United States General Accounting Office

GAO

Report to Congressional Requesters

July 1995

# ABOVEGROUND OIL STORAGE TANKS

## Status of EPA's Efforts to Improve Regulation and Inspections


GAO/RCED-95-180

GAO

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

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

B-261262

July 18, 1995

The Honorable Thomas A. Daschle
The Honorable Charles S. Robb
United States Senate

The Honorable James P. Moran
House of Representatives

Because of your concern about the safety of aboveground storage tanks (AST), you requested that we examine the actions taken by the Environmental Protection Agency (EPA) to address weaknesses in the regulation and inspection of oil storage tanks. This report updates our February 1989 report, in which we recommended steps to reduce the likelihood of oil spills in the future.[1]

We followed up on our seven previous recommendations that EPA (1) strengthen its regulations governing the construction of tanks and measures to minimize damage from oil spills and (2) improve the inspection program for aboveground oil storage facilities. (App. I lists the applicable recommendations contained in our 1989 report.) In addition, you asked that we provide available information on the age, size, and other characteristics of ASTs. This information is provided in appendix II.

## Results in Brief

EPA has not fully implemented any of the seven recommendations from our 1989 report to improve the safety of aboveground oil storage tanks, although EPA generally agreed with these recommendations and has taken some action on each. EPA officials told us that the agency did not do more to implement our recommendations primarily because it placed a higher priority on implementing new legislative requirements. They also said that EPA had encountered difficulties in obtaining approval from the Office of Management and Budget (OMB) to collect data for a national inventory of regulated facilities. The proposed inventory is related to completing certain proposed rules.

To strengthen its regulations governing storage tank construction and contingency plans, EPA has partially implemented one of our three recommendations but has not implemented the other two. To strengthen contingency plans, EPA required about 1 percent of regulated

[1]Inland Oil Spills: Stronger Regulation and Enforcement Needed to Avoid Future Incidents (GAO/RCED-89-65, Feb. 22, 1989).

facilities—those that pose the greatest risk to the environment—to develop response plans to minimize the damage from spilled oil, but the agency did not apply this requirement to other facilities and does not plan to do so. To strengthen tank construction and design, EPA has proposed regulations to implement two other recommendations, but it is not certain when these regulations will be completed.

To improve its inspections of facilities, EPA has started to implement our four recommendations on targeting inspections, improving inspection procedures and documentation, training inspectors, and establishing penalties for noncompliance. EPA expects three of these recommendations to be implemented by 1996 but is not certain when the fourth recommendation (on targeting inspections) will be implemented.

## Background

According to EPA's most recent estimate, in 1991 about 435,000 facilities used one or more aboveground tanks to store petroleum, refined petroleum products, and nonpetroleum oils. According to a trade group survey, about 83 percent of the tanks that store petroleum and petroleum products had a capacity of 500 barrels[2] or less, while about 5 percent of the tanks had a capacity of 10,000 barrels or more.[3]

On occasion, these tanks may collapse suddenly or leak gradually over a period of years. For example, two major collapses in 1988 (releasing about 750,000 gallons in Pennsylvania and about 400,000 gallons in California, respectively) contaminated drinking water, damaged private property, killed wildlife, and disrupted businesses. Also, at a facility in Fairfax, Virginia, 100,000 or more gallons leaked into groundwater over a period of years, affecting an area of about 21 acres. Since the leak was discovered in 1990, EPA and others have undertaken extensive actions to monitor it and clean up the affected area.

EPA regulates ASTs primarily under the authority of the Federal Water Pollution Control Act (also known as the Clean Water Act), as amended by the Oil Pollution Act of 1990. The Clean Water Act prohibits the discharge of oil into navigable waters and authorizes the issuance of rules establishing procedures, methods, equipment, and other requirements to prevent the discharge of oil from storage facilities. To implement these provisions, EPA promulgated the Oil Pollution Prevention Regulation in

[2]A barrel of oil contains 42 gallons.

[3]R.A. Christensen and R.F. Eilbert, Aboveground Storage Tank Survey, April 1989, prepared by Entropy Limited for the American Petroleum Institute.

1973. A facility is covered by this regulation if it (1) has an aboveground storage capacity of more than 660 gallons in any single tank, an aggregate aboveground storage capacity of more than 1,320 gallons, or a total underground storage capacity of more than 42,000 gallons; (2) could reasonably be expected to discharge oil in harmful quantities into the navigable waters of the United States; and (3) is not transportation-related.[4]

The regulation requires each AST owner or operator to prepare a spill prevention, control, and countermeasure (SPCC) plan. The plan is required to address (1) the design, operation, and maintenance procedures to prevent spills from occurring and (2) countermeasures to control, contain, clean up, and mitigate the effects of an oil spill that affects navigable water. The facility must arrange for a registered professional engineer to certify the plan and any significant changes to it.

Following the issuance of our 1989 report, the Congress enacted the Oil Pollution Act of 1990. Among other things, the act expanded activities to prevent and prepare for oil spills and to improve facilities' capability to respond to spills.

As a result of major oil spills, such as the Pennsylvania spill discussed above, along with our 1989 report and similar findings by EPA itself, the agency proposed revisions to its Oil Pollution Prevention Regulation in October 1991 and February 1993. In February 1993, it also proposed rules to implement the 1990 act's requirement that owners and operators of certain facilities submit "facility response plans." These plans are required of facilities that, because of their location, could reasonably be expected to cause substantial harm to the environment by discharging oil into navigable waters or adjoining shorelines.

In July 1994, EPA completed the portions of the 1993 rules governing facility response plans. However, EPA has not completed the 1991 proposed rulemaking and portions of the 1993 proposed rulemaking dealing with storage tank construction and testing, other portions of the Oil Pollution Prevention Regulation, and efforts to collect data for a national inventory of regulated facilities. In its entry in the May 8, 1995, Unified Agenda of Federal Regulations (a compilation of upcoming regulatory actions), EPA indicated that it did not expect to complete the rules before the end of March 1996.

[4]Generally, transportation-related facilities are those that transport oil in inter- or intrastate commerce or transfer oil in bulk to or from a vessel. Other regulations govern such facilities.

EPA inspects facilities to help ensure that they comply with the Oil Pollution Prevention Regulation. In our 1989 report, we stated that in fiscal year 1988, EPA inspected approximately 1,000 facilities. In fiscal year 1994, EPA's 10 regional offices inspected 1,852 facilities. The four regions with the most inspections were Region 9 (San Francisco) with 350, Region 6 (Dallas) with 321, Region 10 (Seattle) with 300, and Region 3 (Philadelphia) with 257.

In its 1990 response to our 1989 report, EPA generally said that it was considering or taking action to implement our seven recommendations on the regulation and inspection of ASTs. In two cases, it projected that action would be completed by the end of 1990.

## EPA's Actions to Strengthen Regulations Governing Tank Construction and Contingency Plans

EPA has taken steps to strengthen the regulations for tank construction and contingency plans, although these steps do not fully implement our three recommendations. EPA officials said that further action on two of these recommendations is planned but that the timing is uncertain.

EPA officials told us that the implementation of our recommendations to strengthen these regulations was delayed primarily because of the requirements imposed by the 1990 act and subsequently delegated to EPA. Among other things, the act mandated the issuance of rules requiring the preparation of facility response plans, required the development of area contingency plans, and required a study of the need for liners under ASTs; a report on the results of the study was due within 1 year. The officials said that implementation was also delayed by the difficulties that EPA encountered in obtaining OMB's approval for a national inventory of regulated facilities. (The inventory is related to EPA's inspection program, as explained in the next section.) An EPA official said that the agency prefers to complete the proposed rules on tank construction and contingency plan regulations together with the proposed rule relating to inspections.

Mandating standards for tank construction and testing. In 1989, we reported that EPA's rules did not incorporate specific standards for constructing and testing ASTs. Therefore, to decrease the chances of damaging oil spills in the future, we recommended that EPA require that ASTs be built and tested in accordance with the industry's or other specified standards.

The rules that EPA proposed in 1991 would strengthen the provisions dealing with tank construction but would not require adherence to the industry's or other standards, a criterion specified in our recommendation. Specifically, the proposed rules would add a new recommendation that the construction, materials, installation, and use of tanks conform with the relevant portions of the industry's standards but would not convert this recommendation into a requirement.[5]

In connection with the testing of ASTs, the proposed rules would considerably strengthen current provisions, which is consistent with our 1989 recommendation. The current Oil Pollution Prevention Regulation provides that ASTs "should" be subject to "periodic" integrity testing and "should" be "frequently" observed for leaks. By contrast, the proposed rules would "require" integrity testing every 5 years, unless the facility incorporates secondary containment features; in such cases, integrity testing would be required every 10 years and when major repairs are made. In addition, the proposed rules would require the facilities without secondary containment to conduct integrity and leak testing of their valves and piping at least annually.

Minimizing damage from spilled oil. In 1989, we reported that EPA's rules addressed containing spilled oil within tank facilities but did not require that tank owners and operators develop plans to deal with oil escaping in large quantities beyond the facilities' boundaries. Therefore, we recommended that owners and operators be required to develop such response plans. Moreover, because spilled oil could be spread very rapidly through storm water drainage systems, we recommended that the rules require, not merely recommend, that such systems be designed and operated to prevent oil from passing through them.

The rules issued pursuant to the 1990 act partially implement our recommendation on response plans. These rules, which became effective in August 1994, require that certain oil storage facility owners and operators prepare facility response plans for responding to "worst case" oil discharges or a substantial threat of such a discharge.[6]

[5]The proposed rules state that the SPCC plan "shall be prepared in accordance with good engineering practice." They further provide that "It is recommended that the construction, materials, installation, and use of tanks conform with relevant portions of industry standards [from the American Petroleum Institute and other groups] . . . which are required in the application of good engineering practice for the construction and operation of the tank." Thus, as the preamble to the proposed rules points out, the rules would not specifically incorporate the industry's standards for tank construction.

[6]The rules generally apply to facilities that (1) have a total oil storage capacity of at least 1 million gallons and meet certain other criteria or (2) have a total oil storage capacity of at least 42,000 gallons and transfer oil over water to or from a vessel or barge.

According to an EPA official, EPA expected to receive such plans from about 6,000 facilities—roughly 1 percent of all covered facilities—that pose the greatest risk to the environment. (We were told that approximately 4,500 facilities had submitted plans as of April 1995.) The official said that EPA had no plans to expand the overall rules to cover additional facilities. However, he also noted that the current rules permit EPA's regional administrators to require the submission of a response plan by certain other facilities that have been determined on a case-by-case basis to present an unusual risk. He estimated that about 1,000 such facilities might be required to submit a response plan.

The 1991 proposed rules address our recommendation on storm water drainage systems by replacing the guidelines in the current rules with requirements. Generally, the rules would require that drainage from diked storage areas must be restrained by valves or other means to prevent a spill or other excessive leakage of oil into the drainage system.

## EPA's Actions to Strengthen the Inspection Program

EPA is taking steps to implement all four of our recommendations to strengthen the inspection program. However, according to EPA officials, three recommendations will not be fully implemented until 1996, and they are uncertain when the fourth recommendation will be implemented. The officials explained that meeting the requirements of the 1990 act was the primary reason why these recommendations were not implemented earlier. Difficulty in securing OMB's approval to collect data for a national inventory of regulated facilities also delayed implementation.

### Developing an Inventory and Better Targeting Inspections

In 1989, we reported that EPA had 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 could not develop effective inspection priorities because it had little information on the number of facilities or tanks or on their size, age, location, or quality of construction. It needed this type of information to target for inspection those facilities that posed the greatest environmental risk. Accordingly, we recommended that EPA develop a system of inspection priorities on the basis of a national inventory of tanks.

We found that EPA is working to develop a national inventory of tanks and to develop inspection priorities. In 1991, EPA sought OMB's approval to collect data from all facilities that might be covered by the Oil Pollution Prevention Regulation. However, OMB stated that EPA had not adequately

justified the proposed reporting requirements and did not approve the request.

EPA is undertaking a more limited survey of about 30,000 facilities that are considered most likely to be covered by the Oil Pollution Prevention Regulation. After a pilot survey in 1994, the survey instrument was mailed out in April 1995, and the results of the survey are expected in late 1995. The survey requests information on the facilities' characteristics and operations, the oil tanks' storage capacity and the product stored, and recent oil spills. Depending on the results of this survey, EPA may seek OMB's approval to collect limited data from all facilities.

EPA also expects to use this survey to provide information on regulated facilities. For example, the information could be used to provide a basis for developing inspection priorities. Such targeting is still needed because only a small fraction of the total number of facilities is inspected each year. As previously noted, the number of facilities inspected by EPA nearly doubled between fiscal years 1988 and 1994. Despite the increase, however, EPA inspected less than one-half of 1 percent of all facilities.

Although EPA has not established overall inspection priorities, it has identified one national priority. It established an expectation that each region will, between fiscal years 1995 and 1997, inspect all of the facilities located in that region that are required to prepare a facility response plan.

Meanwhile, we were told that EPA has taken other steps to help its regional offices identify the facilities that are likely to be covered by the Oil Pollution Prevention Regulation. For example, EPA obtained Dun & Bradstreet data on the facilities in those industries that are considered likely to be regulated and provided this information, for the individual states in each region, to its regional offices.

According to officials in Regions 3 and 6, which we visited for this review, neither region has a complete inventory of the facilities in the states it covers.[7] Region 3's SPCC coordinator told us that the region drafted its own targeting strategy in December 1994. She said that various criteria are used to select the facilities to be inspected. These criteria include a facility's spill history, the facility's potential to cause significant and substantial harm to the environment, and referrals from federal, state, or local government officials or the public.

[7]Region 3 covers Delaware, Maryland, Pennsylvania, Virginia, West Virginia, and the District of Columbia. Region 6 covers Arkansas, Louisiana, New Mexico, Oklahoma, and Texas.

Similarly, according to a Region 6 official, the region targets inspections in the five states it covers by using data on such factors as spill histories, water supplies, and sensitive ecosystems. The region also considers referrals from states and other federal agencies and citizens' complaints.

## Uniform Inspection Procedures and Documentation

In 1989, we reported that EPA headquarters had not required its regions to follow uniform procedures for conducting and documenting inspections. Moreover, the four EPA regions we visited at that time also had not developed written procedures on how to conduct inspections. Regional officials told us that they relied on the experience and knowledge of individual inspectors rather than on written procedures. To help ensure that inspections are performed thoroughly, establish a record of facilities' compliance with the rules, and help pinpoint overall problem areas in the industry, we recommended that EPA develop instructions for performing and documenting inspections.

We found that EPA headquarters still has not developed such instructions, although work to develop uniform procedures has begun. Headquarters officials collected the various regions' instructions, circulated them to officials in other regions in May, and asked for their comments. The cognizant headquarters official said that he hopes to complete the development of uniform procedures by late 1995.

We found both similarities and differences in the inspection procedures and documentation developed by the two regions we visited. For example, staff in both regions collect information about a facility before inspecting it. Region 3 staff said that they check whether the facility has had any reported oil spills and may check with the state's environmental agency for relevant information. Region 6 staff said that they typically visit a facility known to contain ASTs. During this visit, they take photographs and record their observations of the facility's general condition.

We noted a difference in regional practices with respect to advance notification. Region 3 staff told us that they usually do not contact a facility before arriving to inspect it. Region 6 staff told us they do notify the facility in advance that they intend to conduct an SPCC inspection.

Both regions developed inspection checklists, which list items to be checked and also provide a standard format for documenting the inspection results. Region 3 uses a single checklist for all types of facilities that documents both the inspection of the facility and the review of its

spill response plan. Region 6 uses one checklist for inspecting a facility and another for reviewing its SPCC plan and also uses different checklists for different types of facilities.

## Better Training of Inspectors

In 1989, we reported that EPA headquarters had not defined training needs for inspectors. As a result, each EPA region established a training program using different program styles, curricula, and manuals. While most regions had developed training manuals, their contents and use varied from region to region. We concluded that while some regional differences in the oil storage industry may justify some differences in the training of inspectors, because the Oil Pollution Prevention Regulation is national in scope, inspectors should possess a common body of knowledge and a minimum level of skills to implement the regulation. We recommended that EPA define and implement minimum training needs for inspectors.

We found that EPA still has no national guidance on the training of SPCC inspectors. However, headquarters officials told us that a work group has begun developing such guidance and should complete it in early 1996.

Meanwhile, EPA has funded some training-related activities in the regions. EPA headquarters provided an average of approximately $900,000 a year in fiscal years 1992 through 1994 to selected regions to support training and other activities related to enforcing the Clean Water Act. For example, Region 6 developed a series of videotapes that are used to train AST inspectors, among other purposes, and shared them with other regions.

## National Policy for Fining Violators

In 1989, we reported that in the four EPA regions we visited, many of the oil storage facilities that were inspected were found to be out of compliance with the Oil Pollution Prevention Regulation. Nevertheless, EPA rarely imposed penalties (up to $5,000 a day), in part because it lacked national guidance for this action. We recommended that EPA establish a national policy for fining violators.

We found that there is still no final policy on fining violators, although a senior attorney in EPA's Office of Enforcement and Compliance Assurance told us that draft guidance on fining violators has been developed and was provided to the regions for their guidance in 1993. This official said that he hoped the policy would be completed by the end of 1995.

Region 3 officials told us that they rely on the draft penalty guidance in dealing with companies found not to be in compliance with the rules. For example, they said that they had used the guidance in calculating a substantial penalty against a certain company. However, a senior regional attorney told us that, in his opinion, courts would more readily defer to a final policy than to a draft policy.

Region 6 officials told us that they rarely pursue fines against companies not in compliance, even though they found that about 80 percent of the facilities inspected in fiscal years 1993 and 1994 were out of compliance. They said that they prefer to work with companies to bring their facilities into compliance. Also, they can conduct many more inspections and bring more facilities into compliance if they do not divert resources to pursue enforcement action against companies. As in Region 3, a Region 6 attorney agreed that a final policy would carry more weight with the courts.

## Conclusions

EPA generally agreed with the seven recommendations in our 1989 report on the regulation and inspection of ASTs, and it has taken some steps to implement them. In 1994, EPA partially implemented our recommendation on contingency planning, and by 1996 it expects to implement three more recommendations (on inspection procedures and documentation, training for inspectors, and penalties for noncompliance). EPA is uncertain when the other three recommendations (on tank construction and design and on targeting inspections) will be implemented. Implementing all of our recommendations will help EPA ensure that the nation's ASTs are being properly regulated and inspected and that human health and the environment are safeguarded from the effects of oil spills.

## Scope and Methodology

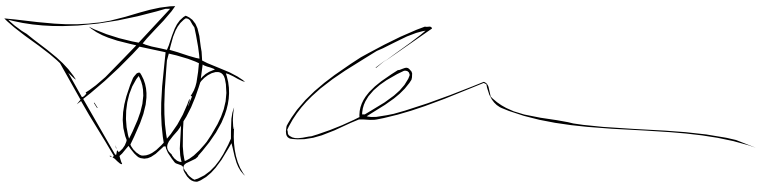
In performing this follow-up work on the regulation and inspection of aboveground storage tanks, we (1) reviewed applicable laws and regulations; (2) interviewed officials in EPA's headquarters (Washington, D.C., and Crystal City, Virginia), Region 3 (Philadelphia), and Region 6 (Dallas); and (3) reviewed relevant records. The activities in these two regions may not be representative of the activities in all EPA regions, but as agreed with your offices, we selected these regions because they have relatively active SPCC programs and because they oversee diverse types of facilities. We did not evaluate the effectiveness of EPA's actions to date. Also, we did not independently verify the data provided by EPA officials. We conducted our work between February and May 1995 in accordance with generally accepted government auditing standards.

## Agency Comments

We requested comments on a draft of this report from EPA. On May 31, 1995, we met with the Acting Chief of the Oil Pollution Response and Abatement Branch to obtain the agency's comments on the draft report. During our meeting, he told us that he generally agreed with the facts presented and the conclusions reached. He identified several areas where he believed that we could present a fuller picture of relevant developments. We revised these areas accordingly. In addition, he provided updated information and technical corrections in a few cases, which we included where appropriate.

As arranged with your offices, we plan no further distribution of this report until 30 days from the date of this letter, unless you publicly announce its contents earlier. Upon release, we will send copies to the Administrator of EPA and will make copies available to others on request.

If you have questions, I can be reached at (202) 512-6111. Other major contributors to this report are listed in appendix III.



Peter F. Guerrero
Director, Environmental
Protection Issues

# Contents



## Tables



**Abbreviations**

| | |
|---|---|
| API | American Petroleum Institute |
| AST | aboveground storage tank |
| EDF | Environmental Defense Fund |
| EPA | Environmental Protection Agency |
| GAO | General Accounting Office |
| OMB | Office of Management and Budget |
| SPCC | spill prevention, control, and countermeasure |

# Summary of Recommendations in GAO's 1989 Report

In 1989, we made seven recommendations to the Administrator of the Environmental Protection Agency (EPA) in order to improve the regulation and inspection of aboveground oil storage tanks. These are listed below.

## Recommendations to Strengthen Regulations Governing Tank Construction and Contingency Plans

To improve the likelihood that aboveground oil storage tanks are built to the industry's standards and decrease the chances of future damaging oil spills, we recommended that the Administrator amend the applicable regulations to require that

- aboveground oil storage tanks be built and tested in accordance with the industry's or other specified standards;
- facilities plan how to react to a spill that overflows their boundaries; and
- storm water drainage systems be designed and operated to prevent oil from escaping through them.

## Recommendations to Improve the Inspection Program

To better ensure the safety of the nation's aboveground oil storage facilities and decrease the chances of oil being discharged into the environment, we recommended that the Administrator strengthen EPA's aboveground oil storage facility inspection program by

- developing, in coordination with state and local authorities, a system of inspection priorities on the basis of a national inventory of tanks;
- developing instructions for performing and documenting inspections;
- defining and implementing minimum training needs for inspectors; and
- establishing a national policy for fining violators.

# Characteristics of Aboveground Storage Tanks

As requested by your offices, we are providing data on various characteristics of aboveground storage tanks from studies done by the Environmental Protection Agency, the American Petroleum Institute (API), and the Environmental Defense Fund (EDF). The data provide broad estimates on the numbers, ages, and locations of oil storage facilities; the construction and operation of aboveground tanks at these facilities; and estimates of leaking tanks and their potential adverse effects. We did not assess the accuracy or reliability of the information presented.

EPA officials told us that because of a lack of data on ASTs, and in view of several oil pollution incidents, such as the contamination of property in Fairfax, Virginia, the agency in recent years has undertaken several AST studies. In a January 1991 study, EPA estimated the numbers of facilities in 16 industrial categories that meet the storage capacity requirements of the Oil Spill Prevention, Control and Countermeasures (SPCC) program established under section 311(j) of the Clean Water Act. In response to proposed October 1991 revisions to the agency's Oil Pollution Prevention Regulation, EPA refined its estimate of the number of facilities covered by the SPCC program's requirements by excluding certain facilities with underground tanks that were covered under other EPA regulations. In August 1994, EPA's Aboveground Oil Storage Facilities Workgroup produced a draft study of the problem of soil and groundwater contamination due to oil spills and leaks from facilities with ASTs. In December 1994, the agency produced a draft study required by section 4113(a) of the Oil Pollution Act of 1990 that assessed the technical and economic feasibility of using liners and related systems to detect leaking oil and to prevent it from contaminating soil and navigable waters.

API has also been active in studying ASTs and publishing AST standards for its members. In April 1989, API published a widely cited Aboveground Storage Tank Survey performed under contract by Entropy Limited that covered the numbers of tanks and their ages, capacities, and construction in all segments of the petroleum industry, namely marketing, refining, transportation, and production. A second API member survey, published in July 1994, among other things ranked the sources of groundwater contamination from ASTs. A series of API standards issued in 1987 and during the 1990s set industry standards for such things as tank inspection, repair, alteration, and reconstruction; tank design, construction, operation, and maintenance; and the establishment of a program to certify inspectors.

EDF published a report on the regulation of ASTs in February 1993. EDF's report addressed pollution prevention, groundwater monitoring, reporting of underground leaks, and cleanup and release containment.

## Numbers of Aboveground Storage Tank Systems Currently in Use

In 1991, EPA estimated that about 435,000 facilities (a facility could have one or more tanks) were required to develop SPCC plans under the Oil Pollution Prevention Regulation. The regulation applies to non-transportation-related facilities that have the potential to discharge oil to waters of the United States in quantities that may be harmful and that have oil storage capacities greater than 42,000 gallons underground, greater than 1,320 gallons aboveground, or greater than 660 gallons in a single tank aboveground. Table II.1 shows EPA's estimate.

**Table II.1: EPA's Estimate of Aboveground Storage Facilities Under the SPCC Program, by Industrial Category**

| Facility category | Estimated number |
|---|---|
| Farms | 131,450 |
| Coal mining/nonmetallic minerals mining | 4,150 |
| Oil production | 187,200 |
| Contract construction | 3,350 |
| Manufacturing | |
| Food and kindred products | 3,850 |
| Chemicals and allied products | 4,900 |
| Petroleum refining and related industries | 2,250 |
| Stone, clay, glass, concrete | 5,500 |
| Primary metal industries | 1,950 |
| Other manufacturing | 6,950 |
| Railroad refueling | 400 |
| Bus transportation | 1,650 |
| Trucking and warehousing/water transportation services | 4,150 |
| Air transportation | 550 |
| Pipelines | 600 |
| Electric utility plants | 4,600 |
| Petroleum bulk stations and terminals | 11,900 |
| Gasoline service stations | 0 |
| Fuel oil dealers | 5,350 |
| Vehicle rental | 150 |
| Commercial and institutional | |
| Health care | 2,600 |
| Education | 5,250 |
| Military installations | 600 |
| Other commercial and institutions | 45,850 |
| **Total facilities with ASTs** | **435,200** |

API's April 1989 survey estimated that about 700,000 aboveground tanks (as opposed to EPA's estimate of 435,000 facilities) were used in the marketing, refining, transportation, and production segments of the petroleum industry. Although the survey excluded tanks at user locations (e.g., vehicle rental locations), API believed them to be a small part of the total tank population. API's definition of capacity of ASTs was basically 1,100 gallons (26 barrels) or greater. Table II.2 shows API's estimate.

**Table II.2: API's Estimate of the Capacity of About 700,000 Tanks Used in the Petroleum Industry**

| Category | Number of tanks | Total capacity (thousands of barrels) |
|---|---|---|
| Marketing | 88,529 | 486,925 |
| Refining | 29,727 | 945,092 |
| Transportation | 9,197 | 556,183 |
| Production | 572,620 | 280,595 |
| **Total** | **700,073** | **2,268,795** |

Marketing includes petroleum products stored for wholesale or for direct sale to users, including tank farm distribution centers as well as gasoline retail stations and home heating supply distributors. Refining includes refineries at which crude oil is chemically and physically treated to produce a variety of petroleum products, including gasoline, diesel fuel, and jet fuels. Transportation includes pipeline operations at which large quantities of crude or refined product are stored until they can be transported offsite by pipelines to refineries or to marketers. Production includes facilities at which crude oil coming from the ground is gathered and stored until it can be delivered to refineries.

EDF, using API data, estimated that there were at least 800,000 to 900,000 aboveground petroleum tanks nationwide. EDF added 100,000 to 200,000 tanks to API's 1989 estimate to account for small distribution facilities not counted by API. Besides petroleum tanks, EDF also estimated that there are an additional 200,000 aboveground tanks storing hazardous products (e.g., chemical industry products and raw materials). Although the Oil Pollution Act of 1990 covers hazardous products, EPA has actively regulated only oil-containing ASTs and underground storage tanks under the SPCC program. According to an SPCC program official, EPA has not implemented provisions of the Oil Pollution Act of 1990 requiring facility response plans for hazardous substances because hazardous substances are covered by other statutes, such as the Clean Air Act, the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (Superfund), the Occupational Safety and Health Act, and the Resource Conservation and Recovery Act of 1976. EPA, however, is currently studying a plan to incorporate hazardous substances into facility response plans.

## Storage Tank Types, Sizes, Construction Methods, and Ages

API's 1989 survey estimated that over 80 percent of ASTs have storage capacities of 500 barrels (21,000 gallons) or less, as shown in table II.3.

**Table II.3: API's Estimate of Tank Capacities**

| Size (barrels) | Number | Percent |
|---|---|---|
| 26-500 | 579,445 | 82.8 |
| >500 to 1,000 | 44,812 | 6.4 |
| >1,000 to 10,000 | 42,513 | 6.1 |
| >10,000 to 100,000 | 29,120 | 4.1 |
| >100,000 | 4,183 | 0.6 |
| **Total** | **700,073** | **100.0** |

The survey also shows that while about 83 percent of the generally smaller production tanks were shop-fabricated, about 95 percent of the generally larger refining tanks were reconstructed, meaning that the tanks were dismantled at one place of service and rebuilt at another, or were riveted, bolted, or welded in the field. Furthermore, the ages of tanks differed significantly by industry sector. API's survey showed that of the tanks whose ages were known, 8 percent of tanks used in production were over 30 years old, while 64 percent of tanks used in refining were over 30 years old. Table II.4 shows the results of API's survey of tank ages.

**Table II.4: API's Estimate of Ages of Tanks, by Category**

| Age (years) | Marketing | Refining | Transportation | Production |
|---|---|---|---|---|
| 0-10 | 9,583 | 2,066 | 876 | 212,440 |
| 11-20 | 13,465 | 3,446 | 1,376 | 167,863 |
| 21-30 | 21,167 | 4,814 | 1,831 | 112,131 |
| 31-40 | 15,578 | 6,877 | 2,096 | 28,865 |
| 41+ | 21,149 | 11,129 | 2,666 | 13,109 |
| Unknown | 7,587 | 1,395 | 352 | 38,212 |
| **Total** | **88,529** | **29,727** | **9,197** | **572,620** |

According to an SPCC program project manager, the tanks in API's universe are representative of larger facilities that may have proportionately larger tanks than those included in EPA's estimate of facilities covered by the SPCC program. The official said that larger tanks tend to be field-erected, while smaller tanks are built in factories as prefabricated units and delivered to sites.

## Types of Products Stored in ASTs

As shown in table II.5, API's April 1989 survey estimated that the following petroleum products were stored in ASTs at marketing, refining, and transportation facilities. The product stored at production facilities is primarily crude oil.

**Table II.5: API's Estimate of Types of Petroleum Products Stored in ASTs, by Category**

Thousands of barrels

| Product | Marketing | Refining | Transportation |
|---|---|---|---|
| Viscous | | | |
| Heavy oils | 9,868 | 102,195 | 54,769 |
| Fluid | | | |
| Heavy oils | 7,092 | 281,170 | 255,649 |
| Lube oils | 11,007 | 42,598 | 565 |
| Distillates | 176,143 | 213,225 | 101,206 |
| Gasolines | 246,415 | 244,576 | 123,758 |
| Waste water | 1,771 | 15,711 | 2,404 |
| Other | 21,098 | 18,924 | 3,893 |

## Location of ASTs

API's April 1989 Survey estimated state-by-state totals for ASTs used in production. The 31 states covered by API are shown in table II.6.

**Table II.6: API's Estimate of State-By-State Totals for ASTs Used in Production**

| State | Number of tanks |
|---|---|
| Alabama | 541 |
| Alaska | 183 |
| Arizona | 16 |
| Arkansas | 8,109 |
| California | 27,390 |
| Colorado | 14,178 |
| Florida | 122 |
| Illinois | 16,083 |
| Indiana | 5,153 |
| Kansas | 61,309 |
| Kentucky | 19,964 |
| Louisiana | 19,905 |
| Michigan | 5,244 |
| Mississippi | 1,572 |
| Missouri | 144 |
| Montana | 7,770 |
| Nebraska | 2,078 |
| Nevada | 54 |
| New Mexico | 14,893 |
| New York | 2,142 |
| North Dakota | 3,903 |
| Ohio | 49,841 |
| Oklahoma | 139,646 |
| Pennsylvania | 10,867 |
| South Dakota | 116 |
| Tennessee | 426 |
| Texas | 139,287 |
| Utah | 1,848 |
| Virginia | 51 |
| West Virginia | 13,810 |
| Wyoming | 5,975 |
| **Total** | **572,620** |

## Numbers of ASTs That Have Leaked or Are Currently Leaking

According to EPA officials, comprehensive data do not exist to quantify adequately the extent to which ASTs are leaking. Accordingly, EPA developed an approach to estimate the number of ASTs leaking oil and the corresponding volume of the products leaked. EPA developed a

relationship between the age of ASTs and tank failure rates. Key data sources for this analysis were API's April 1989 survey, which provided data on the age and storage capacity of ASTs, and a 1988 study of tank failure rates.[8] Table II.7 shows EPA's preliminary estimates of leaking ASTs by storage capacity tier from the draft December 1994 liner study.[9]

**Table II.7: EPA's Estimates of Leaking ASTs by Storage Capacity Tier**

| Storage capacity (gallons) | Marketing | Refining | Production | Transportation | Total |
|---|---|---|---|---|---|
| 1,092-21,000 | 10,406 | 691 | 40,998 | 113 | 52,208 |
| 21,000-42,000 | 711 | 435 | 3,037 | 50 | 4,233 |
| 42,000-420,000 | 1,194 | 1,702 | 1,933 | 241 | 5,070 |
| 420,000-4.2 million | 1,848 | 2,047 | 92 | 828 | 4,815 |
| Over 4.2 million | 71 | 361 | 0 | 276 | 708 |
| Total | 14,230 | 5,236 | 46,060 | 1,508 | 67,034 |

## Location of Leaks

EPA has found that leaks typically originate from the bottom of vertical ASTs as a result of perforations often caused by corrosion. Underground piping was also identified as a significant potential source of leaking oil at AST facilities.

API's July 1994 AST survey report stated that during the past 5 years, groundwater contamination appears to have been caused by a variety of minor sources. Additionally, the survey data noted that AST bottom leaks were not a major source of contamination. Survey respondents indicated that less than 3.6 percent of ASTs (in all age categories) had confirmed bottom failures within the past 5 years. The survey report stated that pressurized buried piping has been the most predominant source of contamination in all three sectors over the past 5 years.

[8]Final Report: Tank Corrosion Study, 1988, Suffolk County, New York, Department of Health Services.

[9]EPA officials stated that these estimates are undergoing management review and are subject to change.

## Amount of Product Discharged Because of These Leaks and the Threat to the Environment and Human Health Posed by the Leaks

EPA estimated oil leaks for 75,000 tanks in the petroleum industry with a storage capacity in excess of 42,000 gallons. On the basis of the age of ASTs, the likelihood of developing corrosion leaks, and leak detection thresholds, EPA's preliminary estimates show that ASTs could be leaking between 43 million and 54 million gallons of oil annually.

Regarding threat, EPA has found that oil discharge incidents have the potential to cause widespread damage, including contamination of soil, groundwater, and surface water supplies and loss of property. Because several hundred thousand onshore facilities with ASTs are located throughout the United States—many are near sensitive environments, including groundwater and surface water—discharges from ASTs represent a potentially significant environmental hazard. In addition, EPA has stated that oil spill incidents can pose risks to human health.

According to EPA, although the extent of injuries is unknown, most known injuries to human beings from exposure to oil have occurred as a result of their inhaling its vapors. Effects on humans from exposure to oil include generalized weakness, lethargy, dizziness, convulsions, coma, and death from acute exposure to volatilized constituents by inhalation; cancers of various organs; blood cancers such as leukemia; and generalized suppression of the immune system from chronic exposure by inhalation.

## Characteristics of Piping for Tank Systems

API's July 1994 member survey found that 78 percent of refining and 54 percent of marketing facilities have 75 percent or more of their AST-associated piping aboveground. In contrast, most transportation facilities leave the AST-associated piping below ground. According to the report, there are several reasons why the AST-associated piping is buried at transportation facilities. For example, these facilities are frequently remotely located, and as a result, piping is buried to prevent vandalism. The report noted that in certain situations, piping can be moved aboveground. However, safety and operational considerations may require that piping be buried. Inspections, emergency access, repair, exposure to radiant heat, expected settlement, earthquakes, thermal expansion/contraction, tank drainage, and susceptibility to vandalism are all considered when deciding to install piping above or below ground. The survey report stated that where operational and safety considerations allow, the relocation of older buried piping aboveground has been an ongoing practice at facilities in the refining, marketing, and transportation sectors for a number of years.

## Types of Secondary Containment Structures Being Used Under Tanks

Secondary containment structures are typically designed to contain the entire contents of the tank or tank battery within the structure and serve to contain any spilled oil or product in the event of a leak or sudden discharge. EPA found that secondary containment structures vary greatly, depending on the size of the tanks and the physical characteristics of the facility, and may be constructed of compacted soil, clay, concrete, or other synthetic material. Each of the different types of liners, such as impervious soil, coated or uncoated concrete, and geomembrane liners, can be effective in preventing groundwater contamination and in detecting leaks if properly installed and maintained. Poor maintenance can significantly reduce the effectiveness of certain types of liners.

## Types of Leak Detection Devices Being Used

According to EPA, current technology has produced a variety of leak detection systems, including alarms, inventory control, acoustic emissions testing, and volumetric measurement, and industry is aggressively developing technology to make leak detection more reliable.

Leak detection methods are either continuous or periodic. Continuous methods provide uninterrupted monitoring and, consequently, instant notification of tank failure or an oil discharge. Examples of continuous systems are overfill alarms and overfill sumps.

Periodic leak detection involves checks or tests at regular intervals to determine the occurrence of oil discharges or tank bottom failure. Periodic systems include internal/external visual inspections, pressure/vacuum testing of tanks and piping, volumetric precision testing of the tank, inventory record and measurement reconciliation, acoustic emissions testing, and chemical gas detection methods.

# Major Contributors to This Report

| | |
|---|---|
| Resources, Community, and Economic Development Division, Washington, D.C. | Lawrence J. Dyckman, Associate Director<br>David Marwick, Assistant Director<br>Robert J. Tice, Evaluator-in-Charge |
| Office of the General Counsel | Karen Keegan, Senior Attorney |

## Ordering Information

**The first copy of each GAO report and testimony is free. Additional copies are $2 each. Orders should be sent to the following address, accompanied by a check or money order made out to the Superintendent of Documents, when necessary. Orders for 100 or more copies to be mailed to a single address are discounted 25 percent.**

**Orders by mail:**

**U.S. General Accounting Office**
**P.O. Box 6015**
**Gaithersburg, MD 20884-6015**

**or visit:**

**Room 1100**
**700 4th St. NW (corner of 4th and G Sts. NW)**
**U.S. General Accounting Office**
**Washington, DC**

**Orders may also be placed by calling (202) 512-6000 or by using fax number (301) 258-4066, or TDD (301) 413-0006.**

**Each day, GAO issues a list of newly available reports and testimony. To receive facsimile copies of the daily list or any list from the past 30 days, please call (301) 258-4097 using a touchtone phone. A recorded menu will provide information on how to obtain these lists.**

**United States**
**General Accounting Office**
**Washington, D.C. 20548-0001**

**Bulk Mail**
**Postage & Fees Paid**
**GAO**
**Permit No. G100**

**Official Business**
**Penalty for Private Use $300**

**Address Correction Requested**