

**CHAPTER 16:****LIMITING VESSEL POLLUTION AND IMPROVING VESSEL SAFETY**

*The benefits from vessel activities are significant, but they also present risks to people and the environment that need to be effectively addressed. Limiting vessel pollution, improving vessel safety, and addressing potential security threats associated with vessel operations depend on responsible owners and operators, conscientious crews, enforceable national and international standards, and development of new technologies and management approaches. There is also a need for heightened awareness and better real-time information about the full array of offshore activities to ensure safety, security, and environmental quality.*

**ASSESSING THE BENEFITS AND RISKS OF VESSEL ACTIVITIES**

Commercial and recreational vessel activities contribute substantially to the U.S. economy. Ships carry more than 95 percent of the nation's overseas cargo<sup>1</sup> and 9 to 15 percent of its domestic freight.<sup>2,3</sup> The U.S. cruise industry and its passengers generated almost \$12 billion in annual spending in 2002,<sup>4</sup> and recreational boaters spend an estimated \$30 billion a year.<sup>5</sup> However, as with all industries, the many benefits derived from vessel operations are accompanied by safety and environmental risks that require effective government oversight. A 1995 U.S. Coast Guard study identified human error as the cause of approximately 80 percent of all maritime casualties.<sup>6</sup> Recent events—such as an oil spill from a barge in Buzzards Bay, Massachusetts that caused significant economic and environmental damage and a Staten Island, New York ferry accident that resulted in multiple fatalities—demonstrate that protecting the environment and enhancing safety require continued focus and vigilance.

It is worth noting that many of the pollutants associated with vessels also have land-based sources. In fact, 80 percent of all ocean pollution originates from land-based activities, including many of the types of pollution commonly associated with vessel activities.<sup>7</sup> For example, spills due to shipborne oil transportation, including spills from tankers, account for only about 9 percent of the human input of petroleum into North American waters.<sup>8</sup> Nevertheless, the existence of other sources does not diminish the importance of finding better ways to reduce vessel pollution.

Improving commercial vessel safety, security, and environmental protection is an international concern. Foreign flag vessels, subject primarily to the jurisdiction and control of other governments, carry more than 90 percent of international commercial freight entering and departing the United States<sup>9</sup> and account for 95 percent of passenger ships and 75 percent of cargo ships operating in U.S. waters.<sup>10</sup> Consequently, it is critical for the United States to participate in worldwide efforts to manage vessel operations. The principal forum for developing international regulations and guidelines on vessel safety, security, and environmental protection is the United Nations International Maritime Organization (IMO). The IMO consists of 163 member nations including the United States, whose combined fleets represent more than 98 percent of world vessel tonnage.<sup>11</sup>

## **STRENGTHENING VESSEL SAFETY, SECURITY, AND ENVIRONMENTAL COMPLIANCE**

Vessel owners and operators and government agencies responsible for oversight of vessel operations share responsibility for continued improvement in vessel safety, security, and environmental compliance. Improvements to date have been based on a combination of voluntary and regulatory measures, including a broad array of guidelines and mandatory regimes for domestic and international operations. Over the past few years, attention has been focused on better implementation, oversight, and enforcement of existing requirements.

The success of all these efforts will depend on a broad domestic and international framework with several components. A key component of the framework is a strong voluntary commitment on the part of vessel owners and operators to build a culture that incorporates safety, security, and environmental protection as important and valued aspects of everyday vessel operations. Another important component is an international commitment to effective oversight and enforcement. This applies particularly to those with primary responsibility for vessel operations and receiving ports.

### **A Culture of Compliance and Safety**

Voluntary partnerships between U.S. government agencies and vessel owners and operators are an important, non-regulatory means of promoting vessel safety and encouraging compliance with environmental regulations. For example, the Coast Guard's Prevention Through People program focuses on the human component of vessel operations to identify risks and develop solutions to common problems, emphasizing the industry's lead role in safety management.

Such partnerships have been credited for reductions in vessel accidents and oil spills. However, the process of building a culture of safety also requires a strong commitment within industry. Safety and environmental plans should be effectively incorporated into routine vessel operations, including investments in improved workplace safety and training. Also important to success are reliable means of measuring the success of these initiatives, as reflected in crew and company performance, including extensive use of third-party audits. The Coast Guard has developed incentives that reward companies and vessels with excellent performance records. The most effective incentives are those that facilitate cargo delivery or other vessel operations, such as reduced government oversight or inspections, which translate directly into lower operational costs.

**Recommendation 16–1. The U.S. Coast Guard should encourage industry partners engaged in vessel management to develop stronger voluntary measures, particularly those that reward crew member contributions, as part of a continuing long-term effort to build a culture of safety, security, and environmental compliance in routine vessel operations.**

Despite these positive developments, effective oversight and enforcement will remain critical to improved safety and environmental protection. While most vessel owners and operators comply with international and domestic requirements to develop safety management plans, the evidence of continuing accidents, criminal prosecutions for falsifying documents, and intentional violation of environmental protection laws indicate that some owners and operators are not implementing these plans. Coast Guard experience has found that performance-based inspections, focusing on demonstrations of crew competencies and incorporation of vessel safety management plans into daily operations, provide the best means of evaluating the effectiveness of implementation efforts.

Vessel oversight and enforcement took on a dramatic new dimension after September 2001, when a series of new security requirements were developed to address vulnerabilities in the U.S. marine transportation system. In 2002, Congress enacted the Maritime Transportation Security Act (MTSA), establishing a comprehensive approach to maritime security, and the IMO adopted a broad new security regime for international shipping, all scheduled to enter into force in July 2004. These initiatives are part of a broader homeland security strategy that places a series of new demands on Coast Guard resources.

Concern has been expressed in Congress and elsewhere about the impact of increased security responsibilities on other Coast Guard missions. U.S. General Accounting Office (GAO) reports have documented a decline in resources in a number of other mission areas, including marine safety and environmental protection, since September 11, 2001, and have called upon the Coast Guard to develop a comprehensive, balanced resource utilization strategy.<sup>12,13</sup>

A 2004 report from the National Research Council identified four key national interests related to the marine transportation system: ensuring marine safety; protecting the marine environment; facilitating commerce; and providing for national security.<sup>14</sup> In planning for future resource needs and allocation, it will be important to ensure that sufficient resources are available to meet new security demands without diminishing the resources necessary to sustain and strengthen marine safety and environmental compliance. For example, performance-based vessel inspections, while the most effective means of verifying compliance, are resource intensive. These inspections have played a critical role in identifying and correcting potential problems, and in assessing the effectiveness of overall efforts to improve safety and environmental compliance.

**Recommendation 16–2. Congress should provide the U.S. Coast Guard with the resources necessary to sustain and strengthen the performance-based inspection program for marine safety and environmental protection. Coast Guard resource commitments in these areas should be coordinated with new demands for vessel security inspections and other security requirements.**

### Flag State Oversight and Enforcement

Government responsibility for oversight and enforcement is vested primarily in the *flag state*, the nation in which a vessel is registered and whose flag the vessel flies. Flag states are responsible for ensuring their vessels' compliance with applicable safety, security, and environmental standards, and for verifying the accuracy of documents and certificates issued under their authority. This responsibility requires flag states to have the necessary domestic laws, administrative infrastructure, and qualified personnel in place to oversee vessel inspections, ensure crew competency, investigate vessel accidents, and take appropriate regulatory and enforcement actions.

Although many flag states take their responsibilities seriously and are active participants within the IMO, oversight and enforcement vary dramatically. Others lack the capacity to adequately oversee and enforce international requirements. In many instances, flag states rely heavily on independent organizations, such as classification societies, for technical expertise and guidance concerning these responsibilities. These organizations may be designated to exercise authority on behalf of a flag state, in which case they are referred to as “responsible organizations.” Many of these organizations are highly professional and competent, but not all adhere to high standards of performance.

Some flag states, known as open registries, allow ship owners to register vessels and fly their flag without any genuine link between the nationality of the owner and the flag state. A few open registries have little interest in the duties of a flag state, other than to collect registration fees. These flag states become havens for owners of substandard vessels seeking to avoid meaningful oversight. The ability to rapidly change vessel registry

from one flag state to another makes it easy for irresponsible owners to avoid effective flag state controls over their operations.

Over the past decade, the IMO has developed guidelines to improve flag state oversight and enforcement including a self-assessment program. However less than one-third of IMO member nations have participated in the program, and a consistently low number of flag states submit mandatory reports to the IMO on actions taken to control pollution violations.<sup>15</sup> An IMO research study completed in 2001 also found an unexpectedly high incidence of fraudulent crew certification documents, with over 80 percent of those surveyed having detected forged certificates in the last five years.<sup>16</sup>

Mounting international security concerns have made effective flag state oversight and control even more urgent. Recently approved IMO security initiatives require flag states to enforce comprehensive new security measures for vessels flying their flag, including the implementation of vessel security plans, development of detailed and regularly updated vessel histories, and verification of vessel and crew security documentation.

The IMO also recently approved the establishment and development of a voluntary Model Audit Scheme to assess how effectively member states are implementing and enforcing convention standards and to provide feedback on audit results. The IMO has been working on a code that clearly enumerates flag state, port state, and coastal state responsibilities. The G-8 nations (the United States, France, Russia, the United Kingdom, Germany, Japan, Italy, Canada) and representatives from the European Union agreed to work together to accelerate the introduction of these IMO initiatives and expand technical cooperation programs to assist flag states in meeting their international obligations.<sup>17</sup>

**Recommendation 16–3. The United States should work with other nations to accelerate efforts at the International Maritime Organization to enhance flag state oversight and enforcement.**

*These efforts should include implementation of:*

- *a code outlining flag state responsibilities and obligations.*
- *a voluntary audit regime, to be followed by adoption of a mandatory external audit regime for evaluating flag state performance.*
- *measures to ensure that responsible organizations, acting on behalf of flag states, meet established performance standards.*
- *increased technical assistance, where appropriate, for flag states that participate in self-assessments and audits.*

**Port State Control**

Nations have the authority to ensure that foreign flag vessels visiting their ports are in compliance with applicable international and domestic requirements. This verification process, exercised through port state control programs, has taken on added significance given the failure of some vessel owners and flag states to effectively exercise their oversight responsibilities.

***U.S. Port State Control***

The Coast Guard currently carries out a port state control program that allocates limited inspection resources to the highest-risk vessels, based on an assessment of the vessel owner, flag state, classification society, performance history, and vessel type. The assessment also considers whether the flag state is a party to important international conventions. In 2002, over 7,000 vessels from eighty-one flag states made more than 53,000 port calls in the United States. The Coast Guard conducted 10,518 inspections leading to the detention of 179 vessels for serious violations.<sup>18</sup>

The Coast Guard's QUALSHIP 21 program rewards foreign flag vessels that have attained particularly high levels of compliance with international safety and environmental requirements by reducing their Coast Guard inspections. This can expedite port calls and reduce costs. The Coast Guard is currently working to develop additional incentives for QUALSHIP 21 vessels.

The Coast Guard's annual reports on port state control identify a small number of flag states whose vessels have consistently poor records, with repeated detentions for major safety and environmental compliance violations.<sup>19</sup> Beginning in 2004, the U.S. port state control program will be expanded to include comprehensive vessel security inspections that will provide additional information on flag state performance.

Poor oversight by flag states places greater burdens on Coast Guard resources; the higher the potential risk presented by a vessel, the greater the need to assign resources to address that risk. More stringent action against irresponsible flag states may encourage vessel owners to register with flag states that have better oversight regimes and performance records, and reduce the burden on port state resources. The Coast Guard should evaluate the potential benefits of additional measures directed at irresponsible flag states owners, such as denial of port entry for all vessels registered with a particular flag state or under control of owners and operators who demonstrate a repeated, material failure to enforce applicable security, safety, or environmental protection requirements.

### *International Port State Control*

Port state control programs around the world can become more effective by sharing information on successful program management practices, and by sharing information on vessel histories and inspections. An international memorandum of understanding, signed by the Coast Guard, established EQUASIS, an independent, nonprofit database designed to provide global access to impartial information on individual vessels to help reduce substandard shipping. This database can be accessed free of charge by anyone, including port states and vessel operators. Although the Coast Guard actively participates in development of EQUASIS policy and provides and uses information from the database, an appropriate funding mechanism has not been identified to allow regular U.S. support for this important information-sharing effort.

**Recommendation 16–4. The U.S. Coast Guard, working with other nations, should establish a permanent mechanism to strengthen and harmonize port state control programs under the auspices of the International Maritime Organization. The Coast Guard should provide sustained funding to support an international vessel information database that can be used to enhance the effectiveness of port state control efforts.**

## **REDUCING VESSEL POLLUTION**

Strengthening commitments to environmental protection, flag state oversight, and port state control will help prevent and reduce the impacts of vessel pollution. However, effective reduction of vessel pollution will also require the development of new control measures. Of particular concern are vessel waste discharges containing pathogens and nutrients, air emissions, and oil releases. (The role of vessels in the spread of invasive species is addressed in Chapter 17.)

### **Waste Stream Discharges**

Every day, vessels ranging from large cruise ships to small recreational boats discharge wastes into coastal waters. The waste streams from recreational vessels primarily contain sewage, while cruise ships discharge both sewage and toxic substances. These wastes, if not properly disposed of and treated, can be a significant source of pathogens and nutrients with the potential to threaten human health and damage shellfish beds,

coral reefs, and other aquatic life. According to the U.S. Environmental Protection Agency (EPA), the amount of bacterial pollution in the discharge of untreated sewage from just one recreational boat is equivalent to the amount in the treated sewage of 10,000 people during a similar time period.<sup>20</sup>

The Clean Water Act prohibits the discharge of untreated sewage in U.S. internal waters and within three miles of the coast. It also allows individual states to ask EPA to establish special no-discharge zones in their waters, within which the discharge of even treated sewage is prohibited. The Clean Water Act also directs EPA and the Coast Guard to establish discharge and design standards for marine sanitation devices (MSDs).

Concerns about the impacts of vessel waste and the effectiveness of Clean Water Act controls increased in the 1990s, along with the increase in cruise ships and recreational vessels. An Alaskan study conducted in 2000 found that most cruise ship MSDs failed to treat sewage to levels necessary to meet federal standards, despite claims by the manufacturers. Additional restrictions on the discharge of wastewater in Alaskan waters had already been voluntarily initiated by the cruise lines earlier that year, in response to growing concerns about potential wastewater impacts.<sup>21</sup>

Decreasing the detrimental effects of these discharges will require a number of actions, including modifications to current statutes and regulations to strengthen standards, improved public outreach and education, and additional research to better understand waste stream impacts.

### ***Cruise Ships***

The cruise industry has grown rapidly since the 1980s. By the end of 2002, 176 vessels were operating in the North American cruise industry, and U.S. ports handled 6.5 million cruise embarkations, an increase of over 10 percent from 2001.<sup>22</sup> While growth is expected to slow somewhat over the next several years, double-digit growth is predicted to continue in the near term.<sup>23</sup> This rapid growth has been accompanied by increasing concerns about the environmental impacts of waste discharges from cruise ships. The United States accounts for about 70 percent of global cruise embarkations; thus a large portion of cruise ship operations occur in or near U.S. waters (Figure 16.1).<sup>24</sup>

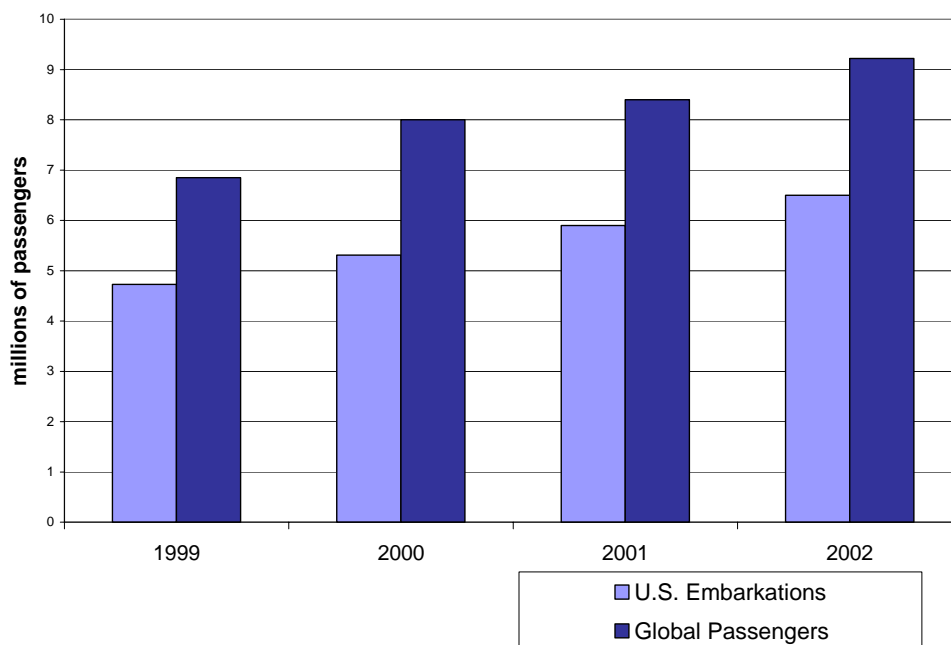
Cruise ships can carry as many as 5,000 passengers and crew, generating large amounts of wastewater, including blackwater (sewage), graywater (drainage from dishwashers, showers, laundry, baths, and washbasins), and hazardous substances. Estimates indicate that a single cruise ship can generate from 140,000 to 210,000 gallons of blackwater and a million gallons of graywater per week.<sup>25,26</sup> Of particular concern are the cumulative environmental impacts caused when cruise ships repeatedly visit the same environmentally sensitive areas.

Between 1993 and 1998, eighty-seven illegal discharge cases, some involving multiple discharges, were brought against cruise lines in the United States resulting in significant civil and criminal penalties<sup>27</sup> While the number of confirmed cases gradually declined during that period, new cases leading to additional civil and criminal penalties have continued over the past several years. Industry efforts to address this problem have included the voluntary adoption of comprehensive management plans for handling cruise ship wastes, participation in research partnerships with government and other public and private stakeholders to investigate the impacts of cruise ship pollution, and significant investments in new technologies to reduce environmental impacts.

In response to particular concerns about the impacts of cruise ship discharges in Alaska, a new federal statutory regime applicable only to Alaskan waters was developed in 2000, followed by a state statutory regime in 2001. These laws included wastewater discharge standards and provisions for sampling and testing, recordkeeping, and inspections, as well as flexibility to encourage voluntary application of innovative

wastewater treatment technologies and methods. However, no comprehensive wastewater management regime is in place for all large passenger vessels operating in U.S. waters.

**Figure 16.1. Most Cruise Travel Originates in U.S. Waters**



Passengers boarding cruise ships at U.S. ports account for over 70 percent of global passengers. Due to the continued growth of U.S. cruise ship operations, appropriate treatment and disposal of wastewater discharges from these ships will continue to be a concern for maintaining water quality and preventing harm to marine organisms in U.S. waters.

Source: Business Research & Economics Advisors. *The Contribution of the North American Cruise Industry to the U.S. Economy in 2002*. Exton, PA: International Council of Cruise Lines, August 2003.

A new regime is needed that provides clear, uniform requirements for controlling the discharge of wastewater from large passenger vessels, as well as consistent interpretation and enforcement of those requirements. The benefits of the Alaskan approach should be extended to other sensitive ocean and coastal areas that experience significant cruise ship traffic. Any new regulatory regime should be science-based and incorporate new results, such as recent EPA studies on the dilution and dispersal of discharges from vessels while underway.<sup>28</sup> Effective enforcement will require that accurate records be maintained to allow the regulated community and enforcement officials to track the treatment and discharge of waste.

**Recommendation 16–5. Congress should amend the Clean Water Act to establish a new national regime for managing wastewater discharges from large passenger vessels, including: uniform discharge standards and waste management procedures; thorough recordkeeping requirements to track the waste management process; required sampling, testing, and monitoring by vessel operators using uniform protocols; and flexibility and incentives to encourage industry investment in innovative treatment technologies.**

### *Recreational Vessels*

Millions of small recreational boats also discharge significant volumes of waste to coastal waters. Many recreational boaters rely on MSDs to treat waste before discharge or store waste until it can be pumped out at

land-based facilities. MSD performance and design standards, however, have not been updated since the mid-1970s and do not account for new technology or the operational life of an MSD system. As a result, many MSDs currently used on recreational vessels do not provide adequate environmental protection, particularly with respect to pathogen discharges.

**Recommendation 16–6.** The U.S. Environmental Protection Agency should revise the Clean Water Act marine sanitation device (MSD) regulations to require that new MSDs meet significantly more stringent pathogen-reduction standards. The U.S. Coast Guard should require manufacturers to provide warranties that MSDs will meet these new standards for a specified time period.

### *Waste Pumpout Facilities*

Pumpout facilities are essential for handling waste from boats equipped with holding tanks. EPA is responsible for determining whether adequate pumpout facilities are available to recreational boaters before approving most state no-discharge zones. In addition, the Clean Vessel Act provides funding to states, through the U.S. Fish and Wildlife Service (USFWS), to purchase and install sewage pumpout stations and portable toilet waste dump stations, and to provide environmental education to boaters. States may also award grants to marinas to construct these facilities. Despite these programs, the current shortfall in adequate pumpout facilities makes it virtually impossible for boaters to comply with prohibitions against the discharge of untreated waste in some coastal areas.

**Recommendation 16–7.** The U.S. Environmental Protection Agency (EPA) should conduct a thorough assessment, including field inspections, to verify the availability and accessibility of functioning pumpout facilities in existing no-discharge zones and prior to the approval of any new no-discharge zones. EPA, working with other appropriate entities, should increase voluntary installation of pumpout facilities.

**Recommendation 16–8.** Congress should provide incentives for boat owners to install improved treatment devices and should increase funding for grants to build pumpout facilities under the Clean Vessel Act. Congress, with input from the National Ocean Council, should also consider transferring the Clean Vessel Act grant program to the U.S. Environmental Protection Agency to consolidate the administration of programs related to marine sanitation devices.

## **Air Emissions**

### *Large Commercial Vessels*

Most commercial ships are powered by marine diesel engines that use fuels containing high concentrations of contaminants.<sup>29</sup> These engines have high emissions on a per engine basis and contribute to high ozone and particulate matter levels in many coastal and port areas.<sup>30</sup> A study of global impacts from large vessel air emissions indicates that approximately 80 percent of vessel air emissions occur within 200 miles of the coast, and that a major part of these emissions are concentrated in a few areas in the Northern Hemisphere, primarily along the east and west coasts of the United States, in the North Pacific, and in northern Europe. International and domestic marine trade is predicted to more than double in the next twenty years, reinforcing the need to expeditiously develop and implement measures to abate vessel-generated air pollution.<sup>31</sup>

New engine types that consume less fuel and emit less pollution are being installed and evaluated. Some vessel owners and operators are also replacing high-sulfur fuels with more expensive, low-sulfur fuels. These voluntary measures are effective in reducing air pollution, but often involve significantly increased costs. Economic incentives can encourage such actions by helping to offset the costs, a useful complement to regulatory measures. Several incentives were suggested during the development of EPA's large marine engine



emission regulations. At the state and port levels, these suggested incentives include differentiated port fees based on a vessel's environmental profile, matching grant programs, and the greater use of shore power where it is determined to be safe, cost-effective, and environmentally advantageous. Future possibilities include market-based measures such as pollution credit trading programs, including trading between fixed and mobile sources.<sup>32</sup> Europe is also considering market-based measures to reduce emissions, such as relating port fees to vessel emission levels, linking fuel taxes with fuel quality, and developing emission trading mechanisms.

**Recommendation 16–9. The U.S. Environmental Protection Agency, working with other appropriate entities, should investigate and develop incentive-based measures that result in measurable voluntary reductions in vessel air emissions.**

International initiatives to curb emissions from large vessels have centered on IMO development of a new Annex VI to the International Convention for the Prevention of Pollution from Ships (MARPOL). Annex VI establishes limits on nitrogen oxide emissions and also addresses the sulfur content of fuel, releases of ozone-depleting substances, volatile organic compounds from refueling, and shipboard incineration. Annex VI also allows nations to establish Sulfur Oxide Emission Control Areas; efforts are already underway to seek this designation for certain European waters. (See Appendix 6)

**Recommendation 16–10. The United States should ratify MARPOL Annex VI and work for adoption by the International Maritime Organization of stricter air emission standards that reflect advances in marine engine technology, availability of cleaner fuels, and improved operational practices. The U.S. Environmental Protection Agency should consider the potential designation of certain U.S. ocean and coastal areas with impaired air quality as Annex VI Sulfur Oxide Emission Control Areas.**

### *Recreational Vessels*

At the other end of the spectrum, the millions of smaller recreational boats with gasoline-fueled, spark-ignition engines may contribute more than 10 percent of total hydrocarbon emissions in some areas of the nation,<sup>33</sup> contributing to ozone formation and associated health problems. EPA has issued regulations under the Clean Air Act to reduce these emissions by requiring the use of significantly improved two-stroke engine designs or substitution with four-stroke engines, either of which will significantly reduce air emissions. EPA estimates that by 2025, after the new engines are in widespread use and the old engines have been largely retired, there will be a 75 percent reduction in hydrocarbon emissions from recreational vessels.<sup>34</sup> Environmental benefits could be achieved even more rapidly if incentives were provided for boat owners to retire old engines before required.

**Recommendation 16– 11. Congress should create an incentive program for boat owners to install or use less polluting engines in recreational boats.**

EPA can also work with state government, recreational boating associations, and marinas to expand education and outreach programs urging recreational boaters to properly maintain engines and fuel systems to optimize combustion and to replace old two-stroke engines more rapidly.

### **Oil Releases**

Vessels can release oil into the marine environment in a variety of ways, including accidental spills of oil and fuel, release of oil during normal engine operations, and intentional discharges. Two devastating recent spills off the coast of Europe involving older single-hull tankers—the *Erika* in 1999 and the *Prestige* in 2002—clearly demonstrate the challenges presented as ship operators and government agencies work to prevent future spills.

### ***Single-Hull Vessel Phase-outs***

One of the major initiatives designed to prevent oil spills is the phase-out of single-hull tankers and barges and their replacement by double-hull vessels. In December 2003, IMO adopted amendments to MARPOL, scheduled to enter into force in 2005, that accelerate international phase-out schedules for single-hull tankers and introduce a ban on carriage of heavy oils by certain single-hull tankers. The IMO provisions reflect similar actions that entered into force in the European Union in October 2003.

Prior to recent international actions, concerns had been raised in the United States about sufficient oil carriage capacity, as regulations under the Oil Pollution Act (OPA) required phase-outs of single-hulls. (The international phase-out schedule differs in certain respects from the schedule under OPA.) A 2000 GAO report analyzed domestic capacity in the U.S. fleet and determined that the industry had sufficient capacity in the near term, but that future capacity was less clear and merited regular examination.<sup>35</sup> As the European and IMO initiatives took shape, additional concerns were raised about their impacts, including the limitations on carriage of heavy oils and the possible diversion of single-hull tankers from the European to U.S. trade. Building on recommendations in the GAO report, the U.S. Department of Transportation and the U.S. Coast Guard need to continue to assess issues related to the phase-out of single-hull vessels. The assessments should address the capacity to meet U.S. demand for double-hull vessels and include evaluations of the impacts of recent MARPOL amendments.

### ***Aging Infrastructure***

While vessel spills are the leading source of oil releases associated with the oil transportation industry, there is also growing concern about the threats posed by aging pipelines and other oil transportation facilities.<sup>36</sup> Reflecting these concerns, Congress and the Office of Pipeline Safety have introduced new statutory and management measures designed to improve pipeline safety. The most effective long-term approach to protection of the marine environment from transportation-related oil spills is a comprehensive, risk-based assessment of potential threats, prioritization of responses, and a coordinated plan of action among agencies responsible for different segments of the oil transportation industry.

**Recommendation 16–12. The U.S. Department of Transportation, U.S. Coast Guard, U.S. Environmental Protection Agency, and Minerals Management Service should conduct a risk-based analysis of all oil transportation systems, identify and prioritize areas of greatest risk, and develop a comprehensive plan for long-term action to reduce the threat of significant spills.**

### ***Places of Refuge***

A *place of refuge* is the term given to a port or protected coastal area that can accommodate ships in distress and help prevent or mitigate the impact of spills. In 2001, the *Castor*, a fully laden tanker that had developed a structural problem in the Mediterranean, was forced to remain at sea for thirty-five days until finally allowed into sheltered waters for cargo transfer and repairs. Many believe that the catastrophic impacts caused by the 2002 *Prestige* oil spill off the coast of Spain may have been avoided or significantly reduced had the distressed vessel been allowed into sheltered waters to transfer its cargo, rather than towed farther out to sea.

In December 2003, the IMO approved new guidelines on places of refuge for distressed ships when human life is not threatened. The guidelines are based on the premise that the best way to prevent damage from the progressive deterioration of a vessel is to transfer its cargo and fuel, and that this is best accomplished in a place of refuge. The guidelines provide a framework for assessing individual cases and taking appropriate action. However, recognizing that the potential economic and environmental consequences of bringing a distressed vessel to the coast are likely to generate political involvement, the guidelines also recommend actions to facilitate communication and decision making during the time of crisis.

Additional work is needed in the United States to create an effective process for responding to vessels seeking refuge. While this will be difficult, it will be too late to find satisfactory solutions once an incident like the *Prestige* disaster is underway. A series of government and industry forums have identified many issues to be addressed, among them: establishing a single point of contact for ship-to-shore communications; identifying available salvage, lightering, and technical resources in local areas; identifying the responsible decision makers at federal, state, and port levels; resolving financial protection, liability, and compensation issues; and deciding whether potential places of refuge should be designated in advance. There is a broad consensus that contingency plans should: allow for consistent implementation at the national, regional, and port levels; provide specific direction on how to receive and act upon requests for assistance in a timely and coordinated manner; and establish clear lines of authority and responsibility for deciding whether to grant a ship's request for refuge.

**Recommendation 16-13. The U.S. Coast Guard, working with the spill response community, should develop comprehensive policy guidance and contingency plans for places of refuge in the United States. The plans should clearly delineate decision-making authorities and responsibilities and provide for a coordinated and timely assessment and response to vessels seeking a place of refuge.**

### ***Pollution Prevention and Response***

U.S. efforts to reduce oil spills from vessels have been very successful, largely due to requirements established by OPA and initiatives by industry working in partnership with government agencies, particularly the Coast Guard. Following the enactment of OPA in 1990, oil released through vessel spills in the United States dropped by more than 60 percent, from over fourteen gallons per million shipped between 1983 and 1990 to 5 gallons per million between 1991 and 1998 (Figure 16.2).<sup>37</sup>

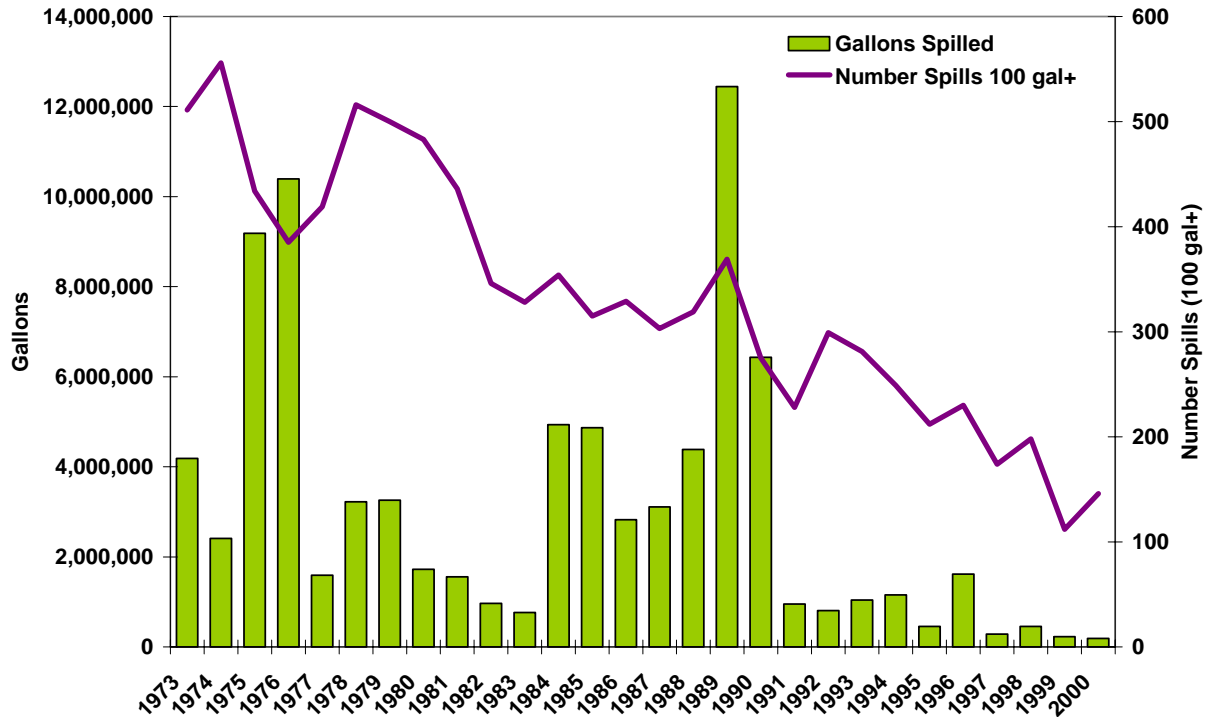
While barge spills have also declined dramatically in the last decade, a 2002 National Research Council report indicated that between 1990 and 1999 the amount of oil released into U.S. waters from barge spills, particularly from spills of heavy distillates, exceeded spills from other vessel sources, including tankers.<sup>38</sup>

Sunken and abandoned vessels also pose environmental dangers. These wrecks may still contain significant amounts of oil or other hazardous substances and represent an increasing threat of gradual or sudden releases to the environment as the vessels age and deteriorate.

When a spill does occur, the United States has a well-developed National Response System (NRS) to manage threats from oil discharges, hazardous chemical releases, and other toxic spills. The NRS includes: a National Response Team made up of sixteen federal agencies; Regional Response Teams, with federal, state, and territorial representatives; Area Committees; and Local Emergency Planning Committees under supervision of their State Emergency Response Commissions. National, regional, and area contingency plans provide an organizational structure, develop policy guidance, and coordinate federal, state, and local responses to discharges and threats of discharges. Federal on-scene coordinators, designated in advance from the Coast Guard, coordinate response resources and efforts during an incident.

The need remains for continued vigilance, dedication of resources, prioritization of threats, and development of additional preventive actions to reduce the number and impacts of oil spills in U.S. waters.

**Figure 16.2. The Oil Pollution Act Curbs Spills in U.S. Waters**



While the overall number of oil spills has decreased steadily since the early 1970s, the volume of oil spilled fluctuated significantly between 1973 and 1990. However, following the *EXXON Valdez* spill in 1989 and the resulting passage of the Oil Pollution Act in 1990, the amount of oil released into the environment was significantly reduced. Data courtesy of Environmental Research Consulting, Cortlandt Manor, NY.

### *Oil from Recreational Vessels*

The millions of recreational vessels and personal watercraft with two-stroke outboard motors are estimated to be a substantial source of petroleum contamination in U.S. waters, although the true magnitude of the problem remains unclear. The National Research Council has estimated that two-stroke outboard motors release anywhere between 0.6 and 2.5 million gallons of oil and gasoline into U.S. coastal waters every year.<sup>39</sup> Petroleum products also spill into coastal waters when boaters are refueling.

Most of the approximately ten million gasoline-fueled recreational motorboats and personal watercraft have older two-stroke engines that will continue to discharge air and water pollutants until they are retired.<sup>40</sup> Actions to reduce air pollutants from recreational vessel engines (discussed above), including upgrades for two-stroke engines, replacement with four-stroke engines, owner incentives, and general boater education, will also reduce discharges of oil, gasoline, and fuel additives.

## INCREASING KNOWLEDGE TO GUIDE CHANGE

### Additional Research Needs

A common theme in any pollution prevention strategy is the need to acquire a better understanding of the impacts of various forms of pollution and the potential for new control technologies. Research can help identify the degree of harm represented by different human activities and can assist in prioritizing limited resources to address the most significant threats. Research must also be at the heart of any science-based

approach toward developing new regulatory and non-regulatory measures to control vessel pollution. Useful research directions include investigations of:

- processes that govern the transport of pollutants in the marine environment;
- small passenger vessel practices, including the impacts of stationary discharges;
- disposal options for concentrated sludge resulting from advanced sewage treatment on large passenger vessels;
- cumulative impacts of commercial and recreational vessel pollution on particularly sensitive areas, such as coastal areas with low tidal exchange and coral reef systems; and
- impacts of vessel air emissions, particularly in ports and inland waterways where the surrounding area is already having difficulty meeting air quality standards.

These examples represent only a small fraction of the research that is needed to increase our understanding of, and our ability to respond to, potential threats to our marine environment from vessel pollution.

**Recommendation 16–14. The U.S. Environmental Protection Agency, National Oceanic and Atmospheric Administration, U.S. Coast Guard, and other appropriate public and private entities should support a vigorous research program on the impacts of all types of vessel pollution. Research results should be used to guide management priorities, develop new control technologies, determine best management practices, and create more effective regulatory regimes.**

### **Improving Awareness of Ocean Activities**

Vessel safety and environmental protection depend not only on appropriate operation of each vessel, but on the safe movement and management of all vessel traffic. Effective vessel traffic management takes place within the larger context of other coastal and ocean uses and requires accommodation between those uses and navigation.

The rapidly increasing variety and number of offshore uses, and the potential for conflicts between competing interests operating in the same area, will increase the need for information concerning the nature and extent of offshore activities. In today's highly interdependent world, efforts to ensure national security, maintain environmental quality, and manage the use of marine resources will require unprecedented awareness of activities, trends, conditions, and anomalies in the maritime domain, including those that may require some intervention.

The Coast Guard, which has a leading role in developing increased maritime domain awareness, defines it as "...the effective understanding of anything in the marine environment that could adversely affect America's security, safety, economy, or environment."<sup>41</sup> For the Coast Guard, maritime domain awareness applies equally to fisheries enforcement, illegal human migration, marine safety, environmental protection, and search and rescue efforts.

While much of the recent effort to increase maritime domain awareness has grown out of concerns for national security, heightened by the September 11, 2001 terrorist attacks, the information gained will benefit a variety of other national interests. For instance, the expanded use of the Automated Identification System not only tracks and identifies vessels for security purposes, but provides information to assist safe navigation and help reduce the risk of accidents that could adversely impact the marine environment. The information can also help identify areas of vessel congestion or potential conflicts with other uses, thus serving as a valuable management tool.

The development of greater maritime domain awareness coincides with efforts to develop more comprehensive, ecosystem-based management approaches for ocean and coastal activities. Close coordination of these efforts will help ensure that the information products developed through maritime awareness can be integrated into other monitoring and observing networks to support a broad variety of management needs.

**Recommendation 16-15. The National Ocean Council should coordinate closely with the U.S. Coast Guard to ensure that initiatives to enhance maritime domain awareness are developed and implemented to provide effective support for all ocean and coastal management needs.**

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