

ANALYSIS OF THE EFFECTIVENESS OF EPA'S SPCC PROGRAM ON SPILL RISK

1. EXECUTIVE SUMMARY

This analysis examines the extent to which compliance with EPA's SPCC Program¹ influences a facility's risk to the environment. This analysis is based on the results of EPA's 1995 Survey of Oil Storage Facilities (1995 SPCC Survey), which collected information from more than 2,600 oil-storing facilities in 23 different industries, and provided information on facility and tank characteristics, spill incidents, and facility operations. Specifically, this analysis investigates whether a facility's overall compliance with the SPCC program, as well as its specific individual regulatory provisions, has an impact on certain measures of oil spill risk. The spill risk measures used in this analysis include annual number of spills, spill volume, cleanup costs, and the degree of off-site migration.²

The results of the analysis point to several conclusions about the SPCC program. First, the analysis shows that compliance with several specific SPCC provisions appears to reduce both the number and volume of spills, as well as the amount of oil that migrates outside of the facility's boundaries. Facility practices such as tank leak detection, spill overfill protection, pipe external protection, and secondary containment, also appear to reduce the number and magnitude of oil spills. The results also indicate that a facility's compliance with even one SPCC measure may serve as a general indicator of a facility owner's/operator's awareness of the importance of other spill prevention and control measures.

Second, an analysis of the overall effectiveness of the SPCC program is contingent on obtaining an adequate sample of facilities that comply with all or most of the SPCC provisions. The results of the 1995 SPCC Survey indicate that a large proportion of facilities that meet the capacity threshold requirements of the SPCC program may not be in full compliance with the SPCC regulatory requirements.³ Nonetheless, the limited analysis of facilities that comply with a set of the SPCC provisions indicates that implementing the SPCC Program reduces oil spill risk for certain industry sectors.

2. APPROACH

Using the results from the 1995 SPCC Survey, EPA examined the effect of a facility's compliance with the full range of SPCC program requirements, as well as compliance with

¹ The Spill Prevention, Control, and Countermeasures regulation is found at 40 CFR Part 112.

² Off-site migration refers to the ratio of the amount of oil contained on-site to the total amount of oil spilled.

³ Facilities subject to EPA's requirements for developing facility response plans, however, appear to be complying with the FRP requirements in greater numbers.

specific individual SPCC provisions, on spill risk.⁴ The results of the analysis are provided below.

2.1 Analysis of the Overall Effectiveness of the SPCC Program

In the first part of this analysis, EPA focused on determining whether facilities that comply with all of the SPCC regulatory provisions have a lower spill risk than facilities that do not comply. A critical step in this analysis is identifying those facilities that fully comply with the SPCC program and those that do not. It then is possible to estimate the spill risk measures for each group and determine whether there are differences between the two groups, whether the differences are positive or negative, and the strength or significance of the differences.

EPA analyzed the 1995 SPCC Survey results for those questions that addressed a facility's compliance with certain SPCC program provisions. Specifically, EPA analyzed responses to questions that asked whether the facility:

- Is subject to the SPCC regulations;
- Uses tank leak detection systems;
- Uses spill/overfill protection;
- Uses pipe external protection;
- Has secondary containment;
- Conducts formal training;
- Has a written spill prevention plan; and
- Has a written spill response plan.

Analysis of the responses to these questions suggests that many facilities are not implementing a majority of these SPCC provisions. The number of facilities that indicated compliance with a combination of several SPCC provisions was too small to perform statistical analysis within acceptable error bounds. In particular, the number of facilities available for analysis declined with the addition of each SPCC provision, such that only 11 of the 2,607 respondents to the 1995 SPCC Survey indicated that their facilities complied with all SPCC

⁴ Where possible, EPA compared the results of the 1995 SPCC Survey with the results of the "1994 Survey of API Members' Aboveground Storage Tank (AST) Facilities" (American Petroleum Institute, 1994) to help assess the validity of EPA's results. Except where noted, EPA found general agreement with the results of the two surveys in terms of tank characteristics, spill prevention measures, and sources of spills.

provisions examined.⁵ Therefore, the set of facilities that appeared to implement the majority of the SPCC-related provisions was too small to support the analysis of program effectiveness. As a result, EPA could not fully address the issue of whether facility compliance with the full range of the SPCC provisions has an effect on the spill risk measures used in this analysis. Nonetheless, EPA did perform a limited set of analyses, discussed in section 3, to examine the relationship between a facility's combined use of several SPCC provisions and the spill risk measures.

2.2 Analysis of the Effectiveness of Individual SPCC Provisions

In the second part of the analysis, EPA examined the effect that several individual SPCC regulatory requirements have on a facility's spill risk by analyzing facility compliance with the following SPCC program requirements:

- Tank leak detection systems;
- Spill/overfill protection;
- Pipe external protection;⁶
- Secondary containment;
- Formal training;⁷
- Written spill prevention plan; and
- Written spill response plan.⁸

⁵ From a total of 2,607 facilities responding to the survey, only 431 indicated that the facility maintains a spill prevention plan; only 381 have both a spill prevention plan and use leak detection; only 281 facilities have a spill prevention plan, secondary containment, and a spill response plan; and only 18 have a spill prevention plan, secondary containment, and use leak detection. The low response rates may result from the fact that several questions (including use of written spill prevention plans) were voluntary.

⁶ Cathodic protection is a common method of external protection. EPA's comparison of the 1995 SPCC Survey results to the 1994 API Survey results indicates that the use of cathodic protection revealed by EPA's Survey is comparable to API's data for facilities in the petroleum refining sector (SIC 29), but is much lower in the petroleum bulk stations and terminals (SIC 5171) and fuel oil dealers (SIC 5983) industries. This finding may be consistent with the fact that the 1995 SPCC Survey found a larger proportion of smaller aboveground storage tanks in these marketing industries than the 1994 API Survey.

⁷ The response rate for the voluntary question that addressed training was too low to perform statistical analysis on the individual effects that training has on the spill risk measures.

⁸ Because certain SPCC provisions are intended to prevent spills (e.g., tank leak detection) while others are intended to mitigate a spill once one occurs (e.g., spill response plans), different definitions or measures of spill risk were used to reflect the purpose of the provision being examined. For example, the total number of spills would be an inappropriate measure of spill risk for the response plan requirement as this requirement is not intended to prevent spills from occurring. Instead, the analysis of the effectiveness of spill response plans measured spill risk in

EPA used standard statistical models to analyze the effectiveness of each SPCC provision on spill risk. Specifically, EPA used the Ordinary Least Squares (OLS) model to determine whether a relationship existed between a particular SPCC provision and the spill risk measure, whether that relationship was positive or negative, and the strength or significance of that relationship. The results of the analysis are based on a facility-level analysis of over 2,000 facility surveys. Because a facility may have more than one tank, and may not use an SPCC provision system on every tank, EPA calculated a facility's propensity to use the system by dividing the number of tanks with the system by the total number of tanks. If the ratio was greater than 50 percent, then the facility was assumed to have a propensity to use the system. EPA used this ratio in an OLS regression model to estimate the relationship between a facility's propensity to use the system and spill risk.

3. RESULTS

The analysis indicates that a facility's compliance with even one of the following SPCC provisions reduces the number and magnitude of oil spills: (1) tank leak detection systems; (2) spill/overflow protection systems; (3) pipe external protection; and (4) secondary containment. In particular, the analysis reveals that each of these SPCC provisions had a significant effect on reducing the annual number of oil spills, the annual total volume of oil spilled, the annual total costs of cleaning up the spilled oil, and the degree of off-site migration. Exhibit 1 provides a summary of the relationships between these SPCC provisions and the spill risk measures. As the exhibit indicates, each of these relationships is significant at the 95-percent confidence level. In addition, EPA's analysis of a facility's use of up to four SPCC provisions indicates that for consumption and institutional facilities⁹ specifically, the annual total volume of oil spilled decreases as the percentage of tanks that use a combination of the SPCC measures increases. However, the analysis did not indicate a relationship between the combination of SPCC provisions and a reduction in the other spill risk measures.

As noted in Exhibit 1, EPA's analysis of the effect that a written spill prevention plan or a spill response plan has on a facility's spill risk was inconclusive. EPA encountered several problems in using the Survey data to conduct the analysis relating spill risk to the presence of a prevention or response plan. For example, response to the Survey question that addresses whether a facility maintains a spill prevention plan was voluntary,¹⁰ which significantly reduced the response rate for that question. The analysis also indicated that most facilities that do maintain a spill prevention plan are predominately larger facilities that generally have more spills than smaller facilities.¹¹ This trend further complicated the analysis because of the small number of respondent facilities within some facility size groups.

terms of annual total volume spilled, whether the oil was contained on-site or not (i.e., off-site migration), and the cost of cleaning up the spill.

⁹ Consumption facilities include those that operate in certain manufacturing, mining, and construction industry sectors. Institutional facilities include such facilities as colleges and hospitals.

¹⁰ In 1994, during the survey development, OMB compelled EPA to make certain survey questions voluntary in order to reduce the information collection burden on survey recipients.

¹¹ See "Analysis of the Relationship Between Facility Characteristics and Oil Spill Risk," U.S. EPA, July 1996.

**Exhibit 1:
Relationships Between SPCC-Related Provisions and Spill Risk Measures**

SPCC Provision	Spill Risk Measure			
	Impact on Number of Spills	Impact on Spill Volume	Impact on Cleanup Cost	Impact on Off-Site Migration
Tank Leak Detection	Reduction ^a	Reduction	Reduction	Reduction
Spill/Overfill Protection	Reduction	Reduction	Reduction	Reduction
Pipe External Protection	Reduction	Reduction	Reduction	Reduction
Secondary Containment	Reduction	Reduction	Reduction	Reduction
Spill Prevention Plan	Inconclusive	Inconclusive	Inconclusive	Inconclusive
Spill Response Plan	Not Estimated ^b	Inconclusive	Inconclusive	Inconclusive

^a "Reduction" indicates that there is 95-percent confidence that the SPCC provision has a positive effect on reducing the particular spill risk measure (e.g., leak detection reduces the number of spills).

^b The impact on the number of spills was not estimated because response plans are designed to minimize spill damage, not the number of spills.

EPA's analysis showed that facility response plans were not statistically related to a facility's annual total spill volume, cleanup costs, or whether the spill was contained on-site. However, this analysis required the use of facilities in all size categories, not only those that may be subject to EPA's facility response plan requirements.¹² It is possible that many facilities that have spill response plans developed them as part of other contingency planning activities and not in response to EPA's program requirements. As a result, the spill response plans of such facilities may not be consistent with the requirements under EPA's facility response plan provisions.

The analysis of individual SPCC provisions also identified several interesting relationships between compliance with an SPCC provision and the effects on the spill risk measures. In particular, the results indicate that certain SPCC provisions not only have a positive effect in terms of preventing the number of spills, but also in terms of containing spilled oil on-site when a spill occurs. For example, although EPA considers tank leak detection systems, spill/overfill protection systems, and pipe external protection to be spill prevention systems, EPA found that these SPCC provisions also have a strong association with the

¹² A control group that is necessary for the analysis of the effectiveness of spill response plans was unavailable (i.e., there were very few facilities with greater than 1 million gallons that also did not have a response plan).

containment of spilled oil on-site. Similarly, although EPA considers secondary containment to be a method of controlling, rather than preventing, oil spills, the analysis shows that the presence of secondary containment systems at a facility strongly correlates with a reduction in the number of oil spills. These results suggest that the presence of one of these SPCC measures at a facility may serve as a general indicator of a facility owner's/operator's awareness of the importance of other spill prevention and control measures.

Given the strong, beneficial effect of individual SPCC provisions on spill risk measures, as well as the results of the limited analysis of the combined use of SPCC provisions, the results indicate that the SPCC program as a whole has a positive influence on reducing the number and magnitude of oil spills. These results serve only as an indication of the overall positive effects of the SPCC program; additional analysis using more complete information from an adequate set of facilities that comply with the full range of SPCC provisions would be necessary to confirm this preliminary finding.