

GAO

Report to the Honorable
Arlen Specter, U.S. Senate

February 1989

INLAND OIL SPILLS

Stronger Regulation and Enforcement Needed to Avoid Future Incidents



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United States
General Accounting Office
Washington, D.C. 20548

**Resources, Community, and
Economic Development Division**

B-232923

February 22, 1989

The Honorable Arlen Specter
United States Senate

Dear Senator Specter:

As you requested, this report assesses federal regulation of above ground oil storage tanks and certain elements of the federal oil spill cleanup program.

Unless you publicly release its contents earlier, we will make this report available to other interested parties 30 days after the date of this letter. At that time, copies of the report will be sent to appropriate congressional committees; the Administrator, Environmental Protection Agency; the Director, Office of Management and Budget; the Commandant, U. S. Coast Guard; and the oil companies referred to in the report. We will also make copies available to others upon request.

This work was performed under the direction of Hugh J. Wessinger, Director, Environmental Protection Issues. Other major contributors are listed in appendix I.

Sincerely yours,

A handwritten signature in cursive script, appearing to read 'J. Dexter Peach'.

J. Dexter Peach
Assistant Comptroller General

Executive Summary

Purpose

In January 1988, about 1 million gallons of diesel fuel spilled into the Monongahela River when an above ground oil storage tank collapsed at the Ashland Oil Co. facility near Pittsburgh. In April 1988, 400,000 gallons of crude oil leaked into a waterway near the San Francisco Bay from a storm water drainage system at a Shell Oil Company above ground tank. The spills contaminated drinking water, damaged the environment and private property, killed wildlife, and disrupted businesses. Senator Arlen Specter requested that GAO, in view of these spills, assess the adequacy of federal regulation of above ground oil storage tanks and the federal inland oil spill removal program.

Background

The Clean Water Act prohibits the discharge of oil into navigable waters and requires the Environmental Protection Agency (EPA) to regulate the oil industry to prevent oil spills and conduct research on the cleanup of spills. EPA's Oil Pollution Prevention regulations issued pursuant to the act require an estimated 650,000 on-shore oil storage facilities to prepare spill prevention plans and set out guidelines for plan contents. These guidelines recommend that tanks be constructed of appropriate materials and be tested periodically for integrity, and that tank operators take precautions to contain spilled oil. In addition, various industry groups have established tank construction and testing standards and state and local governments regulate and inspect tanks.

The act also required EPA to develop the National Contingency Plan which established oil spill response procedures for federal agencies. The plan makes EPA and the Coast Guard chiefly responsible for performing federal cleanups when the party responsible for the spill cannot or will not do the cleanup and for monitoring private party cleanups.

Results in Brief

EPA's regulations do not contain mandatory, specific design and operating practices to avoid spills like the Ashland and Shell spills. Although the regulations recommend safety practices, they do not require that (1) tanks be constructed and tested to meet industry or other specified standards, (2) oil storage facilities plan how to react to an oil spill that overflows facility boundaries, and (3) tank storm water drainage systems be controlled to prevent oil from escaping through them. Imposing and enforcing specific regulations in these areas would reduce the chances of future damaging spills.

EPA also does not have information regarding the number, age, and location of oil storage facilities and the construction and operation of tanks.

Because of inadequate data, EPA's inspection program does not ensure that those posing the greatest threat to the environment are inspected first. Further, EPA has not given inspectors sufficient training and guidance. Inspections were not thorough and well documented in the four EPA regions GAO visited. Finally, most EPA regions have not fined facilities that violated EPA regulations.

Only about one-fifth of the oil spilled into the Monongahela River from the Ashland facility was recovered with available equipment and methods. EPA needs to see if inland oil spill recovery technology can be improved. In addition, EPA and the Coast Guard do not recover costs of monitoring a spiller's cleanup although these costs can be substantial.

Principal Findings

Pollution Regulations

EPA's regulations do not require that operators of oil storage facilities construct and test tanks using industry standards. The Ashland tank was not constructed of materials meeting current industry standards and was not tested for integrity as required by these standards. The tank ripped apart when it was first filled to capacity. Subsequent metallurgical analysis showed that it was not tough enough for the cold temperatures and stress to which it was subjected.

Also, because the regulations do not require that facility owners and operators plan a response to the discharge of oil onto adjacent property, they may be unprepared to deal with this contingency. Before workers realized it, oil from the collapsed Ashland tank reached the Monongahela River through a storm drain outside the Ashland facility.

Equipment and operational deficiencies caused the Shell tank to discharge oil from a storm water drainage system. EPA's regulations do not mandate specific design and operating requirements for this type of system.

Enforcing the Regulations

EPA has not established management controls for its inspection program to ensure that the right facilities are inspected, inspections are well performed, and violations are deterred by appropriate sanctions. A need for

better enforcement is indicated by the large number of oil spills occurring annually—from 2,000 to 3,000 each year since 1982—and by widespread violations of the regulations in the 4 EPA regions GAO visited. In these regions, 41 to 94 percent of inspections found noncompliance with the regulations.

EPA needs more information to decide which tanks to regulate most strictly and inspect most often. For example, because of the threat they may pose, EPA should identify tanks constructed of substandard materials which are located near drinking water. According to EPA officials, because of limited funds, EPA often inspects oil facilities near sites being inspected under other EPA programs.

Inspections were sometimes superficial and poorly documented. In an effort to stretch resources, one region did “windshield” inspections. That is, inspectors observed facilities from the roadway without any examination on-site. GAO also found inspection reports that did not indicate what inspectors checked or what specific violations they found.

The act authorizes fines of up to \$5,000 per violation of the oil pollution prevention regulations. Despite numerous oil spills and other violations, 7 of the 10 EPA regions have not levied fines.

Oil Spill Response Capabilities

Ashland’s cleanup operations only recovered about one-fifth of the oil it spilled into the Monongahela River. EPA and Coast Guard officials believe that the spill response was about as effective as was possible, given weather and river conditions and the technology available. However, some officials told GAO that currently available equipment is not well suited for spills on fast flowing rivers. EPA’s spill response research program was eliminated in 1987 because of budget pressure.

Recovering Monitoring Costs

The act gives federal agencies the right to recover from the responsible party the costs of cleaning up an oil spill. However, the act does not clearly indicate that agencies can recoup their costs of monitoring a cleanup conducted by a private party. These costs can be large and disrupt normal agency operations. For example, EPA spent about \$370,000 monitoring Ashland’s cleanup in the first month and a half following the spill.

Proposal to Strengthen the Program

The EPA units at headquarters and in the regional offices which administer the oil pollution prevention program are also responsible for the Superfund program, a high priority effort to clean up the nation's worst abandoned hazardous waste sites. The emphasis given to the Superfund program, officials said, had diverted resources and attention away from the oil program, with the result that more detailed regulations and better management controls had not been developed. However, following the Ashland spill, EPA convened a multi-agency task force to review its oil program. Like GAO, the task force concluded that EPA's regulations and inspection program needed strengthening. The recommendations made by GAO and the task force are, to a large extent, similar.

Recommendation to the Congress

The Congress should amend the Clean Water Act to explicitly authorize the federal government to recover the costs of monitoring oil spill clean-ups performed by private responsible parties.

Recommendations to the Agency

To reduce the likelihood of future damaging oil spills, GAO recommends that the Administrator, EPA

- amend the Oil Pollution Prevention regulations to require that (1) above ground oil storage tanks be built and tested in accordance with industry or other specified standards, (2) facilities plan how to react to a spill that overflows facility boundaries, and (3) storm water drainage systems be designed with controls to prevent oil from escaping through them;
- inventory above ground oil storage facilities and implement policies for (1) selecting facilities to inspect after coordinating with state and local authorities, (2) conducting and reporting inspections, and (3) fining violators; and
- reassess the need for research and development to improve inland oil spill responses, taking into account anticipated benefits, costs, and other program priorities.

Agency Comments

GAO discussed the report's contents with EPA and Coast Guard officials, and incorporated their comments where appropriate. However, as directed, GAO did not obtain agency comments on a draft of this report.

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Abbreviations

API	American Petroleum Institute
EPA	Environmental Protection Agency
GAO	General Accounting Office
NBS	National Bureau of Standards
NCP	National Contingency Plan
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
SPCC	Spill Prevention Control and Countermeasure Program

Introduction

The U.S. Environmental Protection Agency (EPA) estimates that there are more than 650,000 on-shore oil storage facilities nationwide with above ground oil storage tanks. The total number of storage tanks in use at these facilities is unknown, but some facilities have more than 1,000 tanks. To facilitate transportation of petroleum products, the petroleum industry frequently locates storage facilities along coastal and inland waterways. Oil spills from these storage tanks can contaminate drinking water supplies, harm wildlife, and damage sensitive environmental areas. Since 1982, 2,000 to 3,000 oil spills originating from oil storage facilities have been reported to the federal government annually. Some of these spills enter coastal and inland waterways, causing environmental damage.

Two unusually large and harmful spills occurred in the first half of 1988. Oil facilities at Ashland Oil in Floreffe, Pennsylvania, and Shell Oil in Martinez, California, spilled almost 1.4 million gallons of oil into inland waters. In response to these spills, Senator Arlen Specter asked us to review federal regulation of above ground oil storage tanks and the cleanup of inland oil spills.

Regulatory Authorities

The Clean Water Act establishes EPA's authority to regulate above ground oil storage tanks in order to prevent oil spills into navigable water and to remove or arrange for the removal of oil from navigable water. Specifically, the act authorizes EPA to issue regulations establishing (1) procedures, methods, equipment, and other requirements to prevent the discharge of oil from storage facilities and (2) methods and procedures for removal of discharged oil. It further requires facility owners or operators to immediately notify the appropriate government agency of a spill. The act authorizes the government to clean up oil spills unless the government determines that the cleanup will be done properly by the responsible party. The act sets penalties for violators and makes them liable for government cleanup costs. The act also requires EPA to conduct research on the prevention and cleanup of oil spills.

EPA's Oil Pollution Prevention regulations and the National Contingency Plan (NCP) implement the oil spill prevention and removal provisions of the act. The Oil Pollution Prevention regulations require the owners and operators of oil storage facilities to prepare spill prevention, control, and countermeasure (SPCC) plans. These plans outline facility pollution prevention measures designed to prevent spills into navigable water. EPA's regional offices administer an inspection program in order to ensure that the facilities are in compliance with the regulations. Most

inspections are performed by EPA contractors. The NCP authorizes EPA and the U.S. Coast Guard to remove spilled oil or arrange for the removal of oil unless it is done properly by the owner or operator of the facility.

In addition to EPA, the Occupational Safety and Health Administration (OSHA) has authority to regulate above ground oil storage tanks. Under the Occupational Safety and Health Act, OSHA has adopted accepted industry standards for the design, construction, and testing of tanks. These standards have been developed by, among others, the American Petroleum Institute (API), an industry association, for the design, construction, and testing of tanks. However, according to OSHA officials, OSHA rarely inspects oil storage tanks because they present a low threat to employee safety.¹ The U.S. Coast Guard does not regulate inland above ground oil storage tanks.

States and counties also regulate oil storage facilities to prevent fires, and enforce applicable state and local requirements. According to API representatives, most states have adopted industry standards regarding the construction and testing of above ground oil storage tanks. For example, they may require that tank facilities comply with the National Fire Protection Association (NFPA) code that incorporates widely accepted industry standards.²

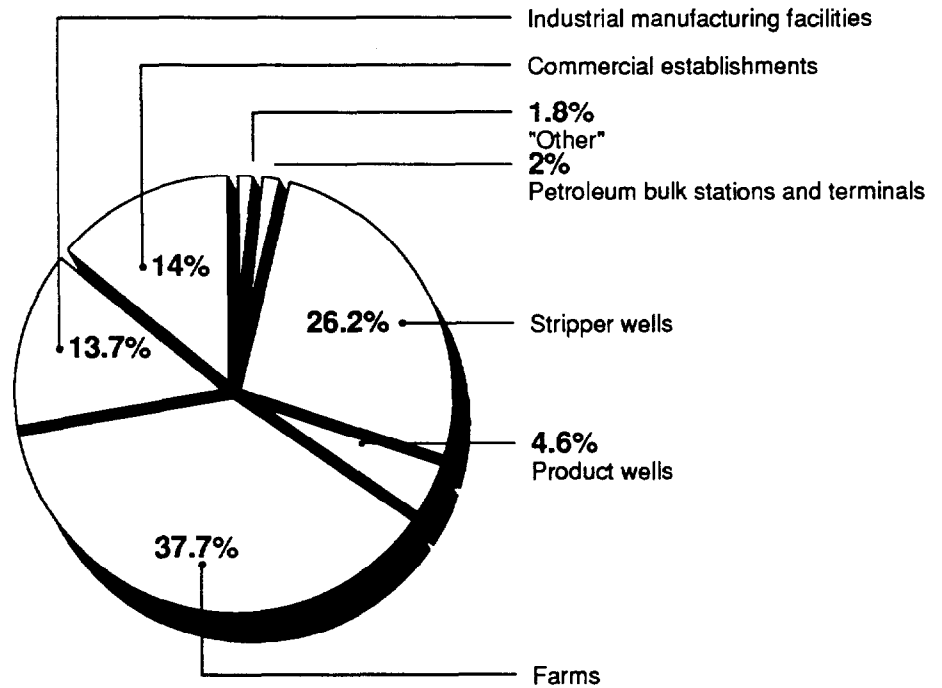
Industry Size

Aggregate data on the number, age, location, and condition of above ground oil storage tanks in the United States is unavailable. However, EPA estimates the number and type of facilities (which may contain one to many tanks) used to store petroleum and petroleum by-products that are subject to EPA's Oil Pollution Prevention regulations. These facilities—estimated to total approximately 650,000—are located at farms, and manufacturing and commercial establishments, as well as oil production, storage and other operations. (See fig. 1.1.)

¹OSHA workplace inspections of the manufacturing industries are ranked in order of priority according to a targeting system that identifies lost work-day injury rates. Industries which have the highest lost work-day injury rates receive the highest inspection priority because they are perceived as presenting the greatest threat to worker safety.

²NFPA was established in 1896 as a voluntary organization composed of engineers, architects, health professionals, and firefighters; its purpose is to develop and promote fire safety codes and standards.

Figure 1.1: Types of Oil Storage Facilities That Fall Under the Clean Water Act



Note: "Other" represents different types of facilities—including fuel oil dealers, petroleum products wholesalers, oil refineries, airports, bus terminal facilities, and trucking terminal facilities—each of which totaled 5,000 or fewer units.

Approximately 650,000 oil storage facilities in the United States come under the oil spill prevention regulations contained in the Clean Water Act.

Source: EPA.

Two Recent Major Inland Oil Spills

EPA reports that, of the 2,000 to 3,000 spills annually, about 20 to 30 spills of more than 150,000 gallons from above ground storage tanks enter inland and coastal waterways. During the first 4 months of 1988, spills from two above ground oil storage tanks caused approximately 1.4 million gallons of oil to enter inland waterways, contaminating drinking water sources, killing indigenous animal life, and producing extensive damage to sensitive ecosystems.

The Ashland Oil Tank Collapse

In January 1988, a 4-million gallon oil storage tank owned by Ashland Oil Company, Inc., split apart and collapsed at an Ashland oil storage facility, located in Floreffe, Pennsylvania, near the Monongahela River. The tank had been dismantled at an Ashland facility in Ohio and moved

to Floreffe where it was reassembled. It was being filled to capacity for the first time when it split. About 1 million gallons of the released diesel oil splashed over the tank's containment dikes, flowed across a parking lot on adjacent property, and poured into an uncapped storm drain that emptied directly into the river. Within minutes the oil slick moved miles downriver, washing over two dam locks and emulsifying into small droplets of oil dispersed throughout the width and depth of the river. The oil was carried by the Monongahela River into the Ohio River. The spill

- temporarily contaminated drinking water sources for an estimated 1 million people in Pennsylvania, West Virginia, and Ohio;
- contaminated the Monongahela and Ohio rivers ecosystems;
- killed thousands of birds and fish indigenous to the river environment;
- closed the Monongahela River to commerce; and
- damaged private property and adversely affected businesses in the area.

The cleanup of the spill was conducted by contractors employed by Ashland. EPA, assisted by the Coast Guard and several other federal agencies, monitored Ashland's cleanup and river conditions. To recover the spilled oil, Ashland's contractors employed booms, vacuum trucks, and other equipment, enabling them to retrieve about 20 percent of the oil that escaped into the river. In September 1988, Ashland Oil Company was indicted by a federal grand jury for negligently discharging oil into the Monongahela River in violation of the Clean Water Act.³

The Ashland oil storage tank collapse is similar to other catastrophic above ground oil storage tank failures. The oil industry has documented oil tank collapses in the United States, Canada, and Europe dating as early as the 1940s and as recently as the 1980s. Nine tank failures were included in a 1954 survey of oil storage tank failures completed by API. The survey showed that the nine tanks suffered complete failures, that is, the tanks fractured and had to be replaced. In addition to the Ashland case, three other total tank failures have occurred since the 1954 survey: in the United States (1972), Canada (1980), and Holland (1970). Similarities among the failures described above and the Ashland failure include cold weather at the time of the failure, and tank construction using metals subject to fracture in cold temperatures.

³The sections of the Clean Water Act allegedly violated pertain to the prohibition against discharging pollutants without a permit.

Almost all of the U.S. failures in the survey occurred during the coldest months of the year, November through March, in the colder regions of the country. The Ashland failure occurred in January with the temperature reported to be 25 degrees Fahrenheit. Three of the tanks reported to have failed in the API survey were welded tanks constructed during the 1940s. The Ashland tank was also a welded tank and was originally built during the late 1930s or early 1940s, using materials that met industry standards at the time.⁴

Two scientific studies of the cause of the Ashland tank collapse, conducted by Battelle Memorial Institute⁵ in Ohio and the National Bureau of Standards (NBS) (completed in May and June 1988 respectively), concluded that the collapse resulted from a brittle fracture in the shell of the tank. According to the studies, brittle fracture in steel is a phenomenon that occurs when three factors—inadequate steel toughness, stress, and a flaw in the steel—coexist. According to the studies, prior research into the causes of failures in steel structures such as ships and oil storage tanks revealed the same pattern. The studies determined that all the factors were present at the time that the Ashland tank collapsed. The steel used in the tank did not meet current toughness standards for the relatively cold climate in which it was placed; the tank was stressed when it was filled to capacity for the first time; and a flaw in the tank shell, caused by cutting the metal years earlier, was discovered at the origin of the split.

The API survey of tank collapses and the Ashland collapse highlight the potential for brittle fracture in tanks. The reports of earlier collapses of above ground oil storage tanks have been of great significance in the design, construction, and testing of above ground storage tanks. API standard 650 established toughness criteria related to the thickness of the material and the temperature of the environment in which the material is used, and toughness tests, such as filling a tank with water prior to its regular use, that reduce the risk of brittle fracture.

The Shell Oil Tank Spill

On April 23, 1988, the roof drainage system of a 12.6-million-gallon oil storage tank at a Shell Oil Refinery in Martinez, California, failed as a

⁴Steels of that time period were manufactured using a process that typically resulted in steel of a lower toughness than steel permitted under today's standards for use in above ground oil storage tanks.

⁵Battelle Memorial Institute is an international technology organization that serves industry and government with a wide range of scientific and technical capabilities.

result of malfunctioning equipment. According to Shell Oil's report to the California Regional Water Quality Control Board describing the incident, the spill occurred because a flexible rainwater drain pipe inside the tank separated from its coupling and a cutoff valve was left open by workers. Approximately 400,000 gallons of crude oil drained from the tank into a marsh and subsequently into the Carquinez Strait, a waterway that empties into the San Francisco Bay. The oil spill

- caused extensive damage to the ecosystem,
- killed indigenous wildlife in the vicinity, and
- damaged private property.

The roof of the Shell tank is designed to float on the stored liquid in order to eliminate vapor space or maintain it at a constant level above the oil. According to EPA's preliminary inspection of the incident, and as depicted in figure 1.2, the tank's roof drainage system was designed to drain rainwater from the roof of the tank through a wall (berm) around the tank, to be discharged into a marsh that leads to the Carquinez Strait.

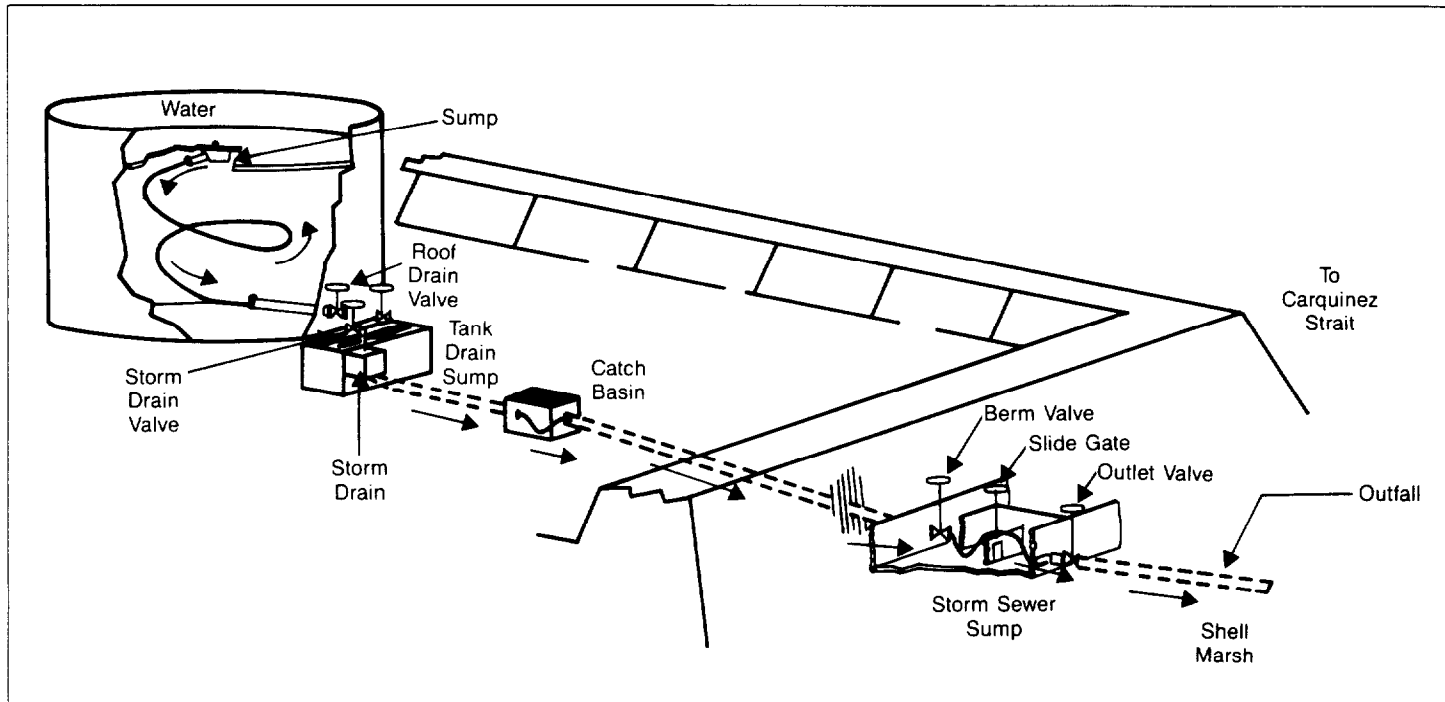
During periods of rain, the roof drain valve is opened and water empties into the storm drain box from the roof of the tank. The berm valves would normally be closed, forcing water to accumulate inside the berm, which would be drained only after checking for oil. When all valves are open, water passes through the system and discharges directly into Shell Marsh, which drains into the Carquinez. Shell internal operating procedures require that an attendant be present when the berm valve is opened in order to monitor the rainwater being drained from the system. Shell officials said it violated its own internal operating procedures by leaving the open berm valve unattended.

Shell and its contractor performed the cleanup of this oil spill under Coast Guard supervision using oil skimmers to clean up the water and vacuum trucks to collect oil in the marsh. In addition, they collected and cleaned contaminated wildlife and restored privately owned oil-stained boats to their original condition. According to Shell estimates, approximately 90 percent of the oil was recovered.

Objectives, Scope, and Methodology

Senator Arlen Specter originally asked us to examine questions associated with the January 2, 1988, Ashland oil spill in Floreffe, Pennsylvania. The assignment was subsequently expanded, at the request of

Figure 1.2: Drawing of Shell's Tank Roof Drainage System



Source: Shell Oil Company.

the Senator's office, to include an examination of the oil spill at the Shell Oil refinery in Martinez, California. We were asked to review the events surrounding these oil spills and to provide a report focusing on the following questions:

- Is federal regulation of above ground oil storage tanks adequate?
- Does the federal oil spill removal program adequately address the unique problems of an inland oil spill?

We performed our work at the headquarters of EPA and the Coast Guard, at field locations in EPA Regions III, V, VI, and IX, headquartered in Philadelphia, Chicago, Dallas, and San Francisco, respectively. We selected these regions because they had the largest number of oil spills from above ground oil storage tanks in calendar year 1987, (spills in these regions comprised approximately 70 percent of the total number of spills of 1,000 gallons or more), and because Regions III and IX played a role during the Ashland and Shell spills. We reviewed a May 1988 report of the SPCC Task Force, which was established on February 2, 1988, to review the tank program following the Ashland spill. In addition, we

interviewed Pennsylvania and California state and local officials who were involved in overseeing the cleanups of the spills, and met with Ashland and Shell Oil company representatives. We also met with oil and steel industry experts in California, New York, and Washington, D.C.

To determine the adequacy of federal regulations concerning above ground oil storage tanks, we reviewed regulations implementing the (1) Clean Water Act's spill prevention requirements and (2) Occupational Safety and Health Act's flammable and combustible liquids requirements pertaining to oil storage tanks. We reviewed the inspection program used by EPA and its regional offices to enforce its Oil Pollution Prevention regulations. Although OSHA has written regulations for above ground oil storage tanks to enhance worker safety, our review focused on the adequacy of EPA's regulations and its enforcement program because EPA is charged by the Clean Water Act with preventing inland oil spills from above ground oil storage tanks. OSHA, for the reasons noted earlier, inspects few above ground oil storage tanks. EPA does not have authority to enforce OSHA regulations.

We reviewed studies conducted by federal, state, and private sector organizations of the Ashland and Shell oil spills. We also examined internal directives, correspondence, and orders that EPA uses to implement its regulations, and evaluated reports from various information systems regarding the compliance rate of oil storage facility owners and operators with EPA's Oil Pollution Prevention regulations. We discussed the regulations and EPA's inspection program with EPA, Coast Guard, and state government officials and with industry experts, and reviewed spill and inspection records maintained at EPA and Coast Guard headquarters and at EPA regional offices.

To determine whether the federal oil spill cleanup program adequately addresses the unique problems of an inland oil spill, we reviewed the NCP, which implements the Clean Water Act's oil removal requirements. We examined the question of whether the federal government has the authority under the Clean Water Act to recover its costs of monitoring a major spill cleanup performed by a private party. We discussed this question with lawyers from EPA and the Coast Guard and reviewed the act's legislative history. Finally, we discussed with EPA and Coast Guard officials, federal efforts to improve spill responses through research and development of new technology and methods.

Our work included a review of EPA's internal controls over the inspection program it uses to enforce its Oil Pollution Prevention Regulations. We reviewed the EPA Administrator's annual statements and reports required by the Federal Managers' Financial Integrity Act of 1982 to identify control weaknesses on inland spills. None were listed.

We conducted our review from February 1988 until October 1988 in accordance with generally accepted government auditing standards. We discussed our findings with EPA's Office of Emergency and Remedial Response and Coast Guard's Marine Safety Office and incorporated their comments where appropriate. However, as requested, we did not obtain official agency comments on a draft of this report.

Stronger Regulations Could Enhance Above Ground Oil Storage Tank Safety

EPA's Oil Pollution Prevention regulations recommend but do not make mandatory, specific oil storage tank design and operating practices to avoid spills such as occurred at the Ashland and Shell facilities. The regulations contain recommended guidelines but do not require that (1) above ground oil storage tanks be built and tested in conformance with industry or other specified standards, (2) tank operators develop plans to minimize damage from spilled oil that floods over a facility's boundaries, and (3) special safeguards be employed for storm water drainage systems that empty outside of tank containment areas. Instituting such mandatory requirements would likely prevent or limit the types of spills that occurred at the Ashland and Shell facilities.

EPA Regulations Do Not Mandate Standards for Safe Tank Construction

EPA regulations do not currently require that oil storage facility owners and operators use materials and testing procedures that meet industry or other specified standards. For example, the regulations state that an oil tank "should not be used to store oil unless the material and construction is compatible with the product stored and operating conditions such as pressure and temperature," but do not define compatible material and construction. The regulations also state that "above ground tanks should be tested periodically for integrity using hydrostatic testing (i.e., filling tanks with water), visual inspections and nondestructive tests of tank shells." EPA attorneys and program officials consider these provisions guidelines or recommendations—not requirements. The Regional Counsel for EPA Region III said that if a tank operator did not follow the guidelines, it could not be said to have violated the regulations.

In contrast to EPA's regulations, OSHA's regulations establish detailed requirements regarding the design, construction, and testing of above ground oil storage tanks. OSHA's requirements are based upon industry standards that have been developed by the American Petroleum Institute (API), Underwriters' Laboratories, and American Society for Mechanical Engineers. As indicated in chapter 1, OSHA rarely inspects oil storage tanks for compliance with these regulations because the tanks are not seen as a serious threat to worker safety.

According to a State of Pennsylvania investigation, when Ashland relocated the faulty tank to Pennsylvania, it did not determine whether the material the original tank was constructed of met the current API standard (API 650) which sets out specifications for the design, construction, and testing of large welded above ground steel tanks. API 650 establishes

specifications for the toughness of materials and recommends that certain materials be used in the construction of tanks, depending upon the temperature ranges in which they will be used. Further, the standard recommends that when materials are used at temperatures outside the API-specified temperature ranges, testing be performed to demonstrate that the material has adequate toughness at the temperature the material is being used. Ashland did not determine whether the material and construction was compatible with its new operating conditions, such as pressure and temperature, as recommended by EPA regulations. According to NBS chemical and mechanical analysis of the reconstructed tank after its collapse, the material used did not conform to any of the steels listed in current API materials standards, was inappropriate for the climate in which the tank was to operate, and exhibited toughness characteristics that NBS described as "seriously deficient."

API 650 lists grades of steel acceptable for oil storage tanks in various regions. The standard provides for the use of steel that is not listed as an allowable material by requiring the manufacturer of the tank to measure the properties of the steel and determine that the material meets the standards contained in API 650. According to the Pennsylvania Task Force, Ashland did not perform tests to determine the appropriateness of the unlisted steel.

According to the Fire Marshall for the county in which the Ashland facility was located, Ashland did not follow industry standards or EPA's guidelines for testing the tank to insure against tank leakage. API 650 requires that the tank be tested after it is built and before being put into service. The method suggested by the API and the method Ashland cites in its operations manual is the hydrostatic test. Under this method the tank would be filled with water to its design level and observed for leaks and possible fracture. EPA's guidelines recommend that periodic integrity testing, such as hydrostatic testing, be done. Ashland conducted only a partial hydrostatic test (filling the 48-foot-high tank to a level of 5 feet) before putting the tank into service.

Adherence to accepted industry standards during the reconstruction and testing of the Ashland oil storage tank might have prevented its collapse because the material used would have been tested to determine whether it was of sufficient toughness. However, following EPA regulations would not necessarily insure that the material used in the construction of the tank would have been of sufficient toughness because toughness tests are not required. As noted earlier, although Ashland was indicted for

violating the Clean Water Act, it was not fined for a violation of EPA regulations.

According to EPA officials, specific tank construction and testing standards were not written into its Oil Pollution Prevention regulations to allow the industry flexibility. The EPA Task Force set up after the Ashland spill concluded, as we do, that more specific requirements should now be included in the regulations.

Adequate Measures Not Established to Prevent Oil From Escaping Oil Storage Facilities

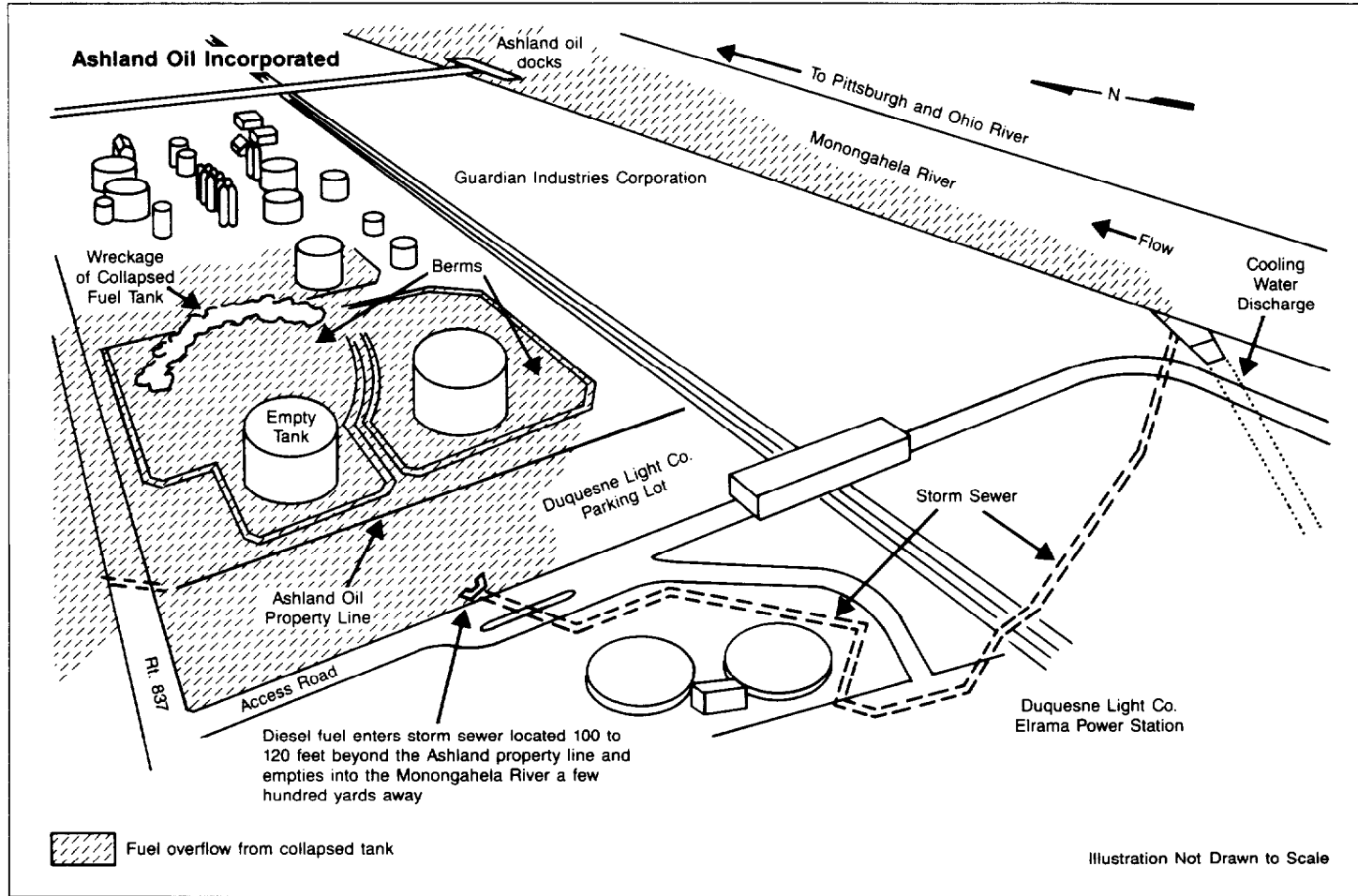
EPA Oil Pollution Prevention regulations require oil storage facility owners and operators to prepare and implement SPCC plans unless, because of its location, the facility could not reasonably be expected to discharge oil into navigable water. The regulations recommend that dikes or retaining walls sufficiently impervious to contain spilled oil be constructed around tanks or that equivalent protective techniques be used. The emphasis in the SPCC regulations is on containing spilled oil within a tank facility. The regulations do not require that tank owners and operators include in their SPCC plans provisions to deal with oil escaping in large quantities beyond the facility boundaries.

The Ashland oil spill into the Monongahela River is an example of the need to plan for the control of oil flooding beyond a storage facility. Following the Ashland tank collapse, an open storm drain on adjacent property about 100 yards from the Ashland facility provided the spilled oil direct, uncontrolled access to the Monongahela River. According to EPA, the drain was plugged approximately 12 hours after the spill occurred, too late to prevent approximately 1 million gallons of oil from reaching the river. (See fig. 2.1.)

The regulations recommend, but do not require, that certain tank owners or operators consider the path that oil escaping their facility will take and to include in their SPCC plans measures to deal with this event. According to EPA officials, workers responsible for the Ashland spill cleanup were unaware at first that a nearby storm drain offered the oil access to the river. The workers' first attempt to plug the drain was unsuccessful. According to EPA officials, EPA intended earlier in the oil program's history to write regulations detailing more specific requirements for SPCC plans, but the demands of the Superfund program,¹

¹Superfund is EPA's program to cleanup the nation's most dangerous abandoned hazardous waste sites.

Figure 2.1: Route of Diesel Fuel From Collapsed Tank Into Monongahela River



Source: Center for Hazardous Materials Research, University of Pittsburgh Applied Research Center

which is administered by the same EPA unit that operates the oil program, prevented the drafting of the regulations. The SPCC task force recommended that this gap in the regulations be closed.

EPA's regulations recommend, but do not require, that SPCC plans include controls on rainwater drainage systems from storage tank containment areas, such as dikes. These drainage systems create a danger of oil discharges into navigable waters and so may need special controls.

EPA regulations allow the discharge of rainwater from the containment areas into water courses, lakes, and ponds but include guidelines to prevent the accidental discharge of oil along with the storm water. The

guidelines include procedures that recommend inspecting the drained rainwater, supervising the opening and closing of the bypass valves, and adequately recording operations.

The Shell spill into the Carquinez Strait is an example of the potential effect that the lack of specific regulations for these drainage systems may have. As discussed earlier, mechanical failure of the roof drainage system and Shell employee practices allowed approximately 400,000 gallons of crude oil to flow into the drainage system, bypass the containment area, and flow undetected into the Strait. Shell amended its SPCC Plan after the spill to eliminate drainage from the roof of the tank and direct the storm water drainage into the tank containment area.

According to EPA officials, EPA's regulations recommend, but do not require, controls over tank storm water drainage, in order to allow flexibility for industry operations. An attorney in EPA's Region IX told us that the lack of specific requirements made fining Shell for a regulatory violation difficult. In October 1988, the Region was considering whether sanctions could be imposed on Shell.

The SPCC Task Force, which focused on the Ashland spill, did not directly address EPA's regulations for drainage systems. However, the Task Force did recommend in its May 1988 report that many of the regulations' guidelines be made mandatory to "require certain practices rather than only encouraging them."

Conclusions

The circumstances of the Ashland and Shell oil spills demonstrate the need to strengthen EPA's Oil Pollution Prevention regulations. The current regulations do not require that above ground oil storage tanks be constructed or tested in accordance with industry or other specified standards, that facilities plan how to respond to the flooding of spilled oil beyond facility boundaries, or that storm water drainage systems be designed and operated to prevent oil from passing through them. Stricter regulations in these areas could enhance tank safety.

Most of the conclusions and recommendations made in this and the following chapters parallel those made in the report of EPA's SPCC Task Force. EPA has established several work groups to decide how to implement the Task Force's recommendations.

**Recommendations to
the Administrator,
EPA**

To improve the likelihood that above ground oil storage tanks are built to industry standards and decrease the chances of future damaging oil spills, we recommend that the Administrator of EPA amend the Oil Pollution Prevention regulations to require that (1) above ground oil storage tanks be built and tested in accordance with industry or other specified standards, (2) facilities plan how to react to a spill that overflows facility boundaries, and (3) storm water drainage systems be designed and operated to prevent oil from escaping through them.

Better Inspections and Enforcement Would Improve Compliance

In the preceding chapter, we discussed why EPA should strengthen its Oil Pollution Prevention regulations. Once revised, these regulations need to be effectively enforced. To date, EPA has not established an effective inspection program. First, it does not know enough about regulated facilities to prioritize inspections so that facilities which pose the greatest threat to the environment are inspected. For example, EPA is not able to identify oil storage facilities and tanks by location, size, and age. In addition, EPA has not established national guidance regarding training of inspectors, performance of inspections, and fining of violators.¹ Inspections in the EPA regions we visited were superficial and poorly documented. Violators of the regulations were seldom fined. Effective inspections are important in order to improve compliance with the regulations by owners and operators of oil storage facilities.

According to EPA officials, management controls, such as a national inspection priority scheme and guidance on the conduct of inspections and imposition of fines, were not developed because the Superfund program has preoccupied the Agency's attention and diverted resources. The oil pollution prevention program was regarded as a lower priority by EPA.

EPA's SPCC Task Force studied the adequacy of inspection resources relative to the rate of noncompliance and recommended increasing SPCC inspection resources. While EPA may indeed need to seek increased resources we believe that it first should make the present inspection program more effective by (1) identifying the universe of oil storage facilities and the number, location, age and condition of tanks at the facilities; (2) prioritizing inspection of the facilities according to threat posed to the environment; (3) training and providing adequate guidance to its inspectors; and (4) penalizing violators of the regulations. In addition, EPA may be able to leverage its resources by encouraging state and local inspection authorities to review facilities for environmental hazards, and by requiring owners and operators of facilities to obtain inspection from independent engineers.

¹ According to EPA's regulations, a fine can be imposed, among other things, for failure to (1) prepare a plan, (2) have the plan certified by a professional engineer, (3) implement a plan, or (4) amend the plan when required.

National Tank Inventory and Policy to Select Facilities for Inspection Needed

EPA has not issued national guidance on how to select facilities for inspection, even though selectivity is necessary since the industry is large and inspection resources are limited. EPA cannot develop effective inspection priorities because it does not have much information on the number of facilities or tanks, their size, age, location, quality of construction, or methods of operation. This type of information is needed to assess environmental risks and to target for inspection the facilities most in need of review.

According to EPA's SPCC Task Force, facility inspections are generally done randomly, but some EPA regions have developed a list of facilities and conduct inspections when time and resources are available. Officials in the EPA regions we visited said that a major factor in their selection of a facility for inspection was a history of spills. However, some officials also said that their selection of facilities was restricted by limited funds. According to the officials, since the EPA and contractor employees who do oil tank inspections are also responsible for the Superfund program, oil storage tank facilities nearby Superfund sites got the most coverage. At one region, a manager said that, lacking an inventory of facilities, inspectors, while they were at Superfund sites, had to check the telephone yellow pages to select oil storage inspection targets.

Facilities which pose the greatest threat to the environment may be overlooked if facilities are selected for inspection randomly or because of their nearness to Superfund sites. For example, the Ashland facility had not been inspected prior to the tank collapse, even though it is located near potable water supplies. The SPCC Task Force reported that only one EPA region attempts to identify facilities located near drinking water. Other factors that might dictate inspection coverage are a tank's size and age, whether it has been moved and reassembled, and whether it was constructed in accordance with industry standards. EPA's SPCC Task Force recommended that a national survey be conducted to inventory facilities subject to the SPCC regulations. This survey could develop information for setting inspection priorities.

National Guidance Needed to Improve SPCC Inspection Program

EPA headquarters needs to improve its guidance to its regions regarding the inspection program in order to improve the rate of compliance with its regulations. According to EPA records, oil storage facilities' noncompliance with EPA's oil pollution prevention requirements is widespread. In order to reduce the high rate of noncompliance, EPA headquarters needs to develop more guidance on how to conduct inspections, document inspection findings, train inspectors, and fine violators of the regulations.

Oil Storage Facility Compliance With EPA's Regulations

The percentage of oil storage facility inspections that discovered non-compliance with the Oil Pollution Prevention regulations ranged from 41 to 94 percent in the EPA regions we visited, as shown in table 3.1.

Table 3.1: Percent of Oil Storage Facilities Not Complying With Regulations at Time of Inspection

	EPA Region			
	III	V	VI	IX
Percent not in compliance ^a	74	56	94	41

^aCompliance rates for oil storage facilities were obtained from EPA regional office records and covered various months in the period October 1984-April 1988, depending on the availability of data in the respective regions.

Summary data were not available in the regions to show the nature of the violations uncovered during inspections at these regions. However, in one region violations included failure to prepare or implement the emergency plan required by EPA's regulations. According to EPA's SPCC Task Force, when inspections disclose violations, few reinspections to confirm improvements are made. The Task Force found that in regions where follow-up inspections are conducted, due to insufficient resources, only 2 to 5 percent of all facilities that are initially out of compliance are inspected a second time.

Performing and Documenting Inspections

EPA headquarters has not required its regions to follow uniform inspection procedures or documentation. The EPA regions we visited also had not developed written procedures on how to conduct inspections. For example, Region III officials said that there was no rule book for inspections but that each inspector did his review according to his own judgment. Officials in other regions said that they relied on the experience and knowledge of individual inspectors rather than on written procedures. However, officials in one region told us that most inspections were "windshield" type inspections, that is, inspections in which the inspector observed the facility from the roadway for obvious violations

such as failure to provide secondary containment. These types of inspections did not involve actual examinations on the facility grounds. EPA's SPCC Task Force estimated that on average, an SPCC inspection should take 20 hours and that inspections of this intensity were not being performed.²

The problem of a lack of written inspection procedures is compounded by there being no agencywide requirements for the recording of inspection findings. SPCC inspections were not consistently documented in the EPA regions we visited. For example, Region V developed a 10-page inspection form which required a narrative description of the facility, SPCC plan, amount and type of products stored, and spill prevention measures used at the facility. In contrast, Region III used a 1-page form calling for 14 blanks to be filled in by the inspector, including some of the "yes/no" variety. Inspection reports we reviewed from on-site inspections from three of the regions we visited were uninformative. For example, reports stated that the SPCC plan "was not implemented," but did not provide a description of what safeguards were not being followed.

In our view, national requirements for performing and documenting inspections would help assure that inspections were being performed thoroughly, establish a record of facility compliance with the regulations, and help pinpoint overall problem areas in the industry. Establishing these policies would also be consistent with the Comptroller General's standard for reasonable assurance because they would provide greater assurance that the SPCC inspection program will more adequately enforce EPA's Oil Pollution Prevention regulations.³

Inspector Training

EPA headquarters has not defined training needs for inspectors. As a result, each of EPA's regions has established a training program for SPCC inspectors using different program styles, curricula, and manuals. Five of the 10 regions have classroom based programs where students review Oil Pollution Prevention regulations in a 2 to 3 hour session, while 9 regions have developed apprenticeship programs that provide students

²The Task Force did not indicate the basis for the 20 hours standard or provide data on the length of current inspections.

³Internal controls that federal agencies are required to follow are set forth in GAO's Standards for Internal Controls in the Federal Government, published in 1983 pursuant to the Federal Managers' Financial Integrity Act of 1982.

with “hands-on” experience. Most of the regions have developed training manuals, but their contents and use vary from region to region. While there may be justification for some regional differences in inspector training because of differences in the oil storage industry, the fact that the Oil Pollution Prevention regulations are national in scope indicates that inspectors should possess a common body of knowledge and a minimum level of skills to implement the regulations.

Penalties for Violations

The Clean Water Act authorizes fines of up to \$5,000 per day for each violation of EPA’s Oil Pollution Prevention regulations. In the absence of national guidance on the imposition of fines, the EPA regional offices have adopted inconsistent policies. Overall, fines are rarely used, although EPA’s data indicate that the rate of noncompliance with the regulations may be high.

According to EPA’s SPCC Task Force, the inspection program has little national consistency with respect to issuing penalties. Seven of the EPA regions have never issued penalties even though they have found violations of the regulations. The Task Force attributed this to the fact that in these regions, the decision on whether to impose a fine was made by a different unit from the one which performed the inspections. In two of the regions we visited, officials told us that they believed that they could gain compliance through inspection and the threat of inspection rather than through penalty assessment, citing instances where an inspection at one facility caused nearby facilities to come into compliance. We agree that more frequent inspection could promote greater adherence to the regulations, but believe that even greater compliance would be achieved if fines, as authorized by the Clean Water Act, were assessed.

Using Outside Assistance to Extend EPA Inspection Resources

The resources currently available to inspect above ground oil storage facilities allow EPA to inspect less than 1 percent of the estimated facilities nationwide. In fiscal year 1988, EPA inspected approximately 1,000 facilities with the 47 staff years available. The program has declined in recent years due to competing program priorities. Even if inspection resources were increased several fold, they would not be sufficient to permit regular inspection of all facilities. For this reason, and in view of expected future tight budgets, EPA should consider coordinating its inspections with state and local regulatory authorities and requiring that facilities obtain certification from independent engineers.

Using State and Local Inspectors

According to EPA's SPCC Task Force, many states have adopted requirements that are closely modeled on federal SPCC requirements. In some cases, states have adopted federal regulations virtually verbatim. In other cases, states have added new requirements, such as licensing, specific tank standards, and location specifications. In addition, local governments, often using their fire marshals, inspect above ground oil storage facilities to enforce local codes. Although some EPA regions have coordinated with some state and local authorities, no systematic nationwide effort has been made to determine the states' capabilities to conduct facility inspections.

State and local regulatory authorities represent a resource that EPA may be able to use to help inspect facilities. A start in this direction could be made by studying state and local regulations, encouraging state and local officials to more closely monitor the industry, and deciding whether to create a training program for state and local inspectors to make them better able to detect environmentally unsafe tank construction and operation. The SPCC Task Force also recommended that increased involvement of state and local authorities be explored.

Using Certifications From Independent Engineers

EPA's current regulations require that facility owners and operators have their SPCC plans certified by Registered Professional Engineers as having been prepared "in accordance with good engineering practices." As a supplement to its enforcement program, EPA needs to consider extending this certification system to the more detailed regulations we recommended in chapter 2. The SPCC Task Force did not make a recommendation directly on this point; however, EPA officials told us that the concept is worth exploring.

Conclusions

EPA has not effectively enforced its Oil Pollution Prevention regulations. EPA has not adequately identified the universe of regulated facilities or prioritized inspections to insure that facilities which pose the greatest threat to the environment are being inspected. In addition, it has not established national guidance regarding training of inspectors, performance of inspections, and fining of violators which could help to reduce the rate of facilities' noncompliance with the regulations. According to EPA offices, the high priority of the Superfund program diverted attention and resources away from the oil program so that management controls were not fully developed.

EPA's inspection resources will, for the foreseeable future, probably be insufficient to permit regular inspections of all facilities. However, EPA may be able to extend the program by encouraging state and local regulators to enforce environmentally safe facility operation and requiring facilities to obtain certification of compliance with standards set forth in the regulations from independent engineers.

Recommendations to the Administrator, EPA

To better ensure the safety of the nation's above ground oil storage facilities and decrease the chances of oil being discharged into the environment, we recommend that the Administrator, EPA

- strengthen EPA's above ground oil storage facility inspection program by (1) developing, in coordination with state and local authorities, a system of inspection priorities, based on a national inventory of tanks; (2) developing instructions for performing and documenting inspections; (3) defining and implementing minimum training needs for inspectors; and (4) establishing a national policy for fining violators; and
- determine the advantages and disadvantages of supplementing EPA's own inspection resources by (1) using state and local inspection resources and (2) requiring that facilities obtain certification from independent engineers that facilities are in compliance with regulations.

Opportunities to Improve the Government's Response to Major Inland Oil Spills

The government does not have explicit authority in the Clean Water Act to recover its oversight costs from spillers who have elected to clean up the oil themselves. In the case of major oil discharges that are the magnitude of the Ashland spill, these costs can be substantial. Seeking to recover oversight costs would allow the government to recoup money it could use for other oil response activities.

EPA has terminated its research and development program for spill recovery technology and techniques. The fact that only 20 percent of the oil spilled from the Ashland tank was recovered may point to a need for EPA to reestablish its research program to develop improved response technology for inland spills.

Unrecovered Oil Spill Oversight Costs

When an oil spill occurs, federal officials determine whether the responsible party is taking prompt and proper action to remove the oil. If these officials determine that the spiller's actions are insufficient, the Clean Water Act authorizes the federal government to expend funds to perform the removal actions itself. Section 311(f) of the act provides that the spiller is liable to the government for the actual costs of the federal removal action. These costs are not to exceed \$50 million unless the discharge was the result of willful negligence or misconduct, in which case the owner or operator is liable for the full amount. EPA and the Coast Guard seek recovery of operational and supervisory costs after the federal government initiates the cleanup.

Although the act is clear in regard to the expenditure and recovery of costs when the government performs the oil removal action, it is not explicit regarding the spiller's liability for the monitoring costs the government incurs in overseeing the spiller's oil removal action. The monitoring actions described in the NCP include surveillance over the actions initiated by the spiller to eliminate the threat and other actions involving water measuring, sampling, and analysis. These costs are similar to the supervisory costs for which EPA and the Coast Guard seek reimbursement after a government-performed cleanup.

EPA and Coast Guard officials either are uncertain whether the act requires spillers to reimburse these monitoring costs or believe that it does not. EPA's General Counsel for Region III told us that there is some question as to whether EPA has legal recourse to recover monitoring costs from a responsible party that is taking prompt and proper removal action. Coast Guard and EPA officials stated that monitoring costs are

usually nominal and can generally be absorbed by agency budgets without disrupting operations. EPA has not developed a formal policy on recovery of monitoring costs. The Coast Guard's policy is not to seek to recover its monitoring costs from spillers who perform the oil removal action because, among other reasons, it believes that recovery of these costs is not authorized by the Clean Water Act and that the policy encourages prompt action on the part of spillers. However, Coast Guard officials said they are examining the entire regulatory framework regarding funding and cost recovery for oil spills.

We agree with EPA and Coast Guard officials that the Clean Water Act does not explicitly authorize recovery of government monitoring costs for private party cleanups. We believe there is justification for recovery of the government's monitoring costs because as in the Ashland case these costs can be substantial. We believe the Congress should amend the Clean Water Act to make clear the government's right of recovery. Federal agencies could be given discretion to exercise this right when monitoring costs are insignificant and/or exceed the costs of collection.

Cost Recovery From the Ashland and Shell Oil Spills

The federal response to the Ashland spill illustrates a need for clear federal rights to recover monitoring costs. EPA incurred costs of \$369,828 between January 3 and February 15, 1988, to monitor Ashland's removal action. As a result, EPA reallocated funds normally used to perform SPCC inspections and on-scene monitoring from its Emergency Response Division's budget. Federal monitoring costs were not compiled by the agencies overseeing the Shell cleanup.

In a March 1988 memorandum to EPA regional offices, EPA's Office of Solid Waste and Emergency Response stated that the budget reallocation as a result of the Ashland spill might, depending on a region's circumstances, cause a halt to SPCC inspections and some on-scene monitoring activities. EPA officials in Region VI told us that they stopped using contractors to perform SPCC inspections and on-scene monitoring through the third quarter of fiscal year 1988 as a result of the reallocation.

After the spill, Ashland announced that the company would pay for all the costs associated with the spill, including the costs federal and state agencies incurred. On the other hand, Shell did not offer to reimburse the government for the costs it incurred in monitoring the cleanup nor did the Coast Guard, which monitored the cleanup, consider trying to recover these costs. As a policy, the Coast Guard and EPA do not seek to

recover their monitoring costs when a responsible party performs the cleanup.

Need to Consider Improving Inland Spill Response

EPA reported that only 205,000 of the 1 million gallons of fuel spilled into the river from the Ashland tank was ultimately recovered. Although EPA and Coast Guard officials believe a proper cleanup as required by the NCP was performed by Ashland Oil and its contractors, they expressed frustration that so large an amount of oil was not recoverable. EPA and Coast Guard officials who oversaw the Ashland cleanup operation told us it was unfortunate that oil spill technology for inland oil spills dates back to the 1960s, and is not as current as that of coastal spills. Further, the SPCC Task Force found that the Ashland spill highlighted a need for research in the area of control technology of oil spills in fast moving inland waters. The Task Force made several recommendations for research on improved devices for recovery techniques and for improving oil storage tank testing. According to EPA research officials, the private sector is pursuing some cleanup research. Any assessment of the need for an expanded government research program would need to take private activity into account. EPA management has not yet decided to fund implementation of the recommended improvements.

EPA's oil spill research and development program was funded at \$200,000 annually but EPA cancelled it in fiscal year 1987. According to an EPA official, money for oil spill research was shifted to a higher priority program, specifically, the underground storage tank research program. However, EPA officials we met with said the relatively small amount of oil recovered from the Ashland oil spill highlighted a need for research in order to improve technology of controlling spills in fast moving inland waters and cold weather spill control and recovery techniques.

Conclusions

The Clean Water Act does not specifically provide for recovery of monitoring costs incurred by federal agencies when a spiller performs the cleanup. These costs can be substantial during a major spill and could require the reallocation of funds otherwise available for SPCC inspections. The Coast Guard interprets the act to hold spillers liable for federal monitoring costs only when the government performs the cleanup. EPA is unsure about its recovery rights. There is justification, in our view, for the government to recover monitoring costs, especially when they are substantial.

In light of the small amount of oil recovered after the Ashland spill and the views of EPA and Coast Guard officials on spill technology, we believe EPA needs to reassess the merits of having an oil spill research and development program after taking private sector research efforts into account.

**Recommendation to
the Congress**

The Congress should amend the Clean Water Act to explicitly authorize the federal government to recover the costs of monitoring oil spill clean-ups performed by private responsible parties.

**Recommendation to
the Administrator,
EPA**

With the goal of improving responses to future oil spills, we recommend that the Administrator, EPA, determine whether to reestablish the oil spill research and development program, taking into account anticipated benefits, costs, and program priorities.

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