasons
for the Proposed Airborne Toxic Control Measure
for Cruise Ship Onboard Incineration**

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**State of California
AIR RESOURCES BOARD**

**Staff Report: Initial Statement of Reasons for
the Proposed Airborne Toxic Control Measure
for Cruise Ship Onboard Incineration**

Executive Summary

I. INTRODUCTION

In California, there has been growing concern over the waste disposal practices of the cruise ship industry. Port communities and other members of the public have become increasingly concerned about the potential health risk from toxic air contaminants (TACs) and other air pollutants from marine vessels. Marine vessels, which include cruise ships, can be a major contributor of emissions at California ports. In addition to air emissions from the main engine exhaust, additional sources of emissions include diesel generators, auxiliary boilers, and onboard incinerators.

In 2004, Assembly Bill 471 (AB 471) was passed by the California Legislature, signed by the Governor, 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. This law became effective January 1, 2005.

II. BACKGROUND

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

The cruise ship industry in California is a fast growing industry. Over the past several years, the number of port calls (visits) has increased in the State. In 2004, there were approximately 650 port calls to California ports. 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 workers who live or work near ports and along the coast. AB 471 states that the Air Resources Board (ARB/Board) shall enforce this legislation and may adopt standards, rules, and regulations for this purpose. ARB is proposing this airborne toxic control measure (ATCM) to implement AB 471 and to ensure this law is adequately enforced. The proposed ATCM is expected to reduce emissions from toxic air contaminants (TACs), such as

polychlorinated dibenzodioxins (PCDDs or dioxins), polychlorinated dibenzofurans (PCDFs or furans), and toxic metals.

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

Cruise 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 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 cruise 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 cruise ship onboard incineration.

III. PUBLIC OUTREACH

An open public process that involves all parties affected by the proposed ATCM is an important component of all of ARB's actions. As part of ARB's outreach program, staff made extensive 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 several workgroup meetings and conducted two public workshops. ARB staff also

attended a site visit to a cruise ship to get a better understanding of current waste incineration practices.

IV. CRUISE SHIP ONBOARD INCINERATOR SURVEY

1. What is the Cruise Ship Onboard Incinerator Survey and what were the results of the Survey?

In April 2005, ARB sent out the Cruise Ship Onboard Incinerator Survey (Survey). The Survey requested cruise 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, 2005, the effective date of AB 471, only 2 out of 26 (eight percent) of the cruise ships incinerated waste within three nautical miles of the California coast. For these two ships, the amount of waste incinerated within three nautical miles of the California coast (prior to January 1, 2005) made up about three percent of all waste incinerated aboard cruise ships for the 22 cruise ships which reported waste in cubic meters. However, for 2004, one of these ships, which incinerated about 70 percent of its total waste within three nautical miles of the California coast, accounted for about 25 percent of the total port calls to Los Angeles/Long Beach.

The Survey also showed that cruise ships incinerate a wide variety of wastes, such as paper, rags, glass, metal, bottles, crockery, and light plastics (for example, food packaging and wrapping). On average, cruise ships operate their incinerator(s) 12 hours per day five to six days per week. About 40 percent of the Survey respondents specified that the cruise ship's incinerator(s) was equipped with some type of air pollution control device(s). The Survey also showed that many ships have sophisticated recycling programs. Many Survey respondents indicated that their hazardous waste and recyclable materials are picked up at port by authorized vendors.

V. POTENTIAL HEALTH IMPACTS OF SUBSTANCES EMITTED FROM ONBOARD INCINERATION

1. What are the potential health impacts remaining after implementation of the proposed ATCM?

ARB staff conducted a multipathway health risk analysis (HRA) to estimate the potential cancer and noncancer health impacts remaining after implementation of the proposed ATCM. Because the standard (i.e., no incineration within three miles of the California coast) was already set forth in AB 471, staff focused its efforts on assessing

the potential health risk remaining after implementation to ensure that it was adequately health protective.

Since emissions data specific to cruise ship onboard incineration were not available, staff used controlled emissions data from land-based municipal waste incinerators along with stack data (e.g., stack height, stack diameter) from cruise ship onboard incinerators. These emissions were adjusted because the majority of cruise ships incinerator stacks are uncontrolled. Exposure pathways used in the analysis include inhalation, soil ingestion, mother's milk ingestion, and dermal exposure. The following TACs were included in the analysis: dioxins, furans, polycyclic aromatic hydrocarbons, arsenic, beryllium, cadmium, hexavalent chromium, hydrochloric acid, lead, manganese, mercury, and nickel.

For the analysis, incinerator emissions from 379 cruise ships were spread across the most heavily traveled southern shipping lane of the Ports of Los Angeles and Long Beach which handle the vast majority of cruise ship traffic. The number of cruise ships used in the health risk assessment represents the number of cruise ship port calls to Los Angeles and Long Beach for 2004. The incineration of materials was assumed to be taking place from three miles to 30 miles out at sea. The incineration time in this 27-mile zone was estimated to be approximately one and one-half hours each way traveling inbound and outbound from three to 30 miles out to sea.

The multipathway HRA estimates that the potential cancer risk remaining after implementation of the proposed ATCM is approximately 1.5 chances per million at the shoreline for residential exposure. The potential cancer risk for an off-site worker at the shoreline is approximately 0.6 chances per million. For noncancer chronic health impacts, the hazard index for both the resident and 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.

VI. SUMMARY OF THE PROPOSED ATCM

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

The proposed ATCM would affect owners or operators of cruise ships that travel within three nautical miles of the California coast, including while at California ports or terminals. To meet the definition of a cruise ship, the vessel must have the capacity to carry 250 or more passengers and must have berths or overnight accommodations for passengers. The proposed ATCM would not apply to noncommercial vessels, warships, non-profit vessels, and vessels operated by the State of California, the United States, or a federal government.

Cruise ship owners or operators are prohibited from conducting onboard incineration within three nautical miles of the California coast. Cruise ship owners or operators are required to maintain certain records for each segment of a voyage.

These records are only required if, during any portion of that segment, the cruise ship travels within three nautical miles of the California coast. It should be noted that all California ports and terminals are 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 and notifying potentially affected cruise ship owners or operators at least 30 days before the updates take effect.

3. What are the key unresolved issues?

Some industry stakeholders do not believe that the recordkeeping requirements for the amount of waste burned should be required in the proposed ATCM because it was not specified in AB 471. However, staff has determined that this piece of information would be critical for determining the appropriate monetary penalties should a violation of the ATCM occur. In addition, the cruise ship operators are already required to record this information under existing international regulations; therefore, there would be minimal additional regulatory burden for the industry.

Some industry stakeholders have also expressed concern about the definition used for “within three miles of the California coast”. The proposed ATCM incorporates by reference specific NOAA nautical charts. These charts show the Three Nautical Mile Line which will be used to enforce the regulation. Industry argues that a more ambiguous definition should be used because not all cruise ships use NOAA nautical charts. Some cruise ships may use British Admiralty nautical charts or other charts which may not show the Three Nautical Mile Line. ARB staff is concerned that an ambiguous definition, which is subject to interpretation, would present enforcement difficulties. We have indicated to the industry that it is not a requirement to purchase or use the NOAA charts, but rather the NOAA charts provide a bright line which will be used for enforcement purposes. Ship navigators could plot the Three Nautical Mile Line on other nautical charts if they did not wish to purchase the NOAA nautical charts. It should be noted that a set of NOAA charts costs about \$100 to purchase.

VII. ECONOMIC AND ENVIRONMENTAL IMPACTS OF THE PROPOSED ATCM

1. What will the ATCM cost?

The proposed 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 cruise ships traveling to California.

While costs to the cruise ship industry are expected to be negligible, some costs were identified for the ARB. It is estimated that ARB costs will be approximately \$25,000 annually for enforcement activities.

2. Are there any significant adverse environmental impacts associated with the proposed 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 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 ATCM will ensure that Californians who live or work near ports or coastal areas are not negatively impacted by emissions from cruise ship onboard incinerators.

VIII. RECOMMENDATION

ARB staff recommends that the Board adopt the proposed ATCM for Cruise Ship Onboard Incineration. In order to implement and interpret State law (AB 471), staff is proposing provisions that prohibit cruise ships from incinerating within three nautical miles of the California coast. This ATCM clarifies the three nautical mile limit for incineration along the California coast and also establishes recordkeeping and reporting requirements to facilitate enforcement efforts. Benefits from the proposed ATCM are reduced public exposure to TACs for residents and off-site workers 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 the waste disposal practices of the cruise ship industry. In response to this concern, the California Legislature enacted Division 37 of the Public Resources Code to gather information and evaluate potential impacts on the environment. The law required the California Environmental Protection Agency (Cal/EPA) to convene a multi-agency Cruise Ship Environmental Task Force (CSETF or Task Force) to gather information on environmental practices and waste streams for cruise ships. The Task Force was required to prepare a report for the California Legislature which includes their findings and recommendations.

The Task Force Report, entitled *Regulation of Large Passenger Vessels in California (August 2003)*, evaluated all types of waste discharged from cruise ships such as wastewater, hazardous waste, ballast water, solid waste, as well as air emissions. One conclusion made by the Task Force was that cruise ships, along with other marine vessels, are a significant source of air pollutants in California, including criteria pollutants and toxic air contaminants (TACs). The Task Force also recommended that cruise ships be regulated by the State and that an inspection and monitoring program be implemented to protect the State's air, water quality, and marine environment. (CSETF, 2003)

Port communities have become increasingly concerned about the potential health risk from criteria pollutants and TACs from marine vessels. Marine vessels, which include cruise ships, can be a major contributor of emissions at California ports and along the coast. In addition to air emissions from the main engines' exhaust, additional sources of emissions include diesel generators, auxiliary boilers, and incinerators. The proposed airborne toxic control measure (ATCM) addresses emissions from cruise ship onboard incinerators only. Air Resources Board (ARB) staff is currently developing a separate regulation to address emissions from auxiliary engines from oceangoing vessels.

In 2004, Assembly Bill 471 (AB 471) was passed by the California Legislature, signed by the Governor, 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 (see Appendix G for a copy of the legislation). This law became effective January 1, 2005. By prohibiting incineration within three nautical miles of the California coast, the potential for adverse public health impacts will be reduced for residents who live or work near ports and along the coast. This ATCM is expected to reduce exposure to emissions from TACs, such as polychlorinated dibenzo-*p*-dioxins (dioxins), polychlorinated dibenzofurans (furans), and toxic metals. ARB staff is proposing this ATCM to implement AB 471 and to ensure that it is adequately enforced.

II. BACKGROUND

A. Cruise Ship Industry in California

The cruise ship industry in California is a fast growing industry. In 2003, California ports experienced a 14 percent growth in cruise embarkations and boarded approximately 807,000 passengers for these cruises (ICCL, 2004). In April 2003, the Port of Long Beach opened to cruise ships, handling 272,000 of these 807,000 passengers (ICCL, 2004). In 2003, the cruise industry estimated a 25 percent increase in the number of vessels that will operate in the waters of the State over the next ten years. In 2002, there were approximately 280 port calls to San Diego, Los Angeles/Long Beach, San Francisco and Monterey (CSETF, 2003). For 2004, those same ports handled about 620 port calls by cruise ships. Of those 620 port calls, approximately 160 were to Long Beach.

1. Cruise Ship Port Calls to California

The California State Lands Commission (CSLC) maintains a database of all cruise ships entering California ports. For 2004, the database showed that 47 different cruise ships entered California ports, for a total of 652 port calls (CSLC, 2004). Table II-1 shows a breakdown of the port calls to California ports.

Table II-1. Cruise Ship Port Calls to California Ports in 2004

Port Name	Number of Port Calls
Los Angeles & Long Beach	361
San Diego	179
San Francisco	76
Avalon/Catalina	23
Monterey	5
Oakland	3
Port Hueneme	2
Humboldt	2
Santa Barbara	1
Total	652

Source: CSLC, 2004. Port calls to Los Angeles and Long Beach are reported as a total and are not separated out.

The CSLC database does not include data on the number of cruise ships that traveled within three nautical miles of the California coast without making a port call in California. However, staff recognizes that cruise ships conducting onboard incineration while traveling within three nautical miles of the California coast can increase the public's exposure to toxic air contaminants (TACs). This could occur even if the cruise ship does not make a port call in California.

B. Cruise Ship Onboard Incineration

Cruise ship onboard incineration is the combustion or burning of any materials or wastes for the purpose of volume reduction, destruction, sanitation, or sterilization, aboard a cruise ship. In general, cruise ship incinerators burn a variety of wastes. Although discussed further in Chapter IV, the most common waste streams incinerated aboard cruise ships which travel in California include paper, rags, glass, metal, bottles, crockery, plastics, and cardboard.

A variety of hazardous waste is also generated onboard. Many ships have their hazardous waste picked up by waste management professionals while at port. Some hazardous waste, however, is incinerated, such as medical and bio-hazardous waste, used oil, oily sludge, and outdated pharmaceuticals (CSETF, 2003).

1. Toxic Air Contaminants Associated with Waste Incineration

There are a wide variety of 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 Chapter V and Appendix F. Note that criteria pollutants, such as oxides of nitrogen (NO_x), oxides of sulfur (SO_x), and particulate matter (PM) can also be emitted from waste incineration.

2. Cruise Ship Waste Stream

Cruise ships produce large and diverse waste streams. Waste management onboard cruise ships is generally handled by a variety of processes depending on the waste stream. Wastes are incinerated onboard, picked up at port, or disposed of at sea. Air Resources Board (ARB) staff conducted a survey to get a better understanding of cruise ship incinerator practices (detailed results of the survey can be found in Chapter IV). Table II-2 shows the types of waste that can be generated onboard a cruise ship (CSETF, 2003).

Table II-2. Types of Waste Generated Onboard a Cruise Ship

Types of Waste	
Hazardous waste	Medical waste
Oil sludge and slops	Bilge water
Oily Waste	Used oil
Oil filters	Ballast water
Sewage or blackwater	Incinerator residue (ash)
Dry cleaning solvents	Paint and solvents
Used sand or bead blasting residue	Food wastes
Plastics	Scrap metals
Photographic processing chemicals	Florescent light bulbs
Batteries	Glassware, bottles, and crockery
Swimming pool chemicals	Cleaning agents
Miscellaneous spray cans	Expired medicines/drugs
Cardboard and paper products	Miscellaneous garbage
Printer cartridges	Insecticides
Graywater	

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.

MARPOL 73/78 contains two regulations for onboard cruise 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, 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. 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, cruise 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).

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.

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.

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.

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, 2005a). Most of the regulated garbage onboard cruise 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.

D. International Council of Cruise Lines Industry Standards

All of the major cruise lines that travel to California ports are represented by the International Council of Cruise Lines (ICCL). The ICCL has established a comprehensive waste management program which is required for all ICCL members. Although not specific to incineration, ICCL industry standard E-01-01 (Revision 2) outlines the environmental standards for the industry. These standards promote reuse, recycling, waste segregation, and waste minimization to the greatest extent possible. These standards specify requirements for certain hazardous waste such as perchloroethylene (a dry cleaning solvent), photo processing waste, print shop waste fluids, photo copying and laser printer cartridges, unused and outdated pharmaceuticals, fluorescent and mercury vapor lamp bulbs, batteries, and incinerator ash. The U.S. Coast Guard has incorporated many of ICCL standards into their inspection checklists when boarding passenger vessels. Industry Standard E-01-01 (Revision 2) and attachments can be found in Appendix D.

III. PUBLIC OUTREACH AND REPORT PREPARATION

An open public process that involves all parties affected by the proposed airborne toxic control measure (ATCM) is an important component of the Air Resources Board's (ARB) actions. As part of ARB's outreach program, staff made extensive 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 several workgroup meetings and conducted two public workshops. ARB staff also attended a site visit to a cruise ship to get a better understanding of current garbage incineration practices.

A. Public Involvement

As described below, affected industries, other government agencies, and organizations interested in minimizing public health impacts from cruise ship onboard incineration have been involved in the development of the proposed ATCM. All members of the public were invited to join the workgroup. ARB staff also conducted two public workshops. 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/crushp/crushp.htm).

1. Industry Involvement

Cruise ship operators have actively participated in the rule development process providing technical information on many aspects of cruise ship onboard incineration. They have provided comments and suggestions during the development of our survey, the boundary for the three mile line, recordkeeping and reporting requirements, and other issues related to the proposed ATCM. Staff also had extensive input from the International Council of Cruise Lines (ICCL), who represents all of the major cruise lines which make calls to California ports. Several workgroup meetings have provided a forum to discuss many of the issues associated with the proposed ATCM. ARB staff has also had discussions with incinerator manufacturers regarding the technical aspects of the incinerators used aboard cruise ships. Port staff has provided us with important information regarding cruise ships at ports, such as the number of port calls (visits) and the amount of time spent at port.

2. Government Agency Involvement

Other local, state, and federal agencies have provided input on certain aspects of the proposed regulation. Staff had discussions with many government agencies regarding the boundary of the three mile line specified in Assembly Bill 471 (AB 471). Participating federal agencies include: the United States Coast Guard, the United States Department of Commerce's National Oceanic and Atmospheric

Administration, and the United States Environmental Protection Agency. Staff also had extensive discussions with State agencies such as the California State Lands Commission, the California Coastal Commission, the Department of Fish and Game, and the State Water Resources Control Board. Additional discussions were held with the United States Department of Food and Agriculture regarding existing regulations for garbage generated onboard a cruise 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 cruise ships and port activities.

B. Data Collection Tools Used to Assist in Report Preparation

1. Cruise Ship Onboard Incinerator Survey

In 2005, 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. Additional information was later collected for incinerator stack conditions, including flow rate, stack diameter, temperature, and other parameters used in the health risk assessment. See Chapter IV for a detailed discussion on the survey.

2. Cruise Ship Site Visit

ARB staff conducted a site visit to a cruise ship. Cruise ship staff provided ARB staff with a tour of the ship's garbage collection and incineration areas and provided an explanation of their waste management practices. ARB staff observed a sophisticated waste recycling program for cans and glass, which are landed ashore for pickup.

Cruise ship staff indicated that the majority of the waste that is incinerated is made up of paper, light plastics (including plastic bottles, clear food packaging, and plastic bags), cardboard and rags. Upon visual inspection, it appeared as though the waste awaiting incineration matched this description. The primary waste components observed were plastic bags, cardboard food containers, light plastic wrap, and paper. ARB staff also observed posted signs stating that the ship's environmental plan required that the incineration of engine oily rags and debris waste be conducted outside of 12 nautical miles from the nearest land.

Cruise ship staff also explained the process for handling special wastes, such as chemicals, spent fluorescent tubes, batteries, used paints/thinners, dry cleaning waste, and photo waste. The ship's staff indicated that these types of wastes are

segregated into leak proof containers. This waste is documented and landed ashore for pick up by authorized waste management professionals.

C. Issues

Some industry sources do not believe that the recordkeeping requirements for the amount of waste burned should be required in the proposed ATCM because it was not specified in AB 471. However, staff has determined that this piece of information would be critical for determining the appropriate monetary penalties should a violation of the ATCM occur. In addition, the cruise ship operators are already required to record this information under existing international regulations; therefore, there would be minimal additional regulatory burden for the industry.

Some industry sources have expressed concern about the definition used for “within three miles of the California coast”. The proposed ATCM incorporates by reference specific National Oceanic and Atmospheric Administration (NOAA) nautical charts. These charts show the Three Nautical Mile Line which will be used to enforce the regulation. Industry sources argue that a more ambiguous definition should be used because not all cruise ships use NOAA charts. Some cruise ships may use British Admiralty nautical charts or other charts which may not show the Three Nautical Mile Line. ARB staff is concerned that an ambiguous definition, which is subject to interpretation, would present enforcement difficulties. ARB staff has indicated to the industry that it is not a requirement to purchase or use the NOAA nautical charts, but rather the NOAA nautical charts provide a bright line which will be used for enforcement purposes. Ship navigators could plot the Three Nautical Mile Line on other nautical charts if they did not wish to purchase the NOAA charts. It should be noted that a set of NOAA nautical charts costs about \$100 to purchase.

IV. CRUISE SHIP ONBOARD INCINERATOR SURVEY

In April 2005, the Air Resources Board (ARB) sent out the Cruise Ship Onboard Incinerator Survey (Survey). The Survey requested cruise ship operators to gather information on incinerator 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 E contains a copy of the Survey.

Cruise ship operators were only required to fill out the Survey if their vessel(s) currently traveled within three nautical miles of the California coast. Surveys for 54 cruise ships were returned. Of the 54 cruise ships which responded, 26 of the cruise ships indicated that they currently travel within three nautical miles of the California coast. Staff compared that number to the total number of ships that entered a California port in 2004. The California State Lands Commission (CSLC) database showed that there were 47 different cruise ships that came to a California port. These cruise ships accounted for approximately 650 port calls statewide. Although we received survey information from only 57 percent of the vessels, the 26 surveys received accounted for about 90 percent of the total California port calls. The remaining ten percent of port calls were conducted by ships which made one or two California port calls per year. There was limited information on these ships, some of which may no longer be operating within three nautical miles of the California coast.

A. Type of Waste Incinerated

The Survey was designed to obtain general information on the type of waste commonly incinerated onboard the cruise ships. The Survey asked the cruise ship operators to specify which type of waste they incinerated based on 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 five categories of garbage from which to choose.

Table IV-1 shows the type of waste and percentage of ships that incinerate the waste. The results showed that most ships incinerate some combination of garbage. One of the limitations with the Survey is that waste was grouped into five categories. Some Survey respondents annotated the Survey with additional information, such as highlighting the specific waste in the category that is incinerated. In some cases, the percentages may be overestimated because the Survey respondents may have checked the box for the entire category; however, they may not incinerate all items listed in the category. For example, paper products are listed with rags, glass, metal, bottles, crockery, etc. Incinerator operators who incinerate only paper products and rags may have checked the box for the entire category. Based on discussions with industry, glass, crockery and metal are not commonly incinerated onboard cruise ships. Therefore, the percentages in

Table IV-1 should only be used as a general guide for the types of waste incinerated.

Table IV-1. Type of Waste and Percentage of Cruise Ships Incinerating this Waste

Type of Waste	Percentage of Cruise Ships Incinerating this Type of Waste
Paper products	88
Rags	81
Glass, metal, bottles, crockery, etc.	69
Plastics ¹	65
Ground down paper products	58
Food waste	50
Ground down rags	50
Floating dunnage, lining, or packing material	46
Ground down glass, metal, bottles, crockery, etc.	35
Other ²	15

1. Approximately 50 percent of the ships provided additional information stating that the plastics they incinerate are either light plastics or contain no PVC. Light plastics include items such as plastic bags, food packaging and wrapping, and plastic bottles.

2. Other includes medical waste, sludge, dried black water residue, and waste oil.

1. Plastics in the Waste Stream

The most common types of plastics in the cruise ship waste stream are likely to contain polyethylene terephthalate (PET), high density polyethylene (HDPE), polyvinyl chloride (PVC), and low density polyethylene (LDPE). Plastics in the waste stream are a concern because of the potential for polychlorinated dibenzo-*p*-dioxins (dioxins), and polychlorinated dibenzofurans (furans) formation during waste incineration. Dioxins and furans, which are highly toxic, can form in the incinerator when a chlorine source such as PVC is present. PET, HDPE, and LDPE do not ordinarily contain chlorine.

PET is used in packaging applications such as plastic water bottles, ovenable film and ovenable prepared food trays, and catsup and salad dressing bottles. HDPE is used in packaging applications for items such as milk, water, juice, shampoo, grocery, trash, and retail bags. PVCs can be found in clear food and non-food packaging and medical tubing. LDPE is used in packing of bread, frozen food bags, and squeezable bottles. (APC, 2005).

Because of the potential for dioxin formation, cruise ship operators should try to minimize the amount of PVC plastics that enter the incinerator waste stream. Although many incinerator operators indicated they do not incinerate PVC, it is possible that PVC might be in clear food packaging (APC, 2005).

B. Amount of Waste Incinerated

The Survey requested the total amount of waste burned in either cubic meters (m³) per year or in tons per year. Under Annex V, cruise ships are only required to report the amount of waste incinerated in cubic meters per year; therefore, very few cruise ships were able to provide the amount of garbage in tons per year. Without knowing the densities of the individual waste streams, it is difficult to convert from cubic meters to tons. Cruise ship representatives have indicated that they do not weigh or measure the trash before going into the incinerator. The estimate is typically made by the incinerator operator by conducting a visual inspection. Table IV-2 shows the minimum, maximum, and average amount of waste burned per cruise ship.

Table IV-2. Waste Burned Per Year¹

	Minimum	Maximum	Average
Total waste burned per year per ship (m ³ /year) (22 ships reporting)	595	8400	4323
Total waste burned per year per ship (tons/year) (4 ships reporting)	168	3190	1736

1. The total waste burned is the sum of the cruise ship's total waste (not just within three nautical miles of California coast) from all onboard incinerators. Most cruise ships reported that they have two incinerators onboard.

The Survey results showed that prior to January 1, 2005, the effective date of Assembly Bill 471 (AB 471), only two out of 26 (eight percent) of the cruise ships incinerated within three nautical miles of the California coast. This is consistent with discussions with industry representatives who indicated that their ships did not incinerate waste while at ports. Table IV-3 summarizes the amount of waste incinerated in 2004 within three nautical miles of the California coast by those two cruise ships.

Table IV-3. Waste Incinerated within Three Nautical Miles of the California Coast in 2004¹

Cruise Ships	Waste Incinerated (m ³)
Cruise Ship One	2600
Cruise Ship Two	188
Total	2788

1. Amount reported was for incineration prior to January 1, 2005, the effective date of AB 471.

For the 26 cruise ships which responded to the Survey and travel within three nautical miles of the California coast, 22 of those reported their total waste incinerated in cubic meters. For the two ships listed in Table IV-3, the waste they incinerated within three miles of the California coast makes up about three percent of all waste incinerated for the 22 cruise ships which reported their waste in

cubic meters. Cruise Ship One's waste, which accounts for approximately 70 percent of this cruise ship's total waste incinerated, incinerated 2600 cubic meters of waste within three nautical miles of the California coast prior to the effective date of AB 471. This cruise ship made approximately 100 port calls to Los Angeles/Long Beach (about 25 percent of all port calls to Los Angeles/Long Beach). Cruise Ship Two only had about five percent of its total waste incinerated within three nautical miles of the California coast. In 2004, this cruise ship only had five California port calls (two in San Diego and three in San Francisco).

C. Operating Schedule

The Survey asked cruise ship operators to include information about the incinerator operating schedule. Table IV-4 shows the minimum, maximum, and average for hours per day of operation, days per week of operation, and days per year of operation.

Table IV-4. Incinerator Operating Schedule

	Minimum	Maximum	Average
Hours per day of operation	6	24	12
Days per week of operation	3	7	5.5
Days per year of operation	156	365	287

D. Air Pollution Control Devices

Of the 26 cruise ships which responded to the survey, 11 ships (42 percent) specified that they had some type of air pollution control device on their incinerator. Table IV-5 shows the different types of control devices and the percentage and number of cruise ships with each control device. Note that some cruise ships had more than one type of control device.

Table IV-5. Air Pollution Control Devices on Cruise Ship Incinerators

Control Device	Percentage of Ships By Control Device	Number of Ships By Control Device ²
Wet Collectors (scrubbers) - spray towers, venturi scrubbers	13	2
Dry Scrubber	13	2
Baghouse	19	3
Carbon Adsorption	13	2
Cyclone Separators	6	1
Other ¹	38	6
No Control	58	15

1. The following were listed by survey respondents as "other": 1) Flue gas cleaning system; 2) Ash removal system, automatic flue gas damper, flue gas fan; 3) combustion control system; 4) smoke density controller; 5) sodium hydrogen carbonate; and 6) flue gas cleaner (activated carbon).
2. Some cruise ships responded that they have more than one control device.

The following is a brief description of air pollution control devices commonly used on incinerators.

1. Wet Collectors, Spray Towers, and Venturi Scrubbers

Wet collectors (scrubbers) can remove particulates and acidic gases from a gas stream. They rely on a pressure drop for particulate removal and on an alkali reagent for treatment of acidic gases. Spray tower scrubbers are the simplest type of wet scrubber and generally have the lowest overall particulate collection efficiency. A venturi scrubber is used when water is readily available and provides for a high-efficiency, high energy gas cleaning as well as control for both particulate matter and acid gases.

2. Dry Scrubber

Dry scrubbers use lime to treat sulfur dioxide, hydrogen chloride, and other acidic gases by absorption and adsorption. A particulate control device (for example, a baghouse) is commonly used in conjunction with a dry scrubber.

3. Baghouse

Baghouses are particulate control devices used at many land-based incinerators. Baghouses can capture over 99.9 percent of the particulate matter (PM) and are effective in capturing some of the smaller particles. Baghouses consist of a series of permeable bags which allow gas, but not particulate matter, to flow through.

4. Adsorption (including Carbon Adsorption)

With carbon adsorption, the flue gas is directed over an adsorptive media such as activated carbon. Other adsorptive media such as silica gel, aluminum oxide, or magnesium silicate can also be used. Sometimes incineration systems can have temperatures too high for the adsorptive material to remain effective.

5. Cyclone Separators

Cyclone separators (cyclones) are mechanical collectors which use particle inertia to separate the particle from the gas stream. Cyclones can only remove particulate matter and only those particles that are relatively large.

E. Alternatives to Onboard incineration

Many of the cruise ships surveyed maintain a sophisticated waste segregation and recycling program. Onboard environmental officers typically oversee the process. Cruise ships recycle one or more of the following items: aluminum, glass, iron, steel, cardboard, plastic bottles, cans, electronics, paper,

batteries, used cooking oil, toner cartridges, and polyvinyl chloride plastic buckets. Some cruise ship waste is picked up at port for recycling, landfilling, or incineration. Several cruise ships reported that special wastes such as chemicals, batteries, dry cleaning wastes, and used paints and thinners are segregated in leak-proof containers and are landed ashore to authorized waste management professionals. Some cruise ships reported that hazardous waste is landed to vendors at various ports of call.

V. POTENTIAL HEALTH IMPACTS OF SUBSTANCES EMITTED FROM ONBOARD INCINERATION

A. An Overview of Health Risk Assessment

A health risk assessment (HRA) is an evaluation or report that a risk assessor (e.g., Air Resources Board (ARB), 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 breathing, the ingestion of soil, water, crops, fish, meat, milk, mother's (breast) milk, and eggs, and dermal exposure. Many of the substances emitted from waste incineration enter the body from inhalation and noninhalation exposure pathways. Such multiple exposure pathway (multipathway) assessments are traditionally used for lipophilic (fat-loving), semivolatile, or low volatility compounds such as polychlorinated dibenzodioxins (PCDDs or dioxins) and dibenzofurans (PCDFs or furans), polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs).

Generally, to develop an HRA, the risk assessor would perform or consider information developed under the following four steps. The four steps are Hazard Identification, Dose-Response Assessment, Exposure Assessment, and Risk Characterization.

1. Hazard Identification

In the first step, the risk assessor would determine if a hazard exists, and if so, would identify the pollutant(s) of concern and the type of effect, such as cancer or respiratory effects.

For this assessment, the pollutants of concern are PCDDs, PCDFs, PAHs, manganese, hydrochloric acid, and toxic metals. All of these substances have been formally identified as toxic air contaminants (TACs) under the California Toxic Air Contaminant Program (Assembly Bill 1807: Health and Safety Code sections 39660-39662). In addition, all of these pollutants have been listed as hazardous air pollutants by the United States Environmental Protection Agency (U.S. EPA) under the Federal Clean Air Act (42 U.S.C. 7412). See Appendix F for information regarding the health effects of these compounds.

2. Dose-Response Assessment

In this step of risk assessment, the assessor would characterize the relationship between a person's exposure to a pollutant and the incidence or occurrence of an adverse health effect.

This step of the HRA is performed for the ARB by the Office of Environmental Health Hazard Assessment (OEHHA). OEHHA supplies these dose-response relationships in the form of cancer potency factors (CPF) for carcinogenic effects and reference exposure levels (RELs) for non-carcinogenic effects. The CPFs and RELs that are used in California can be found in one of four references:

- The OEHHA Air Toxics “Hot Spots” Program Risk Assessment Guidelines, Part I, The Determination of Acute RELs for Airborne Toxicants, March 1999;
- The OEHHA Air Toxics “Hot Spots” Program Risk Assessment Guidelines, Part II, Technical Support Document for Describing Available Cancer Potency Factors (Revised), December 2002;
- The Air Toxics Hot Spots Program Risk Assessment Guidelines; Part III; Technical Support Document for the Determination of Noncancer Chronic Reference Exposure Levels, April 2000;
- The Air Toxics Hot Spots Risk Assessment Guidelines; Part IV; Exposure Assessment and Stochastic Analysis Technical Support Document, September 2000; and
- The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments. August 2003.

These five documents are collectively referred to as the OEHHA HRA guidelines. The individual CPFs and RELs for the pollutants that we are using for this HRA are presented in Section B, Part 3 of this chapter.

3. Exposure Assessment

In this step of the risk assessment, the risk assessor estimates the extent of public exposure by looking at who is likely to be exposed, how exposure will occur (e.g., inhalation and ingestion), and the magnitude of exposure.

For cruise ship onboard incineration activities, the receptors that are likely to be exposed include residents living near the port and along the California coast, and off-site workers located at the port. On-site workers are not included in this HRA because the California Occupational Safety and Health Administration (Cal/OSHA) has jurisdiction over on-site workers. Exposure was evaluated for toxic metals, PCDDs and PCDFs, PAHs, manganese, and hydrochloric acid via the inhalation, soil, dermal, and mother’s milk pathways. Emission estimates were compiled and computer air dispersion modeling was used to provide downwind ground-level concentrations of the TACs at near-source, residential, and off-site worker locations.

4. Risk Characterization

This is the final step of risk assessment. In this step, the risk assessor combines information derived from the previous steps. Modeled concentrations, which are determined through exposure assessment, are combined with the CPFs (for cancer risk) and RELs (for non-cancer effects) determined under the dose-response assessment. This step integrates this information to quantify the potential cancer risk and non-cancer health impacts.

B. Tools and Information Used for this Risk Assessment

The tools and information that are used to estimate the potential health impacts from a source include an air dispersion model and pollutant-specific health values. Information required for the air dispersion model includes emission estimates, physical descriptions of the source, and emission release parameters. Combining the output from the air dispersion model and the pollutant-specific health values provides an estimate of the off-site potential cancer and non-cancer health impacts from the emissions of a TAC. For this assessment, ARB staff is estimating the potential health impacts from the pollutants emitted during onboard waste incineration that complies with the proposed airborne toxic control measure (ATCM). A description of the emission estimates, air dispersion modeling, and pollutant-specific health values is provided in this chapter.

ARB staff conducted an HRA to determine the potential health risk remaining after implementation of the ATCM. Because the standard (i.e., no incineration within three miles of the California coast) was already set forth in Assembly Bill 471, staff focused its efforts on assessing the potential health risk remaining after implementation to ensure that it was adequately health protective.

1. Emission Estimates

In order to estimate emissions of TACs from onboard incineration ARB staff used a variety of tools. Specifically, the Cruise Ship Onboard Incinerator Survey (Survey) was used to obtain information on the stack heights and control equipment. In conjunction with this information, emission testing reports from land-based municipal waste incineration in California were used to estimate emission rates for the TACs of concern.

Emissions data from land-based municipal waste incinerators were used to estimate emissions for cruise ship onboard incinerators because staff was not able to locate any emissions testing for actual cruise ship incinerators. It is important to note that the variability in the waste stream between each cruise ship and between cruise ship and land-based municipal waste incineration can have an impact on emission estimates. However, land-based municipal waste incinerators typically incinerate general household waste and have some similar waste streams to cruise ships, including food waste, packaging, paper and cardboard items, general light plastic waste, rags, etc. Many of the same items recycled on cruise ships are also recycled by households or by municipal material recovery facilities and are not typically part of the waste stream for municipal waste incineration.

Because emissions data from the land-based municipal waste incinerators are based on controlled emissions (and most of the cruise ship incinerator emissions are uncontrolled), staff adjusted the emission rates used in the HRA. ARB staff increased the emissions used in the HRA by assuming 99 percent control efficiency on the municipal waste incinerators. ARB staff estimated that about ten percent of the port calls (visits) in 2004 were by ships with control efficiency similar to the municipal waste incinerators. Another 30 percent had some type of control device but most likely were not controlled to the efficiency of the municipal waste incinerators. Therefore, for this

analysis, ARB staff assumed ten percent of the port calls were made by ships with 99 percent control efficiency and the rest were uncontrolled.

For this HRA, staff evaluated the potential health impacts remaining after implementation of the ATCM at the Port of Los Angeles. Staff adjusted emissions by using the annual number of port calls at the Port of Los Angeles and the Port of Long Beach (Ports) since they are in close proximity to each other and the combination of both Ports could cumulatively impact the potential health impacts for workers at the port or residents living near the Ports. Staff chose these Ports for the HRA since they are the most highly visited by the cruise ships in California. Wilmington meteorological data was used because it is the closest available data to the Ports.

Emissions were spread across the most heavily traveled southern shipping lane of the Ports. This shipping lane handles the vast majority of cruise ship traffic. The incineration of materials was assumed to be taking place from the Three Nautical Mile Line, as specified on the National Oceanic and Atmospheric Administration (NOAA) Nautical Charts, to 30 miles out at sea. The incineration time in this 27-mile zone was estimated to be approximately one and one-half hours each way (ARB, 2005c), traveling inbound and outbound from the Three Nautical Mile Line.

2. Air Dispersion Modeling

Air dispersion models are used to estimate the downwind, ground-level concentrations of a pollutant after it is emitted from a facility. The downwind concentration is a function of the quantity of emissions, release parameters at the source, and appropriate meteorological conditions. The model that was used during this HRA was Hot Spots Analysis and Reporting Program (HARP) (ARB, 2005b). HARP includes the ISCST3 air dispersion model, which is recommended by U.S. EPA for refined air dispersion modeling (U.S. EPA, 1995). HARP is a recommended tool for risk analysis in California that can be used for most source types (e.g., point, area, and volume sources) and is currently used by ARB, districts, and other states.

Cruise ship operators provided ARB staff with information on incinerator design and information such as stack height, diameter, temperature, and flow rates. This data was used in the air dispersion modeling analysis to estimate downwind concentrations.

3. Pollutant-Specific Health Effects Values

Dose-response or pollutant-specific health values are developed to characterize the relationship between a person's exposure to a pollutant and the incidence or occurrence of an adverse health effect. A CPF is used when estimating potential cancer risks and RELs are used to assess potential non-cancer health impacts.

As presented in Appendix F, exposure to TACs may result in both cancer and non-cancer health effects. The inhalation and oral CPFs and non-cancer acute and chronic RELs that are used for this HRA are listed in Table V-1. Also included in Table V-1 are the non-cancer acute and chronic toxicological endpoints for the pollutants. Table V-1 reflects the most current OEHHA-adopted health effects values for these compounds.

Table V-1. Pollutant-Specific Health Values Used for Determining Potential Health Impacts¹

Chemical	Cancer Risk		Non-Cancer Effects					
	Inhalation [†] Cancer Potency Factor (mg/kg-d) ⁻¹	Oral Slope Factor (mg/kg-d) ⁻¹	Acute Inhalation (µg/m ³)	Acute Target Organs	Chronic Inhalation (µg/m ³)	Chronic Inhalation Target Organs	Chronic Oral (mg/kg/d)	Chronic Oral Target Organs
Arsenic (Inorganic)	1.2E+01	1.5E+00	1.9E-01 AveP	Developmental, Reproductive	3.0E-02	Cardiovascular, Developmental, Nervous	3.0E-04	Cardiovascular, Skin
Beryllium	8.4E+00				7.0E-03	Immune, Respiratory	2.0E-03	Alimentary
Cadmium	1.5E+01				2.0E-02	Kidney, Respiratory	5.0E-04	Kidney
Chromium (Treated as five percent hexavalent chromium for HRA)	5.1E+02				2.0E-01	Respiratory	2.0E-02	Hematologic
Hydrochloric Acid (Hydrogen chloride)			2.1E+03	Eye, Respiratory	9.0E+00	Respiratory		
Lead (inorganic)	4.2E-02	8.5E-03						
Manganese					2.0E-01	Nervous		
Mercury (Inorganic)			1.8E+00	Developmental, Reproductive	9.0E-02	Nervous	3.0E-04	Immune, Kidney
Nickel	9.1E-01		6.0E+00	Immune, Respiratory	5.0E-02	Hematologic, Respiratory	5.0E-02	Alimentary
Polychlorinated Dibenzo-p-Dioxins (PCDD) (Treated as 2,3,7,8-TCDD for HRA) ²	1.3E+05	1.3E+05			4.0E-05	Alimentary, Developmental; Endocrine; Hematologic, Reproductive, Respiratory	1.0E-08	Alimentary, Developmental; Endocrine; Hematologic, Reproductive, Respiratory
Polychlorinated Dibenzofurans (PCDF) (Treated as 2,3,7,8-Tetrachlorodibenzo-p-Dioxin for HRA) ²	1.3E+05	1.3E+05			4.0E-05	Alimentary, Developmental; Endocrine; Hematologic, Reproductive, Respiratory	1.0E-08	Alimentary, Developmental; Endocrine; Hematologic, Reproductive, Respiratory
Polycyclic Aromatic Hydrocarbon (PAH) (Treated as Benzo(a)Pyrene for HRA)	3.9E+00	1.2E+01						

Footnotes: see next page.

The CPF describes the excess cancer risk associated with exposure to one milligram of a given chemical per kilogram of body weight. A REL is defined as a concentration level at or below which no adverse health effects are anticipated and is used as an indicator of potential non-cancer adverse health effects. RELs are designed to protect sensitive individuals in the population by including safety factors in their development and can be created for both acute and chronic exposures. An acute exposure is defined as one or a series of short-term exposures generally lasting less than 24 hours. Consistent with risk guidelines, a one-hour exposure is used to determine acute non-cancer impacts. Chronic exposure is defined as long-term exposure usually lasting from one year to a lifetime.

C. Risk Assessment Results

ARB staff conducted a multipathway HRA to evaluate cancer and noncancer health impacts remaining after implementation of the proposed ATCM. Section B provides information on the emissions and modeling estimates used in the analysis. Additional information on the HRA methodology can be found in Appendix H. Compounds considered in the analysis are shown in Table V-1. Pathways included for evaluation include inhalation, dermal, soil ingestion, and mother's milk. These four pathways are the minimum pathways that should be evaluated when assessing compounds with multipathway effects.

Footnotes for Table V-1:

1. Health effect values were obtained from:
 - a. The OEHHA Air Toxics "Hot Spots" Program Risk Assessment Guidelines, Part I, The Determination of Acute RELs for Airborne Toxicants, March 1999;
 - b. The OEHHA Air Toxics "Hot Spots" Program Risk Assessment Guidelines, Part II, Technical Support Document for Describing Available Cancer Potency Factors (Revised), December 2002;
 - c. The Air Toxics Hot Spots Program Risk Assessment Guidelines; Part III; Technical Support Document for the Determination of Noncancer Chronic Reference Exposure Levels, April 2000; and
 - d. The Air Toxics Hot Spots Risk Assessment Guidelines; Part IV; Exposure Assessment and Stochastic Analysis Technical Support Document, September 2000.
2. Polychlorinated Dibenzo-*p*-dioxins and Polychlorinated Dibenzofurans (also referred to as chlorinated dioxins and dibenzofurans): OEHHA has adopted the World Health Organization 1997 (WHO-₉₇) Toxicity Equivalency Factor scheme for evaluating the cancer risk due to exposure to samples containing mixtures of polychlorinated dibenzo-*p*-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) and determining cancer risks for a number of specific PCB congeners. See Appendix A of OEHHA's *Technical Support Document For Describing Available Cancer Potency Factors* for more information about the scheme. See Appendix E of OEHHA's *The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments* for the methodology for calculating 2,3,7,8-equivalents for PCDDs, PCDFs and a number of specific PCB congeners. See section 8.2.3 of OEHHA's *The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments* for conducting health risks when total (unspeciated) chlorinated dioxins and furans are reported.
- AveP. Polychlorinated Dibenzo-*p*-dioxins and Polychlorinated Dibenzofurans (also referred to as chlorinated dioxins and dibenzofurans): OEHHA has adopted the World Health Organization 1997 (WHO-₉₇) Toxicity Equivalency Factor scheme for evaluating the cancer risk due to exposure to samples containing mixtures of polychlorinated dibenzo-*p*-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF) and determining cancer risks for a number of specific PCB congeners. See Appendix A of OEHHA's *Technical Support Document For Describing Available Cancer Potency Factors* for more information about the scheme. See Appendix E of OEHHA's *The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments* for the methodology for calculating 2,3,7,8-equivalents for PCDD, PCDFs and a number of specific PCB congeners. See section 8.2.3 of OEHHA's *The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments* for conducting health risks when total (unspeciated) chlorinated dioxins and furans are reported.

As previously mentioned, staff evaluated the potential health impacts remaining after implementation of the proposed ATCM from onboard incineration for the Ports of Los Angeles and Long Beach because these Ports handle the largest amount of cruise ship traffic. San Diego is the next most heavily traveled port with about half of the calls compared to Los Angeles and Long Beach. Due to a significantly lower number of port calls at other ports throughout California, it is expected that the potential health impacts at other ports would be lower than the potential health impacts at the Ports of Los Angeles and Long Beach.

For this analysis we assumed that all cruise ships (379) are incinerating while coming into port (from 30 miles out at sea to the Three Nautical Mile Line) and while leaving port (from the Three Nautical Mile Line to 30 miles out at sea). This is a conservative estimate since it is unlikely that all cruise ships would be incinerating during that time. One industry representative indicated that some ships, when coming into and out of port, cease incineration at 12 nautical miles away from the coast.

Table V-2 shows the potential cancer risk based on our analysis for the Ports. Table V-3 shows the distribution of the potential cancer risk by pathway. The results show that the residential potential cancer risk onshore remaining after implementation of the proposed ATCM is estimated to be about 1.5 chances per million. The residential risk is based on a 70-year exposure duration. The off-site worker (worker) potential risk onshore is estimated to be about 0.6 chances per million. The exposure duration for a worker is assumed to be 40 years.

Table V-2. Potential Health Impacts from the Proposed ATCM¹

	Potential Cancer Risk 2004 (chances per million)	Potential Cancer Risk 2015 ² (chances per million)
On-shore Point of Maximum Impact - Residential ³	1.5	1.9
On-shore Point of Maximum Impact - Off-site Worker ⁴	0.6	0.8

1. All numbers are rounded. Based on OEHHA guidelines and ARB Interim Risk Management Policy (ARB, 2003). Pathways evaluated include: inhalation, soil, dermal, and mother's milk. Assumes ten percent of port calls from controlled ships.
2. Assumes a 25 percent increase in (vessels) port calls over ten years until 2015.
3. Based on a 70-year exposure duration.
4. Based on 40-year exposure duration.

Table V-3. Distribution of Potential Cancer Risk by Pathway¹

Exposure Pathway	Residential (percent)	Worker (percent)
Inhalation	19	41
Soil Ingestion	45	42
Dermal Exposure	20	17
Mother's (Breast) Milk	15	0

1. All numbers are rounded.

The cruise ship industry estimates a 25 percent increase in the number of vessels that will operate in the waters of the State over the next ten years (CSETF, 2003). Therefore, for our analysis, we assumed a 25 percent increase in the number of Port calls. The potential cancer risk in 2015 would be approximately 1.9 chances per million for the residential onshore cancer risk and about 0.8 chances per million for the worker.

For noncancer chronic health impacts, the hazard index for both the resident and 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.

Lead was evaluated by comparing the modeled 30-day concentration to the lead levels found in the ARB's Risk Management Guidelines for New, Modified, and Existing Sources of Lead (ARB, 2001). The onshore modeled 30-day concentration is well below the concentration that would be considered a significant risk for lead in a high exposure area.

Based on the risk assessment results presented in Table V-2, the estimated risk ranges from about 0.6 to 1.9 chances per million. It is important to note that the HRA is an estimate based on several assumptions in the analysis. The potential health risk could be overestimated given the conservative assumptions built into the analysis. For example, it is unlikely that all 379 ships would be incinerating at the same location. However, the potential health risks could also be underestimated, for example, if a significant portion of the waste stream is made up of hazardous waste. This is probably unlikely since many ships indicated that hazardous wastes are landed ashore for disposal.

VI. THE PROPOSED CONTROL MEASURE

This chapter contains a summary of the proposed airborne toxic control measure (ATCM). It also reviews the basis and rationale for selecting the provisions being proposed. A copy of the ATCM is located in Appendix A.

The proposed ATCM prohibits a cruise ship owner or operator, agent, representative, or employee from conducting onboard incineration while operating within three nautical miles of the California coast. The ATCM is expected to reduce potential health impacts for residents and off-site workers living or working near ports or along the California coast.

A. Summary of the Proposed Control Measure

1. Affected Sources

The proposed ATCM would affect cruise ships that travel within three nautical miles of the California coast, including while at California ports or terminals. To meet the definition of a cruise ship, the vessel must have the capacity to carry 250 or more passengers and must have berths or overnight accommodations for passengers. Based on 2004 vessel data from the California State Lands Commission database, Air Resources Board (ARB) staff estimated that 11 cruise ship lines had approximately 45 vessels which entered one or more California ports in 2004.

2. Exemptions

The proposed ATCM does not apply to noncommercial vessels, warships, non-profit vessels, and vessels operated by the State of California, the United States, or a federal government. In addition, it does not apply to vessels without berths or overnight accommodations for passengers.

3. Requirements for Cruise Ship Owners or Operators

Cruise ship owners or operators are prohibited from conducting onboard incineration within three miles of the California coast. "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 (July 2000);
- Chart 18680, Point Sur to San Francisco (March 2001);

- 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 (August 2003).

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 and 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 ATCM, the Three Nautical Mile Line will be based on the current NOAA 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 and notifying potentially affected cruise ship owners or operators at least 30 days before the updates take effect.

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/staff/charts.htm>.

4. Recordkeeping and Reporting Requirements

Cruise ship owners or operators are required to maintain records containing the following information for each segment of a voyage if, during any portion of that segment, the cruise ship travels within three nautical miles of the California coast.

- 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 (m³); and
- The name or signature of officer in charge of the operation.

This information is required if, during any segment of the voyage, the cruise ship travels within three nautical miles of the California coast or visits California ports or terminals.

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

The recordkeeping requirements in the proposed 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). Cruise ships currently are required to maintain this information in a garbage record log book.

5. Definitions

Several definitions have been included in subsection (d) of the proposed ATCM to ensure clarity. These definitions were taken from Bureau of Customs and Border Protection regulations, cruise ship industry documents, and prior ARB rulemakings.

6. Other Considerations

Based on the definition of “onboard incineration,” the proposed ATCM would not apply during those periods when the onboard incinerator is not burning any waste and is only burning fuel for the specific purpose of maintaining a minimum temperature to reduce the effects of thermal cycling. Thermal cycling refers to rapid, extreme, and frequent changes of the temperature inside the incinerator. Such changes can cause damage to incinerators, depending on their design. Several industry representatives expressed concern over this issue. In order to accommodate their concerns, staff excluded, from the definition of “onboard incineration”, the burning of fuels for this purpose. However, the burning of fuels for the purpose of volume reduction, destruction, sanitation, or sterilization, aboard a cruise ship, would be subject to the ATCM.

B. Basis and Rationale for the Control Measure

Effective January 1, 2005, AB 471 prohibited cruise ships from onboard incineration within three (nautical) miles of the California coast. The purpose of the proposed ATCM is to ensure that this legislation is implemented and adequately enforced.

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 chemicals 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 cruise ship onboard incinerators which travel within three nautical miles of the California coast or which visit California ports or terminals. In 2004, at the port of Los Angeles, there were 220 cruise ship port calls. The average time between arrival and departure from the port was about 15 hours. In the absence of AB 471 and the proposed ATCM, cruise ships could incinerate waste while entering the port, at the port, and leaving the port. This amounts to substantial periods of time that cruise ships could be incinerating near the coast. In addition, there are three berths at the port which can be used simultaneously and where onboard incineration could occur if AB 471 and the proposed ATCM weren't implemented and enforced. As a result, public health impacts could occur to residents and off-site workers who live or work near the coast.

The recordkeeping requirements are similar to recordkeeping requirements under Annex V. This is a cost-effective approach which, along with onboard inspections, will allow ARB or District inspectors to determine compliance with the proposed ATCM.

C. Alternatives Considered

1. No Action

One alternative would have been not to develop the proposed ATCM. This alternative is not recommended. Cruise ships are equipped with incinerators that burn a variety of wastes including hazardous wastes, oil, oily sludge, sewage, medical and bio-hazardous waste, outdated pharmaceuticals, and other solid wastes such as plastics, paper, metal, glass, and food. 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 a 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 AB 471. Therefore, the proposed ATCM is critical to determine compliance with the legislation. In addition, the proposed ATCM clarifies the three nautical mile zone in which onboard incineration is prohibited in the legislative language.

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 a cruise 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 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, the risk assessment results conducted by ARB staff do not warrant this action.

4. Other Prescriptive Standards

Staff did not consider other prescriptive standards because the standard was set forth in AB 471 (i.e., no onboard incineration is permitted within three nautical miles of the California coast).

VII. ECONOMIC IMPACTS OF THE PROPOSED ATCM

This chapter discusses the impacts that the proposed airborne toxic control measure (ATCM) may have on the cruise ship industry and costs to local, state, and federal agencies. Overall, the ATCM is not expected to result in any significant economic impacts. The costs to the cruise ship industry are negligible.

The proposed ATCM is not expected to cause a change in employment, business status, or competitiveness. It is not expected to have an impact on the creation or elimination of jobs and businesses, or the competitiveness of cruise ships traveling to California ports.

Some costs were identified for public agencies. It is expected that the California Air Resources Board (ARB) costs will be approximately \$25,000 annually to cover the costs for enforcement.

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 ATCM is not a major regulation.

B. Affected Businesses

Approximately 11 cruise ship companies traveled into California ports during 2004. None of these companies are small businesses. These 11 companies accounted for about 45 different vessels entering California ports.

All of the vessels are foreign-flagged. According to industry representatives, the standard practice is to cease incineration before they arrive within three nautical miles of the California coast. ARB staff conducted the Cruise Ship Onboard Incinerator Survey (Survey) to get information on cruise ship waste incineration practices. Responses from that Survey showed that prior to January 1, 2005, when AB 471 took effect, only two out of 26 (eight percent) of cruise ships incinerated within three nautical miles of the California coast. For these cruise ships, a change in operating schedule of the incinerator was necessary to ensure that incineration stopped before the cruise ship arrived within three nautical miles of the California coast.

The recordkeeping requirements for the proposed 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 cruise 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 cruise ship operators are already required to keep these records, recordkeeping costs from this regulation would be negligible.

To ensure compliance with AB 471, reviewing the garbage record logs may be necessary. Inspectors can ask to inspect 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 cruise ship environmental officer's staff time to be present during annual inspections. It is not expected that the annual inspection would take longer than one hour.

Although many cruise ships already carry the specified National Oceanic and Atmospheric Administration (NOAA) Nautical Charts incorporated by reference in the proposed ATCM, there may be some ships which use different nautical charts. In this situation, although not a requirement, a cruise 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.

C. Potential Impact on Employment

For 2003, the cruise ship industry employed over 43,000 people and paid a total of 1.9 billion dollars in wages to California workers (ICCL, 2004). The proposed ATCM is not expected to cause a change in California employment because, based on ARB's Survey, prior to the effective date of AB 471, only two out of 26 (eight percent) cruise ships incinerated waste within three nautical miles of the California coast. For these two cruise ships, a change in incinerator operating schedule is not expected to impact employment. Additionally, since

the recordkeeping requirements are already required under Annex V, there is no impact expected on employment due to recordkeeping and reporting requirements.

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

Because costs for the proposed ATCM are negligible, the proposed regulation 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 ATCM is not expected to have an impact on business competitiveness. The proposed regulation is consistent with current industry practices and the requirements are identical across all cruise ships which travel to California ports.

F. Costs to Public Agencies

In order to promote statewide consistency, ARB will have the primary responsibility for enforcing the proposed ATCM. In the future, the five local air districts where cruise ships dock may wish to participate in the enforcement of the regulation. It is unknown whether or not they would choose to enforce the regulation at a future date.

1. Costs to the California Air Resources Board

The annual cost of the proposed ATCM to ARB is approximately \$25,000. This is based on anticipated, annual inspection costs by ARB inspectors. The cost estimate assumes that each cruise ship that enters a California port or terminal is inspected once per year for a total of 40 to 50 annual inspections. Assuming one inspection takes eight hours (includes travel time to ports and follow-up activities) the total annual inspection time is 320 to 400 hours per year. This is approximately 0.15 to 0.20 Person Years (PY). Assuming \$100,000 per PY, this computes to a cost of about \$15,000 to \$20,000. Mileage reimbursement of 200 miles per inspection at \$0.34 per mile equals \$2,720 to \$3,400. The total for staff time and mileage reimbursement is less than \$25,000. It is anticipated that these costs can be absorbed into the existing budget. However, the cruise ship industry estimates a significant increase in the number of cruise ships that operate in California over the next ten years. Should this occur, ARB may need additional resources to adequately enforce this growing industry.

VIII. ENVIRONMENTAL IMPACTS OF THE PROPOSED ATCM

The intent of the proposed airborne toxic control measure (ATCM) is to protect the public health by reducing the public's exposure to toxic air contaminants (TACs) from incineration aboard cruise ships. Air Resources Board (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 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 cruise 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. Cruise ships are already prohibited from dumping wastes within three nautical miles of the coast (IMO, 1997) so a prohibition against incineration in this same zone would not impact ocean water quality.

C. Diesel Emissions

A negligible increase in diesel emissions could occur if the two cruise ships which incinerated within three nautical miles of the California coast prior to January 1, 2005, chose to have all or a portion of that waste picked up by solid waste collection vehicles which operate on diesel fuel. 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., cruise 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.

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 cruise ships which incinerated within three nautical miles of the California coast prior to January 1, 2005, 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. Because only two ships incinerated their waste within three nautical miles of the California coast prior the effective date of AB 471, 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., cruise 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.

E. Waste Storage

Because the proposed ATCM limits when cruise 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 a cruise 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, 2005a)

Although there are no requirements on how long regulated garbage may be stored on a cruise 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, 2005a)

ARB staff does not expect negative environmental impacts due to the potential for garbage storage from the proposed ATCM. Cruise ships which travel internationally do not typically stay at port or within three nautical miles of the California coast for more than 24 hours. For 2004, at the port of Los Angeles, the average time between arrival and departure from port was 15 hours with a maximum of 20 hours. 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, cruise ships may either send their wastes to landfills or land-based municipal waste incinerators.

F. Reasonably Foreseeable Alternative Means of Compliance with the ATCM

ARB is required to do an analysis of reasonably foreseeable alternative means of compliance with the ATCM. Alternatives to the ATCM are discussed in Chapter VI. ARB staff has concluded that the proposed ATCM provides clarity in implementing AB 471. The ATCM is enforceable with the least burdensome approach to reducing public health impacts from cruise ship onboard incineration.

G. Environmental Justice

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 ATCM is not expected to result in significant negative impacts in any community. The proposed 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 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 (August 2003).

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