INSPECTION, EVALUATION, AND TESTING

7.1 Introduction

Regularly scheduled inspections, evaluations, and testing by qualified personnel are critical parts of discharge prevention. Their purpose is to prevent, predict, and readily detect discharges. They are conducted not only on containers, but also on associated piping, valves, and appurtenances, and on other equipment and components that could be a source or cause of an oil release. Activities may involve one or more of the following: an external visual inspection of containers, piping, valves, appurtenances, foundations, and supports; a non-destructive shell test to evaluate integrity of certain containers; and additional evaluations, as needed, to assess the equipment's fitness for continued service. The type of activity and its scope will depend on the exercise of good engineering practice; not every action will necessarily be applicable to every facility and container, and additional inspections may be required in some cases. An inspection, evaluation, and testing program that complies with SPCC requirements should specify the procedures, schedule/frequency, types of equipment covered, person(s) conducting the activities, recordkeeping practices, and other elements as outlined in this chapter.

The remainder of this chapter is organized as follows:

- **Section 7.2** provides an overview of the SPCC inspection, evaluation, and testing requirements.
- **Section 7.3** discusses specific cases, including the use of environmentally equivalent measures.
- **Section 7.4** discusses the role of the EPA inspector in reviewing a facility's compliance with the rule's inspection, evaluation, and testing requirements.
- **Section 7.5** summarizes industry standards, code requirements, and recommended practices (RPs) that apply to different types of equipment.

7.2 Inspection, Evaluation, and Testing under the SPCC Rule

Various provisions of the SPCC rule relate to the inspection, evaluation, and testing of containers, associated piping, and other oil-containing equipment. Different requirements apply to different types of equipment and to different types of facilities. The requirements are generally aimed at preventing discharges of oil caused by leaks, brittle fracture, or other forms of container failure by ensuring that containers used to store oil have the necessary physical integrity for continued oil storage. The requirements are also aimed at detecting container failures (such as small pinhole leaks) before they can become significant and result in a discharge as described in §112.1(b).

7.2.1 Summary of Inspection and Integrity Testing Requirements

Table 7-1 summarizes the provisions that apply to different types of equipment and facilities. Some inspection and testing provisions apply to bulk storage containers at onshore facilities (other than production facilities). Inspection and/or testing requirements also apply to other components of a facility that might cause a discharge (such as vehicle drains, foundations, or other equipment or devices). Other inspection requirements also apply to oil production facilities. In addition, inspection, evaluation, and testing requirements are required under certain circumstances, such as when an aboveground field-constructed container undergoes repairs, alterations, or a change in service that may affect its potential for a brittle fracture or other catastrophe, or in cases where secondary containment for bulk storage containers is impracticable (§112.7(d), as described in Chapter 4 of this document.) Facility owners and operators must also maintain corresponding records to demonstrate compliance (§§112.8(c)(6), 112.8(d)(4), 112.9(b)(2), 112.9(c)(3), and 112.9(d)(1) and (2)) per §112.7(e).

Table 7-1. Summary of SPCC inspection, evaluation, testing, and maintenance program provisions.

Facility Component	Section(s)	Action	Method, Circumstance, and Required Action
General Requirements Applicable to All Facilities			
Bulk storage with no secondary containment and for which an impracticability determination has been made	112.7(d)	**Test**	Integrity testing.[1] *Periodically. However, because there is no secondary containment, good engineering practice may suggest more frequent testing than would otherwise be scheduled*.
Valves and piping associated with bulk storage containers with no secondary containment and for which an impracticability determination has been made	112.7(d)	**Test**	Integrity and leak testing of valves and piping associated with containers that have no secondary containment as described in §112.7(c). *Periodically.*

[1] Integrity testing is any means to measure the strength (structural soundness) of a container shell, bottom, and/or floor to contain oil, and may include leak testing to determine whether the container will discharge oil. Integrity testing is a necessary component of any good oil discharge prevention plan. It will help to prevent discharges by testing the strength and imperviousness of containers, ensuring they are suitable for continued service under current and anticipated operating conditions (e.g., product, temperature, pressure). Testing may also help facilities determine whether corrosion has reached a point where repairs or replacement of the container is needed, and thus avoid unplanned interruptions in facility operations. (67 FR 47120)

Facility Component	Section(s)	Action	Method, Circumstance, and Required Action
Recordkeeping requirement	112.7(e)	**Record**	Keep written procedures and a signed record of inspections and tests for a period of three years.[2] Records kept under usual and customary business practices will suffice. *For all actions.*
Lowermost **drain** and all outlets of tank car or tank truck	112.7(h)(3)	**Inspect**	Visually inspect. *Prior to filling and departure of tank car or tank truck.*
Field-constructed **aboveground container**	112.7(i)	**Evaluate**	Evaluate potential for brittle fracture or other catastrophic failure. *When the container undergoes a repair, alteration, reconstruction or a change in service that might affect the risk of a discharge or failure due to brittle fracture or other catastrophe, or has discharged oil or failed due to brittle fracture failure or other catastrophe. Based on the results of this evaluation, take appropriate action.*
Subpart B: Onshore Facilities – Petroleum and Other Non-Petroleum Oils Subpart C: Onshore Facilities (Excluding Production Facilities) – Animal Fats and Vegetable Oils			
Onshore Facilities (Excluding Production)			
Diked areas	112.8(b)(1) & 112.8(b)(2) or 112.12(b)(1) & 112.12(b)(2) & 112.8(c)(10) or 112.12(c)(10)	**Inspect**	Visually inspect content for presence of oil. *Prior to draining.* You must promptly remove any accumulations of oil in diked areas.
Buried *metallic* storage tank installed on or after January 10, 1974	112.8(c)(4) or 112.12(c)(4)	**Test**	Leak test. *Regularly.*
Aboveground **bulk storage** container	112.8(c)(6) or 112.12(c)(6)	**Test**	Test container integrity. Combine visual inspection with another testing technique (such as non-destructive shell testing). *Following a regular schedule and whenever material repairs are made.*
Aboveground **bulk storage** container	112.8(c)(6) or 112.12(c)(6) & 112.8(c)(10) or 112.12(c)(10)	**Inspect**	Inspect outside of container for signs of deterioration and discharges. *Frequently.* Promptly correct visible discharges which result in a loss of oil from the container, including but not limited to seams, gaskets, piping, pumps, valves, rivets, and bolts.

[2] Certain industry standards require recordkeeping beyond three years.

Facility Component	Section(s)	Action	Method, Circumstance, and Required Action
Bulk storage container **supports and foundation**	112.8(c)(6) or 112.12(c)(6)	**Inspect**	Inspect container's supports and foundations. *Following a regular schedule and whenever material repairs are made.*
Diked area	112.8(c)(6) or 112.12(c)(6) & 112.8(c)(10) or 112.12(c)(10)	**Inspect**	Inspect for signs of deterioration, discharges, or accumulation of oil inside diked areas. *Frequently*. You must promptly remove any accumulations of oil in diked areas.
Steam return and exhaust lines	112.8(c)(7) or 112.12(c)(7)	**Monitor**	Monitor for contamination from internal heating coils. *On an ongoing basis*.
Liquid level sensing devices	112.8(c)(8)(v) or 112.12(c)(8)(v)	**Test**	Test for proper operation. *Regularly.*
Effluent treatment facilities	112.8(c)(9) or 112.12(c)(9)	**Observe**	Detect possible system upsets that could cause a discharge. *Frequently.*
Buried piping	112.8(d)(1) or 112.12(d)(1)	**Inspect**	Inspect for deterioration. *Whenever a section of buried line is exposed for any reason.* If you find corrosion damage, you must undertake additional examination and corrective action as indicated by the magnitude of the damage.
Buried piping	112.8(d)(4) or 112.12(d)(4)	**Test**	Integrity and leak testing. *At the time of installation, modification, construction, relocation, or replacement.*
All aboveground **valves, piping, and appurtenances**	112.8(d)(4) or 112.12(d)(4)	**Inspect**	During the inspection, assess general condition of items, such as flange joints, expansion joints, valve glands and bodies, catch pans, pipeline supports, locking of valves, and metal surfaces. *Regularly.*
Onshore Production Facilities			
Diked area	112.9(b)(1)	**Inspect**	Visually inspect content. *Prior to draining.* You must remove accumulated oil on the rainwater and return it to storage or dispose of it in accordance with legally approved methods.
Field **drainage systems, oil traps, sumps, and skimmers**	112.9(b)(2)	**Inspect**	Detect accumulation of oil that may have resulted from any small discharge. *Inspect at regularly scheduled intervals.* You must promptly remove any accumulations of oil.
Aboveground containers	112.9(c)(3)	**Inspect**	Visually inspect to assess deterioration and maintenance needs. *Periodically and on a regular schedule.*

Facility Component	Section(s)	Action	Method, Circumstance, and Required Action
Foundations or supports of each container that is on or above the surface of the ground	112.9(c)(3)	**Inspect**	Visually inspect to assess deterioration and maintenance needs. *Periodically and on a regular schedule.*
All aboveground **valves and piping** associated with transfer operations	112.9(d)(1)	**Inspect**	During the inspection, assess general condition of flange joints, valve glands and bodies, drip pans, pipe supports, pumping well polish rod stuffing boxes, bleeder and gauge valves, and other such items. *Periodically and on a regular schedule.*
Saltwater disposal facilities	112.9(d)(2)	**Inspect**	Inspect to detect possible system upsets capable of causing a discharge. *Often, particularly following a sudden change in atmospheric temperature.*
Offshore Oil Drilling, Production, and Workover Facilities			
Flowlines	112.9(d)(3)	**Inspect**	Have a program of flowline maintenance to prevent discharges from each flowline. *Each program may have its own specific and individual inspection, testing, and/or evaluation requirements and frequencies as determined by the PE*.
Sump system (liquid removal system and pump start-up device)	112.11(c)	**Inspect and Test**	Use preventive maintenance inspection and testing program to ensure reliable operation. *Regularly scheduled.*
Pollution prevention equipment and systems	112.11(h) & (i)	**Inspect and Test**	Prepare, maintain, and conduct testing and inspection of the pollution prevention equipment and systems commensurate with the complexity, conditions, and circumstances of the facility and any other appropriate regulations. You must use simulated discharges for testing and inspecting human and equipment pollution control and countermeasure systems. *On a scheduled periodic basis.*
Sub-marine piping	112.11(p)	**Inspect and Test**	Inspect and test for good operating conditions and for failures. *Periodically and according to a schedule.*

The SPCC rule is a performance-based regulation. Since each facility may present unique characteristics and since methodologies may evolve as new technologies are developed, the rule does not prescribe a specific frequency or methodology to perform the required inspections, evaluations, and tests. Instead, it relies on the use of good engineering practice, based on the professional judgement of the Professional Engineer (PE) who certifies the SPCC Plan considering industry standards. In addition, recommended practices, safety considerations, and requirements of other federal, state, or local regulations may be considered in the development and PE certification of the SPCC Plan. Section 112.3(d) specifically states that the PE certification of a Plan attests that “procedures for required inspections and testing have been established.” Thus, in certifying an SPCC Plan, a PE is also certifying that the inspection program it describes is appropriate for the facility and is consistent with good engineering practice. Section 112.3(d) also states that the Plan must be prepared in accordance with good engineering practice, including consideration of applicable industry standards, and with the requirements of 40 CFR part 112.

The preamble to the 2002 revised SPCC rule lists examples of industry standards and recommended practices that may be relevant to determining what constitutes good engineering practice for various rule provisions. These industry standards are summarized in Tables 7-2 and 7-3 (Section 7.2.6) and further discussed in Section 7.5. It is important to note, however, that the industry standards may be more specific and more stringent than the requirements in the SPCC rule. For example, EPA does not prescribe a particular schedule for testing. This is because "good engineering practice" and relevant industry standards change over time. In addition, site-specific conditions at an SPCC-regulated facility play a significant role in the development of appropriate inspections and tests and the associated schedule for these activities. For example, the American Petroleum Institute (API) Standard 653, "Tank Inspection, Repair, Alteration, and Reconstruction," includes a cap on the maximum interval between external and internal inspections, and provides specific criteria for alternative inspection intervals based on the calculated corrosion rate. API 653 also provides an internal inspection interval when the corrosion rates are not known. Similarly, the Steel Tank Institute (STI) Standard SP-001, 3rd Edition, provides specific intervals for external and internal inspection of shop-built containers based on container size and configuration.

Integrity testing requirements for the SPCC rule may be replaced by environmentally equivalent measures as allowed under §112.7(a)(2) and reviewed by the PE who certifies the Plan. Chapter 3 of this guidance provides a general discussion of environmental equivalence, while Section 7.3 discusses its particular relevance to inspection, evaluation, and testing requirements.

7.2.2 Regularly Scheduled Integrity Testing and Frequent Visual Inspection of Aboveground Bulk Storage Containers

§§112.8(c)(6) and 112.12(c)(6)
Test each aboveground container for integrity on a regular schedule, and whenever you make material repairs. The frequency of and type of testing must take into account container size and design (such as floating roof, skid-mounted, elevated, or partially buried). You must combine visual inspection with another testing technique such as hydrostatic testing, radiographic testing, ultrasonic testing, acoustic emissions testing, or another system of non-destructive shell testing. You must keep comparison records and you must also inspect the container's supports and foundations. In addition, you must frequently inspect the outside of the container for signs of deterioration, discharges, or accumulation of oil inside diked areas. Records of inspections and tests kept under usual and customary business practices will suffice for purposes of this paragraph.

Note: The above text is only a brief excerpt of the rule. Refer to 40 CFR part 112 for the full text of the rule.

Section 112.8(c)(6) of the SPCC rule specifies the inspection and testing requirements for aboveground bulk storage containers at onshore facilities that store, use, or process petroleum oils and non-petroleum oils (except animal fats and vegetable oils). Section 112.12(c)(6) contains the same requirements for facilities with animal fats and vegetable oils.

The provision sets two distinct requirements for aboveground bulk storage containers:

(1) Regularly scheduled integrity testing; and
(2) Frequent visual inspection of the outside of the container.

Regularly scheduled integrity testing. The integrity testing requirements are distinct from, and are in addition to, the requirement to frequently inspect the outside of an aboveground storage container ("visual inspection," see below). The integrity testing requirement applies to large (field-constructed or field-erected) and small (shop-built)[3] aboveground containers; aboveground containers on, partially in (partially buried, bunkered, or vaulted tanks), and off the ground wherever located; and to aboveground containers storing any type of oil.

Generally, visual inspection alone is not sufficient to test the integrity of the container as stated in §§112.8(c)(6) and 112.12(c)(6); it must be combined with another testing technique and must include the container's supports and foundations. Testing techniques include but are not limited to:

- Hydrostatic testing;[4]
- Radiographic testing;
- Ultrasonic testing;
- Acoustic emissions testing; and
- Another system of non-destructive shell testing.

The SPCC rule requires that integrity testing of aboveground bulk storage containers be performed on a regular schedule, as well as when material repairs[5] are made, because such repairs might increase the potential for oil discharges. As stated in the preamble to the final 2002 rule, "Testing on a 'regular schedule' means testing per industry standards or at a frequency sufficient to prevent discharges. Whatever schedule the PE selects must be documented in the Plan" (67 FR 47119). The frequency of integrity tests should reflect the particular conditions of the container, such as the age, service history, original construction specifications, prior inspection results, and the existing condition of the container. It may also consider the degree of risk of a discharge to navigable waters and adjoining shorelines. For example, where secondary containment is inadequate (none provided, insufficient capacity or insufficiently impervious) and adequate

[3] According to STI SP-001, a field-erected aboveground storage tank (AST) is a welded metal AST erected on the site where it will be used. For the purpose of the standard, ASTs are to be inspected as field-erected ASTs if they are either: (a) an AST where the nameplate indicates that it is a field-erected AST, and limited to a maximum shell height of 50 feet and maximum diameter of 30 feet; or (b) an AST without a nameplate that is more than 50,000 gallons and has a maximum shell height of 50 feet and a maximum diameter of 30 feet. A shop-fabricated AST is a welded metal AST fabricated in a manufacturing facility or an AST not otherwise identified as field-erected with a volume less than or equal to 50,000 gallons. (STI SP-001, "Standard for the Inspection of Aboveground Storage Tanks," July 2005)

[4] Hydrostatic testing is allowed per §112.8(c)(6); however, hydrotesting the container may actually result in container failure during the test and should be performed in accordance with industry standards and using the appropriate test media.

[5] Examples of material repairs include removal or replacement of the annular plate ring; replacement of the container bottom; jacking of a container shell; installation of a 12-inch or larger nozzle in the shell; replacement of a door sheet or tombstone in the shell, or other shell repair; or such repairs that might materially change the potential for oil to be discharged from the container.

secondary containment would be impracticable, §112.7(d) requires, among other measures, periodic integrity testing of bulk storage containers. Given the higher potential of a discharge reaching navigable waters or adjoining shorelines, however, the PE may decide, based on good engineering practice, that more frequent integrity tests would be needed than for containers that have adequate secondary containment. This approach of establishing an increased inspection frequency for an aboveground container without secondary containment is used in the STI SP-001 standard.

Frequent visual inspection. There must be a frequent inspection of the outside of the container for signs of deterioration, discharges, or accumulations of oil inside diked areas (§112.8(c)(6)). This visual inspection is intended to be a routine walk-around. EPA expects that the walk-around, which will occur on an ongoing routine basis, can generally be conducted by properly trained facility personnel, as opposed to the more intensive but less frequent visual inspection component of the non-destructive examination conducted by qualified testing/inspection personnel. Qualifications of these personnel are outlined in tank inspection standards, such as API 653 and STI SP-001. A facility owner or operator can, for example, visually inspect the outside of bulk storage containers on a daily, weekly, and/or monthly basis, and supplement this inspection with integrity testing (see above) performed by a certified inspector, with the scope and frequency determined by industry standards or according to a site-specific inspection program developed by the PE.

Oil-filled electrical, operating, and manufacturing devices or equipment are not considered bulk storage containers; therefore, the integrity testing requirements in §§112.8(c)(6) and 112.12(c)(6) do not apply to those devices or equipment. However, EPA recommends that even where not specifically required by the rule, it is good engineering practice to frequently inspect the outside of oil-filled operational, electrical, and manufacturing equipment to determine whether it could cause a discharge. For example, in a food manufacturing process, certain containers that contain edible oil (such as reactors, fermentors, or mixing tanks) are considered oil-filled manufacturing equipment and are not required to undergo integrity testing. Since a discharge as described in §112.1(b) can occur from manufacturing, discharge discovery and thus visual inspection procedures outlined in an SPCC Plan should include this equipment as well as other oil-filled equipment to prevent such a discharge as part of the facility's countermeasures per §112.7(a)(3)(iv) for discharge discovery. Although oil-filled equipment is not subject to the integrity testing requirements under §112.8(c)(6) or §112.12(c)(6), EPA recommends routine inspections at least visually to detect discharges as part of the facility's countermeasures per §112.7(a)(3)(iv) for discharge discovery.

7.2.3 Brittle Fracture Evaluation of Field-Constructed Aboveground Containers

Brittle fracture is a type of structural failure in larger field-constructed aboveground steel tanks characterized by rapid crack formation that can cause sudden tank failure. This, along with catastrophic failures such as those resulting from lightning strikes, seismic activity, or other such events, can cause the entire contents of a container to be discharged to the environment. A review of past failures due to brittle fracture shows that they typically occur (1) during an initial hydrotest,

(2) on the first filling in cold weather, (3) after a change to lower temperature service, or (4) after a repair/modification. Storage tanks with a maximum shell thickness of one-half inch or less are not generally considered at risk for brittle fracture.[6] Brittle fracture was most vividly illustrated by the splitting and collapse of a 3.8 million gallon (120-foot diameter) tank in Floreffe, Pennsylvania, which released approximately 750,000 gallons of oil into the Monongahela River in January 1988.

Section 112.7(i) of the SPCC rule requires that field-constructed aboveground containers that have undergone a repair or change in service that might affect the risk of a discharge due to brittle fracture or other catastrophe, or have had a discharge associated with brittle fracture or other catastrophe, be evaluated to assess the risk of such a discharge. Unless the original design shell thickness of the tank is less than one-half inch (see API 653, Section 5, and STI SP-001, Appendix B), evidence of this evaluation should be documented in the facility's SPCC Plan.

§112.7(i)
If a field-constructed aboveground container undergoes a repair, alteration, reconstruction, or a change in service that might affect the risk of a discharge or failure due to brittle fracture or other catastrophe, or has discharged oil or failed due to brittle fracture failure or other catastrophe, evaluate the container for risk of discharge or failure due to brittle fracture or other catastrophe, and as necessary, take appropriate action.

Note: The above text is only a brief excerpt of the rule. Refer to 40 CFR part 112 for the full text of the SPCC rule.

In summary, industry standards discuss methods for assessing the risk of brittle fracture failure for a field-erected aboveground container and for performing a brittle fracture evaluation including API 653, "Tank Inspection, Repair, Alteration, and Reconstruction," API RP 920 "Prevention of Brittle Fracture of Pressure Vessels," and API RP 579, "Fitness-for-Service." These standards include a decision tree or flowchart for use by the owner/operator and PE in assessing the risk of brittle fracture. STI SP-001 also addresses brittle fracture failures for smaller diameter field-erected tanks with a wall thickness less than one-half inch.

7.2.4 Inspections of Piping

For onshore facilities, the SPCC rule specifies the following inspection and testing requirements for piping. Buried piping at non-production facilities that has been installed or replaced on or after August 16, 2002, must have a protective wrapping and coating and be protected from corrosion cathodically or by other means, as per §§112.8(d)(1) and 112.12(d)(1). Any exposed line must be inspected for deterioration, and, if corrosion damage is found, additional inspection or corrective action must be taken as needed.

Aboveground piping, valves, and appurtenances at non-production facilities must be regularly inspected, as per §§112.8(d)(4) and 112.12(d)(4) and in accordance with industry

[6] McLaughlin, James E. 1991. "Preventing Brittle Fracture of Aboveground Storage Tanks – Basis for the Approach Incorporated into API 653." Case Studies: Sessions III and IV of the IIW Conference: Fitness for Purpose of Welded Structures. October 23-24, 1991, Key Biscayne, Florida, USA. Cosponsored by the American Welding Society, Welding Research Institute, Welding Institute of Canada, and International Institute of Welding. Published by the American Welding Society, Miami, Florida. Pages 90-110.

standards. Buried piping must be integrity and leak tested at the time of installation, modification, construction, relocation, or replacement.

Aboveground valves and piping associated with transfer operations at production facilities must be inspected periodically and on a regular schedule, as per §112.9(d)(1) and in accordance with industry standards. A program of flowline maintenance is required by §112.9(d)(3) and is described in the following section of this document.

For offshore facilities, §112.11(n) specifies that all piping appurtenant to the facility must be protected from corrosion, such as with protective coatings or cathodic protection. Section 112.11(p) requires that sub-marine piping appurtenant to the facility be maintained in good operating condition at all times, and that such piping be inspected or tested for failures periodically and according to a schedule.

In addition, if the owner/operator determines that these required measures are not practicable, periodic integrity and leak testing of valves and piping must be conducted, as per §112.7(d).

7.2.5 Flowline Maintenance

The objective of the SPCC flowline maintenance program requirement (§112.9(d)(3)) is to help prevent oil discharges from production flowlines, e.g., the piping that extends from the pump/well head to the production tank battery. Common causes of such discharges include mechanical damage (i.e., impact, rupture) and corrosion. A flowline maintenance program aims to manage the oil production operations in a manner that reduces the potential for a discharge. It usually combines careful configuration, inspection, and ongoing maintenance of flowlines and associated equipment to prevent and mitigate a potential discharge. EPA recommends that the scope of a flowline maintenance program include periodic examinations, corrosion protection, flowline replacement, and adequate records, as appropriate. EPA suggests that facility owner/operators conduct inspections either according to industry standards or at a frequency sufficient to prevent a discharge as described in §112.1(b). EPA is aware that API attempted to develop an industry standard for flowline maintenance, but the standard has not been finalized. However, according to practices recommended by industry groups, such as API, a comprehensive piping (flowline) program should include the following elements:

- **Prevention measures** that avert the discharge of fluids from primary containment;
- **Detection measures** that identify a discharge or potential for a discharge;
- **Protection measures** that minimize the impact of a discharge; and
- **Remediation measures** that mitigate discharge impacts by relying on limited or expedited cleanup.

If a standard for flowline maintenance is developed, inspectors are encouraged to review this standard. At present, the details below serve to guide the inspector in reviewing the scope of a flowline maintenance program. If an impracticability determination under §112.7(d) is made for flowlines for secondary containment required by §112.7(c), EPA inspectors should extensively review the adequacy of the flowline maintenance program along with the contingency plan (67 FR 47078).

A flowline maintenance program should ensure that flowlines, associated equipment, and safety devices are kept in good condition and would operate as designed in the event of a discharge. The PE certifying the Plan will typically establish the scope and frequency of inspections, tests, and preventive maintenance based on industry standards, manufacturer's recommendations, and other such sources of good engineering practice.

General Spill Prevention

The maintenance program should ensure that the equipment is configured and operated to prevent discharges. Adequate supports and signage should be maintained to help prevent mechanical damage to aboveground flowlines. Finally, the maintenance program should ensure the proper operation of safety devices such as low-pressure sensors and safety shut-down valves to mitigate the extent of a spill in the event of a flowline rupture.

Corrosion Protection

Internal corrosion may be prevented through the use of compatible materials (PVC, fiberglass, coatings) or by the addition of corrosion inhibitors. External corrosion may be prevented through the use of compatible materials, coatings/wrappings, and/or cathodic protection.

Periodic Examination

Visual observation of the flowlines by facility personnel should be included as part of any flowline maintenance program and is of paramount importance for those facilities with flowlines that have no secondary containment and rely on rapid spill detection to implement a contingency plan in a timely manner. Facility personnel may "walk the flowlines" or perform aerial fly-overs, if they are located aboveground, to detect any evidence of leakage. The visual inspection should cover the piping, flange joints, valves, drip pans, and supports, and look for signs of corrosion, deterioration, leakage, malfunction, and other problems that could lead to a discharge. The frequency of inspections can vary according to their scope, the presence of secondary containment, and the detection capability needed to ensure prompt implementation of a contingency plan (if no containment is present), and may include daily, monthly, quarterly, or annual inspections. Regular visual inspection may be supplemented by periodic integrity testing using non-destructive evaluation methods, such as ultrasonic or other techniques to determine remaining wall thickness, or hydrostatic testing at a pressure above normal operating pressure. This guidance document refers to some relevant industry standards that describe methods used to test the integrity of piping, such as API 570 and ASME B31.4.

Flowline Replacement and Recordkeeping

The facility's SPCC Plan should describe how the flowlines are configured, monitored, and maintained to prevent discharges. The program is to be implemented in the field, and facility personnel responsible for the maintenance of the equipment should be aware of the flowline locations and be familiar with maintenance procedures, including replacement of damaged and/or leaking flowlines. Records of inspections and tests kept under usual and customary business practices should be prepared and made available for review, as required by the rule (§112.7(e)).

If an impracticability determination is made for flowlines, the flowline maintenance program should be shown to be adequate along with the contingency plan (67 FR 47078).

7.2.6 Role of Industry Standards and Recommended Practices in Meeting SPCC Requirements

The SPCC rule does not require the use of a specific industry standard for conducting inspections, evaluations, and integrity testing of bulk storage containers and other equipment at the facility. Rather, the rule provides flexibility in the facility owner/operator's implementation of the requirement, consistent with good engineering practice, as reviewed by the PE certifying the Plan.

To develop an appropriate inspection, evaluation, and testing program for an SPCC-regulated facility, the PE must consider applicable industry standards (§112.3(d)(1)(iii)). If the facility owner or operator uses a specific standard to comply with SPCC requirements, the standard should be referenced in the Plan. Where no specific and general industry standard exists to inform the determination of what constitutes good engineering practice for a particular inspection or testing requirement, the PE should consider the manufacturer's specifications and instructions for the proper use and maintenance of the equipment, appurtenance, or container. If neither a specific and objective industry standard nor a specific and objective manufacturer's instruction apply, the PE may also call upon his/her professional experience to develop site-specific inspection and testing requirements for the facility or equipment as per §112.3(d)(1)(iv). The inspection and testing program must be documented in the Plan (§112.7(e)). A checklist is provided as Table 7-5 at the end of this chapter to assist inspectors in reviewing the relevant industry standards based on the equipment observed at an SPCC-regulated facility.

In the preamble to the 2002 SPCC rule, EPA provides examples of industry standards that may constitute good engineering practice for assessing the integrity of different types of containers for oil storage (67 FR 47120). Compliance with other industry standards and federal requirements may also meet SPCC inspection, evaluation, and testing requirements. The U.S. Department of Transportation (DOT) regulates containers used to transport hazardous materials, including certain oil products. For example, mobile/portable containers that leave a facility are subject to the DOT construction and continuing qualification and maintenance requirements (49 CFR part 178 and 49 CFR part 180). These DOT requirements may be used by the facility owner and operator and by the certifying PE as references of good engineering practice for assessing the fitness for service of mobile/portable containers.

Industry standards typically apply to containers built according to a specified design (API 653, for example, applies to tanks constructed in accordance with API 650 or API 12C); the standards describe the scope, frequency, and methods for evaluating the suitability of the containers for continued service. This assessment usually considers performance relative to specified minimum criteria, such as ability to maintain pressure or remaining shell thickness. The integrity testing is usually performed by inspectors licensed by the standard-setting organizations (e.g., American Petroleum Institute, Steel Tank Institute).

Table 7-2 summarizes key elements of industry standards (and recommended practices) commonly used for testing aboveground storage tanks (ASTs). Table 7-3 summarizes key elements of standards (and recommended practices) used for testing piping and other equipment. Section 7.5 of this chapter provides a more detailed description of the standards listed in the tables. Other industry standards exist for specific equipment or purposes. Many of these are cross-referenced in API 653, including publications and standards from other organizations such as the American Society for Testing and Materials (ASTM), the American Society for Non-Destructive Testing (ASNT), and the American Society of Mechanical Engineers (ASME). Other organizations, such as the National Fire Protection Association (NFPA), the National Association of Corrosion Engineers (NACE), and the Underwriters Laboratory (UL), also provide critical information on all container types and appurtenances.

Table 7-2. Summary of industry standards and recommended practices (RP) for ASTs.

	API 653	**STI SP-001**	**API RP 575**	**API RP 12R1**
Equipment covered	Field-fabricated, welded, or riveted ASTs operating at atmospheric pressure and built according to API 650.	ASTs including shop-fabricated and field-erected tanks and portable containers and containment systems.	Atmospheric and low-pressure ASTs.	Atmospheric ASTs employed in oil and gas production, treating, and processing.
Scope	Inspection and design; fitness for service; risk.	Determined by the type of material stored within the tank and the operating temperature. Inspection of tanks by the owner/ operator and certified inspectors.	Inspection and repair of tanks.	Setting, connecting, maintaining, operating, inspecting, and repairing tanks.
Inspection interval	*Certified inspections*: Dependent on tank's service history. Intervals from 5 to 20 years. *Owner inspections*: monthly.	*Certified inspection*s: Inspection intervals and scope based on tank size and configuration. *Owner inspections*: monthly, quarterly, and yearly.	Same as API 653.	Scheduled and unscheduled internal and external inspections conducted as per Table 1 of the Recommended Practice.
Inspection performed by	Certified inspector, tank owner.	Certified inspector, either by API or STI.	Same as API 653.	Competent person or qualified inspector, as defined in recommended practice.
Applicable section of this document	Section 7.5.1	Section 7.5.2	Section 7.5.3	Section 7.5.4

Table 7-3. Summary of industry standards and recommended practices (RP) for piping, valves, and appurtenances.

	API 570	API RP 574	API RP 1110	ASME B31.3	ASME B31.4
Equip-ment covered	In-service aboveground and buried metallic piping	Piping, tubing, valves and fittings in petroleum refineries and chemical plants	Liquid petroleum pipelines (pressure testing)	Process piping for oil, petrochemical, and chemical processes	Pressure piping for liquid hydrocarbons and other liquids
Scope	Inspection, repair, alteration, and rerating procedures	Inspection practices	Procedures, equipment, and factors to consider during pressure testing	Minimum safety requirements for design, examination, and testing	Safe design, construction, inspection, testing, operation, and maintenance
Inspection interval	Based on likelihood and consequence of failure (“risk-based”), maximum of 10 years	Based on five factors	–	As part of quality control function	Not specified
Inspection performed by	Certified piping inspector	Authorized piping inspector	–	Qualified Inspector, as defined in standard	Qualified Inspector, as defined in standard
Applicable section of this document	Section 7.5.5	Section 7.5.6	Section 7.5.7	Section 7.5.10	Section 7.5.11

“-“ means that the standard provides no specific information for the element listed.

7.3 Specific Circumstances

Integrity testing (a combination of visual inspection and another testing technique) is required for all aboveground bulk storage containers located at onshore facilities (except production facilities), unless the facility owner/operator implements an environmentally equivalent method (as described in Chapter 3 and in Section 7.3.4, below) and documents the deviation in the SPCC Plan. Typically, visual inspection is combined with non-destructive shell testing in order to adequately assess the container condition. EPA has indicated that visual inspection alone may provide equivalent environmental protection in some cases, if certain conditions are met and if the inspections are conducted at appropriate time intervals (see Section 7.3.4 of this document) in accordance with good engineering practice. Therefore, if the Plan calls for visual inspection *alone* in accordance with an industry standard, then the Plan must discuss the reason for the nonconformance with §112.8(c)(6) or §112.12(c)(6) and comply with the environmental equivalence provision in §112.7(a)(2).

Some facilities may not have performed integrity testing of their tanks. In this case, developing an appropriate integrity testing program will require assessing baseline conditions for these tanks. This "baseline" will provide information on the condition of the tank shell, and the rate of change in condition due to corrosion or other factors, in order to establish a regular inspection schedule. Section 112.7 requires that if any facilities, procedures, methods, or equipment are not yet fully operational, the SPCC Plan must explain the details of installation and operational start-up; this applies to the inspection and testing programs required by the rule. For all types of facilities, the PE is responsible for making the final determination on the scope and frequency of testing when certifying that an SPCC Plan is consistent with good engineering practice and is appropriate for the facility.

This section provides guidance on integrity testing for the following circumstances the inspector may encounter at an SPCC-regulated facility:

- Aboveground bulk storage containers for which the baseline condition is known;
- Aboveground bulk storage containers for which the baseline condition is *not* known;
- Deviation from integrity testing requirements based on environmental equivalence; and
- Environmental equivalence scenarios for shop-built containers.

This is not a comprehensive list of circumstances. For these and other cases, the PE may recommend alternative approaches.

7.3.1 Aboveground Bulk Storage Container for Which the Baseline Condition Is Known

In the case of tanks for which the baseline condition is known (e.g., the shell thickness and corrosion rates are known), the inspection and testing schedule should typically occur at a scope and frequency based on industry standards (or the equivalent developed by a PE for the site-specific SPCC Plan) per §112.8(c)(6) or §112.12(c)(6). There is an advantage to knowing the baseline condition of a tank, particularly if the remaining wall thickness and the corrosion rate are known. Only when the baseline is known can an inspection and testing program be established on a regular schedule. The inspection interval should be identified consistent with specific intervals per industry standards or should be based on the corrosion rate and expected remaining life of the container. This inspection interval must be documented in the Plan in accordance with §§112.3(d), 112.7(e), 112.8(c)(6), and 112.12(c)(6). API 653 is an example of an industry standard that directs the owner/operator to consider the remaining wall thickness and the established corrosion rate to determine an inspection interval for external and internal inspections and testing.

Inspection and testing standards may require visual inspection of both the exterior and interior of the container, and the use of another method of non-destructive evaluation depending on the type and configuration of the container. Inspectors should note that the scope and frequency of inspections and tests for shop-built tanks and field-erected tanks at an SPCC-regulated facility may vary due to the age of the tank, the configuration, and the applicable industry standard used as the reference. For example, the PE may choose to develop an inspection and testing program for the facility's shop-built tanks in accordance with STI SP-001, and may elect to develop the program for the facility's field-erected tanks in accordance with API 653. As an alternative example, the PE may elect to develop a program in accordance with STI SP-001 for the facility's shop-built tanks and for its field-erected tanks of a certain capacity and size. For containers at facilities storing animal fats and vegetable oils, the PE may elect to develop a hybrid testing program building upon elements of both API 653 and STI SP-001 or only one of the standards.

7.3.2 Aboveground Bulk Storage Container for Which the Baseline Condition Is Not Known

For a facility to comply with the requirement for integrity testing of containers on a regular schedule (§§112.8(c)(6) and 112.12(c)(6)), a baseline condition for each container is necessary to establish inspection intervals. The PE must attest that procedures for required inspections and testing have been established (§112.3(d)(1)(iv)). However, for shop-built and field-erected containers for which construction history and wall and/or bottom plate thickness baselines *are not known,* a regular integrity testing program cannot be established. Instead, the PE must describe in the SPCC Plan an interim schedule (in accordance with the introductory paragraph of §112.7) that allows the facility to gather the baseline data to establish a regular schedule of integrity testing in accordance with §§112.8(c)(6) and 112.12(c)(6). It should be noted that the introductory paragraph of §112.7 of the SPCC rule allows for the Plan to describe procedures, methods, or equipment that are not yet operational, and include a discussion of the details.

When a container has no prior inspection history or baseline information, the implementation of the baseline inspection program is important in order to assess the container's "suitability for continued service." Both API 653 and STI SP-001 include details on how to assess a container's suitability for continued service. In some cases, where baseline information is not known, the testing program may include two data collection periods to establish a baseline of shell thickness and corrosion rate in order to develop the next inspection interval (or "regular" schedule), or an alternative inspection schedule established by the PE in accordance with good engineering practice.

When no baseline information is available for a container, the PE may schedule visual inspection and another testing technique within the first five-year review cycle of the SPCC Plan in order to establish a regular integrity testing schedule based on current container conditions. In this example, the review cycle would begin on the revised rule implementation deadline of August 18, 2006, so the first (baseline) container inspection and integrity test would be completed by August 18, 2011. In the case of a tank that is newly built, construction data (e.g., as-built drawings and/or manufacturers cut-sheets) may typically be used as an initial datum point to establish wall thicknesses and would be included in the established procedures for inspection and testing.

The implementation, particularly in establishing inspection priorities, of the testing program should be in accordance with good engineering practice and include consideration of industry standards (§112.3(d)), as discussed in this document. For instance, special consideration may be discussed in the Plan for containers for which the age and existing condition is not known (no baseline information exists). For example, older tanks or tanks in more demanding service may be identified as high-priority tanks for inspection, versus tanks for which the baseline information is

Figure 7-1. Example baselining plan to determine the integrity testing and inspection schedule.

Scenario:
Facility has three aboveground atmospheric, mild-carbon steel tanks of different ages and conditions. Some have prior inspection histories; others have never been inspected. Although there is limited history available for tank construction, the tanks are presumed to be field-erected tanks and to each have 100,000 gallons in storage capacity. What is an appropriate inspection schedule for these tanks? API 653 is the referenced inspection standard.

Additional information:
API 653 recommends a formal visual inspection every 5 years or ¼ of corrosion rate, whichever is less, and a non-destructive shell test (UT) within 15 years or ½ of corrosion rate, whichever is less. If corrosion rates are not known, the maximum interval is 5 years. An internal inspection of the bottom of the tank is to be done based on corrosion rates. If the corrosion rate is known, the interval cannot exceed 20 years. If the corrosion rate is unknown, the interval cannot exceed 10 years.

Determination of inspection schedule:

	Construction Date	Last Inspection	Next Inspection (External)	Next Inspection (Internal)
Tank 1	unknown	none	formal visual and shell test (external) within first five-year Plan review cycle	formal (internal) bottom inspection within first five-year Plan review cycle
Tank 2	2001	none	**2006** for both visual inspection and non-destructive shell test	**2011** (i.e., not to exceed 10 years when corrosion rate of tank bottom is not known)
Tank 3	1984	1994	**1999 & 2004** formal visual **2009** non-destructive shell test both intervals may be decreased based on calculated corrosion rates from the 1994 inspection.	**2014** or less based on calculated corrosion rates from the 1994 inspection

Note: Actual inspection schedule is ultimately an engineering determination made by the PE, based on industry standards, and is certified in the Plan.

known.

An example baselining plan is presented in Figure 7-1. The example presents a simple scenario and is only provided as an illustration of some of the factors that may be considered when determining a schedule to initiate inspections of bulk storage containers.

7.3.3 Deviation from Integrity Testing Requirements Based on Environmental Equivalence

Chapter 3 of this document describes the flexibility provided in the SPCC rule through the use of environmental equivalent measures, per §112.7(a)(2). The discussion below describes examples of measures that facility owners and operators can use to deviate from inspection and testing requirements, while providing equivalent environmental protection.

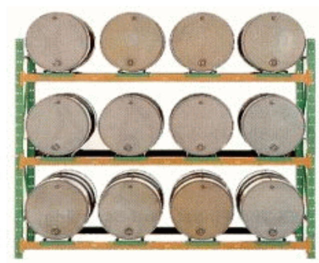
The SPCC rule provides flexibility regarding integrity testing requirements of bulk storage containers, as long as the alternatives provide equivalent environmental protection per §112.7(a)(2). Measures that may be considered environmentally equivalent to integrity testing for shop-built containers are those that effectively minimize the risk of container failure and that allow detection of leaks before they become significant. Alternative measures to integrity testing requiring the combination of internal, external, and non-destructive evaluation may, for example, prevent container failure by minimizing the container's exposure to conditions that promote corrosion (e.g., direct contact with soil), or they may enable facility personnel to detect leaks and other container integrity problems early so they can be addressed before more severe integrity failure occurs. The ability to use an environmentally equivalent alternative to integrity testing will often hinge on the degree of protection provided by the tank configuration and secondary containment. EPA believes that larger tanks (including larger shop-built tanks) may require inspection by a professional inspector, in addition to the visual inspection by the tank owner/operator during the tank's life. EPA defers to applicable industry standards and to the certifying PE as to the type and scope of inspections required in each case. However, the inspector should look for a clear rationale for the development of the inspection and testing program, paying close attention to the referenced industry standard.

EPA believes that environmental equivalence may be appropriate in other situations. For example, facilities that store edible oils as part of a food manufacturing process may adhere to very strict housekeeping and maintenance procedures that involve ongoing visual inspection and routine cleaning of the exterior and interior of the containers (which are elevated so all sides are visible or sit on a barrier that allows for rapid detect of a leak) by facility personnel. As part of these routine inspections, small leaks can be detected before they can cause a discharge as defined in §112.1(b). The PE certifying the facility's SPCC Plan may determine, upon considering applicable food-related regulations, industry standards, and site-specific conditions, that such inspections and housekeeping procedures provide environmental protection equivalent to performing an integrity test on these containers.

As with other requirements eligible for environmental equivalence provision, the measures implemented as alternatives to integrity testing required under §112.8(c)(6) or §112.12(c)(6) may not be measures already required to meet another part of the SPCC rule. A facility may not rely solely on measures that are required by other sections of the rule (e.g., secondary containment) to provide "equivalent environmental protection." Otherwise, the deviation provision would allow for approaches that provide a lesser degree of protection overall. However, for certain tank sizes and configurations of secondary containment, continuous release detection and frequent visual inspection by the owner/operator may be the sole inspection requirement, provided that the rationale is discussed in the Plan (STI SP-001). This rationale should include a discussion of good engineering practice referencing appropriate industry standards.

7.3.4 Environmental Equivalence Scenarios for Shop-Built Containers

Figure 7-2. Drums elevated on a storage rack. Drums are also subject to secondary containment requirements for bulk storage in §112.8(c)(2).



Scenario 1: Elevated Drums. As EPA has indicated in the 2002 preamble to the revised SPCC rule, certain smaller shop-built containers (e.g., 55-gallon drums) for which internal corrosion poses minimal risk of failure, which are inspected at least monthly, and for which all sides are visible (i.e., the container has no contact with the ground), visual inspection alone might be considered to provide equivalent environmental protection, subject to good engineering practice (67 FR 47120). In fact, certain industry standards also reference these conditions as good engineering practice. For example, elevating storage drums on an appropriately designed storage rack (as shown in Figure 7-2) such that all sides are visible allows the effective visual inspection of containers for early signs of deterioration and leakage, and is therefore considered environmentally equivalent to the requirement for integrity testing beyond visual inspection for these smaller bulk storage containers. Note that the drums, even if elevated, remain subject to the bulk storage secondary containment requirements in §112.8(c)(2) or §112.12(c)(2). Determination of environmental equivalence is subject to good engineering practice, including consideration of industry standards, as certified by the PE in accordance with §112.3(d).

Scenario 2: Single-Use Bulk Storage Containers. For containers that are single-use and for dispensing only (i.e., the container is not refilled), EPA recognizes that industry standards typically require only visual examination by the owner/operator. Since these containers are single-use, internal or comparative integrity testing for corrosion is generally not appropriate because the containers are not maintained on site for a long enough period of time that degradation and deterioration of the container's integrity might occur. Single-use containers (e.g., 55-gallon drums) typically are returned to the vendor, recycled, or disposed of in accordance with applicable regulations. Good engineering practices for single-use containers should be identified in the Plan, and these practices should ensure that the conditions of storage or use of a container do not subject it to potential corrosion or other conditions that may compromise its integrity in its single-use lifetime. Typically, good engineering practice recommends that these containers be elevated (usually on pallets or other support structures) to minimize bottom corrosion and to facilitate a visual inspection of all sides of the container to detect any leaks during the regular owner/operator inspections outlined in the Plan. Determination of environmental equivalence is subject to good engineering practice, including consideration of industry standards, as certified by the PE in accordance with §112.3(d).

When the container is fully emptied and meets the definition of a permanently closed container (§112.2) (including labeling), it is not subject to the SPCC requirements, including the integrity testing requirements. In this case, the capacity of the container does not count toward the facility threshold capacity. If the container is refilled on site, however, it is not considered a single-use container, and is therefore subject to the integrity testing requirements of the rule.

Scenario 3: Elevated shop-built containers. For certain shop-built containers with a shell capacity of 30,000 gallons or under, EPA considers that visual inspection provides equivalent environmental protection when accompanied by certain additional actions to ensure that the containers are not in contact with the soil. These actions include elevating the container in a manner that decreases corrosion potential and makes all sides of the container, including the bottom, visible during inspection. Examples of adequate measures include elevating shop-built containers on properly designed tank saddles as illustrated in Figure 7-3 and described in EPA's letter to PMAA.[7] Determination of environmental equivalence is subject to good engineering practice, including consideration of industry standards, as certified by the PE in accordance with §112.3(d).

Figure 7-3. Shop-built containers elevated on saddles.

Scenario 4: Shop-built containers placed on a liner. For certain shop-built containers with a shell capacity of 30,000 gallons or under, visual inspection, plus certain additional actions to ensure the containment and detection of leaks, is also considered by EPA to provide equivalent environmental protection. Actions may include placing the containers onto a barrier between the container and the ground, designed and operated in a way that ensures that any leaks are immediately detected. For example, placing a shop-built container on an adequately designed, maintained, and inspected synthetic liner would generally provide equivalent environmental protection. Determination of environmental equivalence is subject to good engineering practice, including consideration of industry standards, as certified by the PE in accordance with §112.3(d).

Other Situations. Although the scenarios discussed above primarily address shop-built tanks, environmental equivalence may be used for other types of bulk storage containers, subject to good engineering practice. In any case where the owner or operator of a facility uses an alternative means of meeting the integrity testing requirement of §112.8(c)(6) or §112.12(c)(6), the SPCC Plan must provide the reason for the deviation, describe the alternative approach, and explain how it achieves equivalent environmental protection (§112.7(a)(2)), while considering good engineering practice and industry standards. The description of the alternative approach should address how

[7] For more information, refer to EPA's letter to the Petroleum Marketers Association of America, available on EPA's Web site at http://www.epa.gov/oilspill/pdfs/PMAA_letter.pdf.

the approach complies or deviates from industry inspection standards and how it will be implemented in the field. For example, if the alternative approach involves the visual inspection of the containers, the SPCC Plan should describe the key elements of this inspection, including the inspection frequency and scope, the training and/or qualifications of individuals conducting the inspections, and the records used to document the inspection. If the alternative measure relies on engineered systems to mitigate corrosion (e.g., coatings, cathodic protection) or to facilitate early detection of small leaks, the SPCC Plan should describe how such systems are maintained and monitored to ensure their effectiveness. For instance, where the alternative measure relies on the presence of a liner, the Plan should discuss how the liner is adequately designed, maintained, and inspected. This discussion may consider such factors as life expectancy stated by the manufacturer (from cut-sheets), as-built specifications, and inspection and maintenance procedures.

As discussed above, the environmental equivalence provision applies to the inspection and appropriate integrity testing of bulk storage containers at §§112.8(c)(6), 112.9(c)(3), and 112.12(c)(6). PEs have the flexibility to offer environmental equivalent integrity testing options for all classes of tanks, including shop-built tanks above 30,000 gallon capacity and field-erected tanks, if the rationale is provided referencing appropriate industry standards.

7.4 Documentation Requirements and Role of the EPA Inspector

The facility SPCC Plan must describe the scope and schedule of examinations to be performed on bulk storage containers (as required in §§112.3(d)(1)(iv), 112.7(e), 112.8(c)(6), 112.9(c)(3), and 112.12(c)(6)), and should reference an applicable industry inspection standard or describe an equivalent program developed by the PE, in accordance with good engineering practice. If a PE specifies a hybrid inspection and testing program, then the EPA inspector should verify that the testing program covers minimum elements for the inspections, the frequency of inspections, and their scope (e.g., wall thickness, footings, tank supports). See Section 7.5 for a list of suggested minimum standards.

A hybrid testing program may be appropriate for a facility where an industry inspection standard does not yet contain enough specificity for a particular facility's universe of tanks and/or configuration, or while modifications to an industry inspection standard are under consideration. For example, a tank user may have made a request to the industry standard-setting organizations recommending a change or modification to a standard. Both API and STI have mechanisms to allow tank users (and the regulatory community) to request changes to their respective inspection standards. In this case, the modification to a standard may be proposed, but not yet accepted by the standard-setting organization. In the meantime, the facility is still subject to the SPCC requirements to develop an inspection and testing program. In this scenario, a hybrid inspection and testing program may be appropriate. When reviewing the scope and schedule of a hybrid program, the inspector should review whether an industry inspection standard and appropriate good engineering practices were used in the development of the hybrid program.

The facility must maintain records of all visual inspections and integrity testing, as required by the SPCC rule in §§112.7(e), 112.8(c)(6), 112.9(c)(3), and 112.12(c)(6). Records do not need to be specifically created for this purpose, and may follow the format of records kept under usual and customary business practices. These records should include the frequent inspections performed by facility personnel. Also, industry standards generally provide example guidelines for formal tank inspections, as well as sample checklists. The EPA inspector should review the inspection checklists used by the facility to verify that they cover at least the minimum elements and are in accordance with the PE-certified inspection and testing program. The tank inspection checklist from Appendix F of 40 CFR part 112, reproduced as Table 7-6 at the end of this chapter, provides an example of the type of information that may be included on an owner/operator-performed inspection checklist.

The EPA inspector should review records of frequent visual inspections by facility personnel as well as regular integrity testing of the container. Comparison records maintained at the facility will aid in determining a container's suitability for continued service. Both API 653 and STI SP-001 contain details on determining a container's suitability for continued service. Though §112.7(e) requires retention of all records for a period of three years, industry standards usually recommend retention of certified inspection and non-destructive examination reports for the life of the container.

In cases where the SPCC Plan has not identified a regularly scheduled inspection and testing program, the inspector should request information on the anticipated schedule (e.g., when a baseline has not been established). If the facility has not performed any integrity testing of bulk storage containers so far, the EPA inspector should verify that the SPCC Plan describes: (1) the strategy for implementing an inspection and testing program and collecting baseline conditions within ten years of the installation date of the tank, or during the first five-year Plan cycle (or another schedule as identified and certified by a PE); and (2) the ongoing testing program that will be established once the baseline information has been collected. When the inspection program establishes inspection priorities for multiple containers, the inspector should consider the rationale for these priorities as described in the SPCC Plan and verify implementation.

The EPA inspector should review records of regular and periodic inspections and tests of buried and aboveground piping, valves, and appurtenances. Such inspections may be visual or conducted by other means.

The inspector reviewing a maintenance program, such as the flowline maintenance program required under §112.9(d)(3) for oil production facilities, should verify that the Plan describes how the flowlines are configured, monitored, and maintained to prevent discharges. The inspector should also verify that the program is implemented in the field; for example, by verifying that facility personnel responsible for the maintenance of the equipment are aware of the flowline locations and are familiar with maintenance procedures, including replacement of damaged and/or leaking flowlines.

If an impracticability determination is made for secondary containment of flowlines, the EPA inspector should extensively review the adequacy of the flowline maintenance program along with the contingency plan (67 FR 47078).

In summary, the EPA inspector should verify that the owner or operator has inspection reports that document the implementation of the testing, evaluation, or inspection criteria set forth in the Plan. He/she may also verify whether the recommended actions that affect the potential for a discharge have been taken to ensure the integrity of the container/piping until the next scheduled inspection or replacement of the container/piping. When an inspection procedure is outlined in the Plan that does not meet the requirement of §§112.8(c)(6) and 112.12(c)(6) (e.g., a combination of visual inspection and another testing technique), the inspector should verify that the Plan includes a discussion of an environmentally equivalent measure in accordance with §112.7(a)(2). Implementation of the SPCC Plan as certified by the PE is the responsibility of the facility owner/operator (§112.3(d)(2)).

By certifying an SPCC Plan, the PE attests that the Plan has been prepared in accordance with good engineering practice, that it meets the requirements of 40 CFR part 112, and that it is adequate for the facility. Thus, if testing, evaluation, or inspection procedures have been reviewed by the certifying PE and are properly documented, they should generally be considered acceptable by the EPA inspector. However, if testing, evaluation, or inspection procedures do not meet the standards of common sense, appear to be at odds with recognized industry standards, do not meet the overall objective of oil spill response/prevention, or appear to be inadequate for the facility, appropriate follow-up action may be warranted. In this case, the EPA inspector should clearly document any concerns to assist review and follow-up by the Regional Administrator. The EPA inspector may also request additional information from the facility owner or operator regarding the testing, evaluation, or inspection procedures provided in the Plan.

7.5 Summary of Industry Standards and Regulations

This section provides an overview and description of the scope and key elements of pertinent industry inspection standards, including references to relevant sections of the standards. Additionally, the section discusses the minimum elements for a so-called “hybrid” inspection program for unique circumstances for which industry inspections standards do not contain enough specificity for a given facility’s tank universe and configuration, or for which the PE chooses to deviate from the industry standards based on professional judgement. When words such as “must,” “required,” and “necessary,” or other such terms are used in this section, they are used in describing what the various standards state and are not considered requirements imposed by EPA, unless otherwise stated in the regulations.

Industry standards are technical guidelines created by experts in a particular industry for use throughout that industry. These guidelines assist in establishing common levels of safety and common practices for manufacture, maintenance, and repair. Created by standard-setting organizations using a consensus process, the standards establish the minimum accepted industry practice. The SPCC rule (§112.3(d)(1)(iii)) requires that the Plan be prepared in accordance with good engineering practices, including the consideration of applicable industry standards. Use of a particular standard is voluntary. If a standard (or parts of a standard) is incorporated into a facility's SPCC Plan, then adherence to that standard is mandatory for implementation of the Plan.

Although these guidelines are often grouped together under the term "standards," several other terms are used to differentiate among the types of guidelines:

- **Standard (or code)**—set of instructions or guidelines. Use of a particular standard is voluntary. Some groups draw a distinction between a standard and a code. The American Society of Mechanical Engineers (ASME), for example, stipulates that a code is a standard that "has been adopted by one or more governmental bodies and has the force of law..."
- **Recommended practice**—advisory document often useful for a particular situation.
- **Specification**—may be one element of a code or standard or may be used interchangeably with these terms.

7.5.1 API Standard 653 – Tank Inspection, Repair, Alteration, and Reconstruction

API Standard 653 – Tank Inspection, Repair, Alteration, and Reconstruction (API 653)[8] provides the minimum requirements for maintaining the integrity of carbon and alloy steel tanks built to API Standard 650 (Welded Steel Tanks for Oil Storage) and its predecessor, API 12C (Welded Oil Storage Tanks). API 653 may also be used for any steel tank constructed to a tank specification.[9]

API 653 covers the maintenance, inspection, repair, alteration, relocation, and reconstruction of welded or riveted, non-refrigerated, atmospheric pressure, aboveground, field-fabricated, vertical storage tanks after they have been placed in service. The standard limits its scope to the tank foundation, bottom, shell, structure, roof, attached appurtenances, and nozzles to the face of the first flange, first threaded joint, or first welding-end connection. The standard is intended for use by those facilities that utilize engineering and inspection personnel technically trained and experienced in tank design, fabrication, repair, construction, and inspection. Section 1 of the standard introduces the standard and details its scope. Sections 2 and 3 of the standard list the works cited and definitions used in the standard, respectively.

The standard requires that a tank evaluation be conducted when tank inspection results reveal a change in a tank from its original physical condition. Sections 4 and 5 of the standard describe procedures for evaluating an existing tank's suitability for continued operation or a change of service; for making decisions about repairs or alterations; or when considering dismantling, relocating, or reconstructing an existing tank. Section 4 of the standard details the procedures to

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[8] API Standard 653, "Tank Inspection, Repair, Alteration, and Reconstruction," Third Edition, Addendum 1, American Petroleum Institute, September 2003.

[9] See Section 1.1.3 of API Standard 653.

follow in evaluating the roof, shell, bottom, and foundation of the tank. Section 5 of the standard provides a decision tree to evaluate a tank's risk of brittle fracture.

Section 6 focuses on factors to consider when establishing inspection intervals and covers detailed procedures for performing external and internal tank integrity inspections. Inspection intervals are largely dependent upon a tank's service history. The standard establishes time intervals for when routine in-service inspections of the tank exterior are to be conducted by the owner/operator and when external visual inspections are to be conducted by an authorized inspector. External ultrasonic thickness (UT) inspections may also be conducted periodically to measure the thickness of the shell and are used to determine the rate of corrosion. Time intervals for external UT inspections are also provided and are based on whether or not the corrosion rate is known.

Internal inspections (Section 6.4 of the standard) primarily focus on measuring the thickness of the tank bottom and assessing its integrity. Measured or anticipated corrosion rates of the tank bottom can be used to establish internal inspection intervals; however, the inspection interval cannot exceed 20 years using these criteria. Alternatively, risk-based inspection (RBI) procedures, which focus attention specifically on the equipment and associated deterioration mechanisms presenting the most risk to the facility (Section 6.4.3 of the standard), can be used to establish internal inspection intervals; an RBI may increase or decrease the 20-year inspection interval. API 653 states that an RBI assessment shall be reviewed and approved by an authorized tank inspector and a tank design/corrosion engineer. If a facility chooses to use RBI in the development of a tank integrity testing program, the EPA inspector should verify that these parties conducted the initial RBI assessment.

An external inspection (Section 6.5 of the standard) can be used in place of an internal inspection to determine the bottom plate thickness in cases where the external tank bottom is accessible due to construction, size, or other aspects. If chosen, this option should be documented and included as part of the tank's permanent record. Owners/operators should maintain records that detail construction, inspection history, and repair/alteration history for the tank (Section 6.8 of the standard). Section 6.9 of the standard stipulates that detailed reports should be filed for every inspection performed.

Sections 7 through 11 of API 653 do not address integrity testing, but instead focus on the repair, alteration, and reconstruction of tanks. Section 12 provides specific criteria for examining and testing repairs made to tanks. Section 13 addresses the specific requirements for recording any evaluations, repairs, alterations, or reconstructions that have been performed on a tank in accordance with this standard. Appendix A to API 653 provides background information on previously published editions of API welded steel storage tank standards. Appendix B details the approaches that are used to monitor and evaluate the settlement of a tank bottom.[10] Appendix C provides sample checklists that the owner/operator can use when developing inspection intervals and specific procedures for internal and external inspections of both in-service and out-of-service

[10] See Section 1.1.3 of API 653.

tanks. The requirements for authorized inspector certification are the focus of Appendix D. Certification of authorized tank inspectors, which is valid for three years from the date of issue, requires the successful completion of an examination, as well as a combination of education and experience. Technical inquiries related to the standard are the focus of Appendix E. Appendix F summarizes the non-destructive examination (NDE) requirements for reconstructed and repaired tanks. Technical inquiries regarding the use of the standard can be made through API's Web site (www.api.org). Selected responses to technical inquiries are provided in the Technical Inquiry appendices of the standard.

7.5.2 STI Standard SP-001 – Standard for the Inspection of Aboveground Storage Tanks

STI Standard SP-001 – Standard for the Inspection of Aboveground Storage Tanks (SP-001)[11] provides the minimum inspection requirements and evaluation criteria required to determine the suitability for continued service of aboveground storage tanks until the next scheduled inspection. Only aboveground tanks included in the scope of this standard are applicable for inspection per this standard. Other standards, recommended practices, and other equivalent engineering and best practices exist that provide alternative inspection requirements for tanks defined within the scope of this standard and for tanks outside the scope of this standard. For example, API Standard 653, "Tank Inspection, Repair, Alteration, and Reconstruction," provides additional information pertaining to tanks built to API 650 and API 12C. API 12R1, "Recommended Practice for Setting, Maintenance, Inspection, Operation, and Repair of Tanks in Production Service," pertains to tanks employed in production service or other similar service.

SP-001 applies to the inspection of aboveground storage tanks, including shop-fabricated tanks, field-erected tanks, and portable containers, as defined in this standard, as well as the containment systems. The inspection and testing requirements for field-erected tanks are covered separately in Appendix B of the standard. Specifically, the standard applies to ASTs storing stable, flammable, and combustible liquids at atmospheric pressure with a specific gravity less than approximately 1.0 and those storing liquids with operating temperatures between ambient temperature and 200 degrees Fahrenheit (93.3˚C). At a minimum, the following tank components shall be inspected (as applicable): tank, supports, anchors, foundation, gauges and alarms, insulation, appurtenances, vents, release prevention barriers, and spill control systems.

Section 3 addresses safety considerations, and Section 4 addresses AST inspector qualifications.

Section 5 of the standard addresses the criteria, including AST type, size, type of installation, corrosion rate, and previous inspection history, if any, that should be used to develop a schedule of inspections for each AST. Table 5.5 (Table of Inspection Schedules) places tanks into one of three categories and establishes different requirements regarding the type and frequency of periodic inspection by tank owner/operators as well as formal external and internal inspections by a

[11] STI Standard SP-001, "Standard for the Inspection of Aboveground Storage Tanks," 3rd Edition, Steel Tank Institute, July 2005.

certified inspector. The factors used for categorizing tanks include tank size, whether or not the tank is in contact with the ground, the presence or absence of secondary containment (or spill control), and the presence or absence of a continuous release detection method (CRDM).

Section 6 provides guidelines for the periodic inspections conducted by the owner or his/her designee. The owner's inspector is to complete an AST Record for each AST or tank site, as well as a Monthly Inspection Checklist and an Annual Inspection Checklist. Monthly inspections should monitor water accumulation to prevent Microbial Influenced Corrosion (MIC), and action should be taken if MIC is found. Additional requirements for field-erected tanks are in Appendix B of SP-001.

Section 7 of SP-001 contains the minimum inspection requirements for formal external inspections, which are to be performed by a certified inspector. Inspections should cover the AST foundations, supports, secondary containment, drain valves, ancillary equipment, piping, vents, gauges, grounding system (if any), stairways, and coatings on the AST. Original shell thickness should be determined using one of several suggested methods. Ultrasonic Thickness Testing (UTT) readings are to be taken at different locations of the AST depending upon whether the AST is horizontal, vertical, rectangular, and/or insulated. The final report should include field data, measurements, pictures, drawings, tables, and an inspection summary, and should specify the next scheduled inspection.

Section 8 of the standard details the minimum inspection requirements for formal internal inspections, which are to be performed by a certified inspector. A formal internal inspection includes the requirements of an external inspection with some additional requirements for specific situations that are outlined in the standard. Double-wall tanks and secondary containment tanks may be inspected by checking the interstice for liquid or by other equivalent methods. For elevated ASTs where all external surfaces are accessible, the internal inspection may be conducted by examining the tank exterior using such methods as Ultrasonic Thickness Scans (UTS). For all other situations, entry into the interior of the AST is necessary. Internal inspection guidelines are detailed separately for horizontal ASTs and for vertical and rectangular ASTs in Sections 8.2 and 8.3, respectively. Additional requirements for field-erected tanks are in Appendix B. The final report should contain elements similar to reports prepared for external inspections.

Section 9 addresses leak testing methods. For shop-fabricated ASTs, the standard references the Steel Tank Institute Recommended Practice R912, "Installation Instructions for Shop Fabricated Stationary Aboveground Storage Tanks for Flammable, Combustible Liquids." The standard also references DOT regulations for portable containers:

- 49 CFR part 173.28, Reuse, reconditioning, and remanufacturing of packagings, mainly for drums;
- 49 CFR part 178.803, Testing and certification of intermediate bulk containers (IBCs); and
- 49 CFR part 180.605, or equivalent, for portable container testing and recertification.

Section 10 addresses the suitability for continued service based on the results of formal internal and/or external inspections. For ASTs that show signs of damage caused by MIC, the criteria for assessing their suitability for continued service differ based on the category they fall into (as per Section 5 of SP-001). Categories refer to the level of reduction of the shell thickness. For other tank damage, an engineer experienced in AST design or a tank manufacturer should determine if an inspection is required for any AST that was exposed to fire, natural disaster, excessive settlement, overpressure, or damage from cracking.

Section 11 of the standard details recordkeeping requirements. Appendix A presents supplemental technical information including terms commonly associated with ASTs, and Appendix B presents information for the inspection of field-erected ASTs.

For more information on SP-001, please visit the Steel Tank Institute Web site, http://www.steeltank.com.

7.5.3 API Recommended Practice 575 – Inspection of Atmospheric and Low-Pressure Storage Tanks

API Recommended Practice 575 – Inspection of Atmospheric and Low-Pressure Storage Tanks[12] (API RP 575), which supplements API 653, covers the inspection of atmospheric tanks (e.g., cone roof and floating roof tanks) and low-pressure storage tanks (i.e., those that have cylindrical shells and cone or dome roofs) that have been designed to operate at pressures from atmospheric to 15 pounds per square inch gauge (psig). (API RP 572 covers tanks operating above 15 psig.) In addition to describing the types of storage tanks and standards for their construction and maintenance, API RP 575 also covers the reasons for inspection, causes of deterioration, frequency and methods of inspection, methods of repair, and the preparation of records and reports. API RP 575 applies only to the inspection of atmospheric and low-pressure storage tanks that have been in service. Section 1 of API RP 575 introduces the recommended practice and details its scope. Section 2 lists the references that are cited in the recommended practice.

Section 3 of API RP 575 describes selected methods for non-destructive examination of tanks, including ultrasonic thickness measurement, ultrasonic corrosion testing, ultrasonic shear wave testing, and magnetic flux testing. Section 4 describes the construction materials and design standards, use, and specific types of atmospheric and low-pressure storage tanks. Section 5 covers the reasons for inspection and causes of deterioration of both steel and non-steel storage tanks. Section 5 also covers the deterioration and failure of auxiliary equipment.

Section 6 of API RP 575 addresses inspection frequency; it mainly defers to the inspection frequency requirements described in API 653. Section 7 covers the methods of inspection and inspection scheduling. It addresses the external inspection of both in-service and out-of-service

[12] API RP 575, "Inspection of Atmospheric and Low-Pressure Storage Tanks," 1st ed., American Petroleum Institute, November 1995.

tanks and the internal inspection of out-of-service tanks. Section 7 provides some information about scheduling tank inspections, but it mostly defers to API 653. Section 8 addresses the methods for repairing tanks. Recordkeeping and inspection reports are the focus of Section 9, which stresses the importance of keeping complete records. Appendix A of the recommended practice provides a typical field record form and history card. Appendix B contains a typical tank report form. Appendix C provides sample checklists for internal and external tank inspections.

7.5.4 API Recommended Practice 12R1 – Recommended Practice for Setting, Maintenance, Inspection, Operation, and Repair of Tanks in Production Service

API Recommended Practice 12R1 – Recommended Practice for Setting, Maintenance, Inspection, Operation, and Repair of Tanks in Production Service (API RP 12R1)[13] provides guidance on new tank installations and maintenance of existing production tanks. These tanks are often referred to as "upstream" or "extraction and production (E&P) tanks." The recommended practices are primarily intended for tanks fabricated to API Specifications 12B, D, F, and P that are employed in on-land production service.[14] This said, the basic principles in the recommended practices can also be applied to other atmospheric tanks that are employed in similar oil and gas production, treating, and processing services; however, they are not applicable to refineries, marketing bulk stations, petrochemical plants, or pipeline storage facilities operated by carriers. According to the recommended practice, tanks that are fabricated to API Standards 12C or 650 should be maintained in accordance with API 653, summarized above.

Sections 1, 2, and 3 of API RP 12R1 describe the scope of the standard, the 19 standards it references, and the relevant definitions, respectively. The remaining four main sections describe the recommended practices. Section 4 provides recommended practices for setting of new or relocated tanks and connecting tanks. Section 5 recommends practices for safe operation and spill prevention for tanks.[15] Section 6 details the recommended practices for routine operational and external and internal condition examinations, internal and external inspections, maintenance of tanks, and recordkeeping. Table 1 of this recommended practice details the type of observations, frequency, and associated personnel requirements for internal and external tank inspections. Records from these inspections should be retained with permanent equipment records. Finally, Section 7 provides guidance for the alteration or repair of various tank components. API RP 12R1 also contains nine appendices detailing the recommended requirements of qualified inspectors, sample calculations for venting requirements, observations regarding shell corrosion and brittle fracture, checklists for internal and external condition examinations and inspections, details regarding the minimum thickness of tank elements, and various figures and diagrams.

[13] API Recommended Practice 12R1, "Recommended Practice for Setting, Maintenance, Inspection, Operation, and Repair of Tanks in Production Service," 5th edition. American Petroleum Institute. August 1997.

[14] API Specifications 12B, D, F, and P correspond to bolted tanks for storage of production liquids, field welded tanks for storage of production liquids, shop welded tanks for storage of production liquids, and specification for fiberglass reinforced plastic tanks, respectively.

[15] Section 7 of API RP 12R1 states that "..the spill prevention and examination/inspection provisions of this recommended practice should be a companion to the spill prevention control and countermeasures (SPCC) to prevent environmental damage."

7.5.5 API 570 – Piping Inspection Code: Inspection, Repair, Alteration, and Rerating of In-service Piping Systems

API 570 – Piping Inspection Code: Inspection, Repair, Alteration, and Rerating of In-service Piping Systems (API 570)[16] covers inspection, repair, alteration, and rerating procedures for metallic piping systems that have been in service. API 570 was developed for the petroleum refining and chemical process industries. In-service piping systems covered by API 570 include those used for process fluids, hydrocarbons, and similar flammable or toxic fluids. API states that this standard is not a substitute for the original construction requirements governing a piping system before it is placed in service. API 570 is intended for use by organizations that maintain or have access to an authorized inspection agency; a repair organization; and technically qualified piping engineers, inspectors, and examiners. The owner/operator is responsible for implementing a piping system inspection program, controlling the inspection frequencies, and ensuring the maintenance of piping systems in accordance with this standard.

Section 5, the first substantive section of the standard, addresses the specific inspection and testing practices for in-service piping systems. Section 6 addresses the frequency and extent of inspection of piping. Inspection intervals for piping are based largely on the likelihood and consequence of failure (i.e., they are risk-based), which takes into account the corrosion rate and remaining life calculations; piping service classification; applicable jurisdictional requirements; and the judgement of the inspector, the piping engineer, the piping engineer supervisor, or a corrosion specialist. Table 6-1 of API 570 provides maximum inspection intervals for piping based on piping service classification (Class 1 poses the highest risk of an emergency if a leak were to occur; Class 2, which includes the majority of unit process piping, poses an intermediate risk; Class 3 poses the lowest risk) and the corrosion measurement technique (i.e., thickness measurements or visual external inspection) that is used. In general, the maximum inspection interval for in-service piping should be between five years for Class 1 piping to ten years for Class 3 piping.

Section 7 of the standard addresses data evaluation, analysis, and recording. The owner/operator should maintain permanent records for all piping systems covered by API 570. Section 8 provides guidelines for repairing, altering, and rerating piping systems. Inspecting buried process piping is different from inspecting other process piping because the inspection is hindered by the inaccessibility of the affected areas of the piping; therefore, API 570 addresses the inspection of buried piping separately in Section 9. Appendices A, B, C, and D of API 570 address inspector certification, technical inquiries, examples of repairs, and the external inspection checklist for process piping, respectively.

[16] API 570, "Piping Inspection Code: Inspection, Repair, Alteration, and Rerating of In-service Piping Systems," 2nd ed., American Petroleum Institute, October 1998.

7.5.6 API Recommended Practice 574 – Inspection Practices for Piping System Components

API Recommended Practice 574 – Inspection Practices for Piping System Components (API RP 574)[17] covers inspection practices for piping, tubing, valves (other than control valves), and fittings used in petroleum refineries and chemical plants. API RP 574 is not specifically intended to cover specialty items, such as control valves, level gauges, and instrument controls columns, but many of the inspection methods are applicable to these items. API RP 574 provides more detailed information about piping system components and inspection procedures than API 570. Section 1 introduces the recommended practice and details its scope. Sections 2 and 3, respectively, list the references and definitions used throughout the recommended practice.

Section 4, which begins the substantive portion of the recommended practice, details the types, material specifications, sizes, and other characteristics of the components of the piping system, which include the piping, tubing, valves, and fittings. This section of the recommended practice also addresses the common joining methods used to assemble piping components. Section 5 of API RP 574 presents the rationale for inspecting the piping system: to maintain safety, attain reliable and efficient operation, and meet regulatory requirements. The procedures for monitoring the piping system components for corrosion and inspecting for deterioration are the focus of Section 6. Section 7 provides guidelines for establishing the frequency and time (i.e., while equipment is operating or while equipment is shut down) of inspection. Similar to API 570, this recommended practice uses the following conditions to determine the frequency of inspection: the consequences of a failure (piping classification, see summary of API 570 for a description), the degree of risk, the amount of corrosion allowance remaining, the historical data available, and the regulatory requirements.

Section 8 of API RP 574 outlines the safety precautions that should be taken and preparatory work that should be performed prior to inspecting the piping system components. The inspection tools commonly used to inspect piping are tabulated in Section 9 of this recommended practice. Section 10 details the specific procedures that should be followed when inspecting the components of the piping system. This section also covers the inspection of underground piping (Section 10.3) and new construction (Section 10.4). Section 11 describes the procedures a piping engineer should follow to determine the thickness at which piping and valves and flanged fittings should be retired. Recordkeeping is the focus of Section 12. Appendix A of the recommended practice provides an external inspection checklist for process piping.

[17] API RP 574, "Inspection Practices for Piping System Components," 2nd ed., American Petroleum Institute, June 1998.

7.5.7 API Recommended Practice 1110 – Pressure Testing of Liquid Petroleum Pipelines

API Recommended Practice 1110 – Pressure Testing of Liquid Petroleum Pipelines (API RP 1110)[18] provides guidance regarding the procedures, equipment, and factors to consider when pressure testing new and existing liquid petroleum pipelines. Pressure testing uses a liquid test medium (typically water) to apply internal pressure to a segment of pipe above its normal or maximum operating pressure for a fixed period of time under no-flow conditions to verify that the "test segments have the requisite structural integrity to withstand normal and maximum operating pressures[19] and to verify that they are capable of liquid containment." This testing should be performed by "test personnel" in accordance with ASME B31.4 [20] and 49 CFR part 195.[21]

Sections 1 and 2 of API RP 1110 describe the scope of the standard and publications it references, respectively. Section 3 explains how the pressure testing, performed one segment of pipe at a time, should be executed. Generally this is done by filling a section of pipe with the testing medium and increasing the pressure from its static pressure level at a controlled rate. Pipe connections are tested for leaks during the pressurization and after the test pressure has been reached.

Complete records of the testing should be kept, including information on any failures, the places they occurred, and the methods of repair they require in order to comply with ASME B31.4, 49 CFR part 195, and any other applicable regulations. The final part of API RP 1110 is Appendix A, which provides samples of various test record forms.

7.5.8 API Recommended Practice 579, Fitness-for-Service, Section 3

This recommended practice[22] addresses "Assessment of Existing Equipment for Brittle Fracture" and provides guidelines for evaluating the resistance to brittle fracture of existing carbon and low alloy steel pressure vessels, piping, and storage tanks. If the results of the fitness-for-service assessment indicate that the AST is suitable for the current operating conditions, then the equipment can continue to be operated under the same conditions provided that suitable monitoring/inspection programs are established. API RP 579 is intended to supplement and augment the requirements in API 653. That is, when API 653 does not provide specific evaluation procedures or acceptance criteria for a specific type of degradation, or when API 653 explicitly allows the use of fitness-for-service criteria, API RP 579 may be used to evaluate the various types of degradation or test requirements addressed in API 653.

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[18] API Recommended Practice 1110, "Pressure Testing of Liquid Petroleum Pipelines," 4th edition, American Petroleum Institute, March 1997.

[19] This does not include low-pressure pneumatic testing.

[20] ASME B31.4, "Liquid Transportation Systems for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia, and Alcohols."

[21] U.S. Department of Transportation. Research and Special Programs Administration (49 CFR part 195).

[22] API Recommended Practice 579, "Fitness for Service," 1st Edition, American Petroleum Institute, January 2000.

A brittle fracture assessment may be warranted based on operating conditions and/or the condition of the AST. API RP 579 provides separate brittle fracture assessment procedures for continued service based on three levels. All three apply to pressure vessels, piping, and tankage, although a separate assessment procedure is provided for tankage.

- Level 1 assessments are used for equipment that meets toughness requirements in a recognized code or standard (e.g., API 650).
- Level 2 assessments exempt equipment from further assessment and qualify it for continued service based on one of three methods. These methods are based on operating pressure and temperature; performance of a hydrotest; or the materials of construction, operating conditions, service environment, and past operating experience.
- Level 3 assessments, which normally utilize a fracture mechanics methodology, are used for tanks that do not meet the acceptance criteria for Levels 1 and 2.

A decision tree in API RP 579 (Figure 3.2, Brittle Fracture Assessment for Storage Tanks) outlines this assessment procedure. The Level 1 and Level 2 brittle fracture assessment procedures are nearly identical to those found in API 653, Section 5, with a few notable exceptions: API 653 does not use the Level 1 and Level 2 designations; API 653 applies only to tanks that meet API 650 (7th edition or later) construction standards, whereas API 579 applies to tanks that meet toughness requirements in the “current construction code”; and the two standards set a different limit on the maximum membrane stress (the stress forces that form within the shell as a result of the pressure of the liquid inside the vessel). There is, however, one major difference between API 653 and API 579: API 653, Section 5, does not allow for an exemption of the hydrostatic test requirement as API 579 does. API 579 allows for a probabilistic evaluation of the potential for brittle fracture using engineering calculations (i.e., a Level 3 assessment) in lieu of the hydrostatic test.

7.5.9 API Standard 2610 - Design, Construction, Operation, Maintenance, and Inspection of Terminal & Tank Facilities

The standard[23] has short sections on petroleum terminals, pipeline tankage facilities, refinery facilities, bulk plants, lube blending and packaging facilities, asphalt plants, and aviation service facilities; these sections mainly serve to define what is meant by each type of facility. The standard does not apply to installations covered by API Standard 2510 and API RP 12R1, as well as a list of specific types of facilities and equipment indicated in the standard. The standard lists governmental requirements and reviews that should be conducted to ensure that facilities meet applicable federal, state, or local requirements (Section 1.3); and has an extensive list of standards, codes, and specifications to use (Section 2.1).

Section 4 of the standard covers the site selection and spacing requirements for the design and construction of new terminal facilities. Section 5 addresses the methods of pollution prevention

[23] API Recommended Practice 2610, “Design, Construction, Operation, Maintenance, and Inspection of Terminal and Tank Facilities,” 2nd edition, American Petroleum Institute, May 2005.

and waste management practices in the design, maintenance, and operation of petroleum terminal and tank facilities. Section 6 covers the safe operation of terminals and tanks such as hazard identification, operating procedures, safe work practices, emergency response and control procedures, training, and other provisions. Section 7 covers fire prevention and protection, including tank overfill protection and inspection and maintenance programs. This section also covers considerations for special products. Section 8 covers aboveground petroleum storage tanks and appurtenances such as release prevention, leak detection, and air emissions. This section covers operations, inspections, maintenance, and repair for aboveground and underground tanks. Section 9 addresses dikes and berms. Section 10 covers pipe, valves, pumps, and piping systems. Section 11 covers loading, unloading, and product transfer facilities and activities including spill prevention and containment. Section 12 addresses the procedures and practices for achieving effective corrosion control. Section 13 addresses structures, utilities, and yards. Section 14 covers removal or decommissioning of facilities. All of these sections extensively reference the regulatory requirements and applicable industry standards.

7.5.10 ASME B31.3 – Process Piping

ASME B31.3 – Process Piping[24] is the generally accepted standard of minimum safety requirements for the oil, petrochemical, and chemical industries' process piping design and construction (for process piping already in service, other standards should be used, such as API 570, "Piping Inspection Code"). ASME B31.3 is written to be very broad in scope to cover a range of fluids, temperatures, and pressures. This broad coverage leaves a great deal of responsibility with the owner to use good engineering practices. The safety requirements for the design, examination, and testing of process piping vary in stringency based on three different categories of fluid service. Categories include "Category D" for a low hazard of fluid service, "Category M" for a high hazard of fluid service, with all remaining fluid services that are not in Category D or Category M being "Normal." It is the owner's responsibility to select the appropriate fluid service category, which determines the appropriate examination requirements.

The examination of process piping is to be completed by an examiner who demonstrates sufficient qualifications to perform the specified examination and who has training and experience records kept by his/her employer that can support these qualifications.[25] Different types of examinations performed include visual examinations, radiographic examinations, ultrasonic examinations, in-process examinations, liquid-penetrant examinations, magnetic-particle examinations, and hardness testing.

While these examinations are a part of the quality assurance procedures for new piping, leak testing should also be performed to test the overall system. According to ASME B31.3, leak testing is required for all new piping systems other than those classified as Category D, which can

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[24] ASME B31.3, "Process Piping: The Complete Guide to ASME B31.3," Charles Becht IV, The American Society of Mechanical Engineers, 2nd edition, 2004.

[25] ASME B31.3 does not have specific requirements for an examiner, but SNT-TC-1A, "Recommended Practice for Nondestructive Testing Personnel Qualification and Certification," acts as an acceptable guide.

be examined for leaks after being put into service. Options for leak testing include hydrostatic tests, pneumatic tests, hydropneumatic tests, and alternative leak tests.

The standard requires that records detailing the examination personnel's qualifications and examination procedures be kept for at least five years. Test records or the inspector's certification that the piping has passed pressure testing are also required to be retained.

7.5.11 ASME Code for Pressure Piping B31.4-2002 – Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids

ASME Code for Pressure Piping B31.4-2002 – Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids[26] describes "engineering requirements deemed necessary for safe design and construction of pressure piping." These requirements are for the "design, materials, construction, assembly, inspection, and testing of piping transporting liquids" such as crude oil and liquid petroleum products between various facilities. Piping includes bolting, valves, pipes, gaskets, flanges, fittings, relief devices, pressure-containing parts of other piping components, hangers and supports, and any other equipment used to prevent the overstressing of pressure-containing pipes. This code's primary purpose is to "establish requirements for safe design, construction, inspection, testing, operation, and maintenance of liquid pipeline systems for protection of the general public and operating company personnel."

The personnel inspecting the piping are deemed qualified based on their level of training and experience and should be capable of performing various inspection services such as right-of-way and grading, welding, coating, pressure testing, and pipe surface inspections. Inspections of piping material and inspections during piping construction should include the visual evaluation of all piping components. Once construction is complete, these piping components and the entire system should be tested. Testing methods include hydrostatic testing of internal pressure piping; leak testing; and qualification tests based on a visual examination, bending properties, determination of wall thickness, determination of weld joint factor, weldability, determination of yield strength, and the minimum yield strength value.

Records detailing the design, construction, and testing of the piping should be kept in the files of the operating company for the life of the facility.

7.5.12 DOT 49 CFR 180.605 – Requirements for Periodic Testing, Inspection, and Repair of Portable Tanks and Other Portable Containers

Section 180.605[27] applies to any portable tank constructed to a DOT (e.g., 51, 56, 57, 60, or intermodal [IM]) or United Nations (UN) specification. According to these requirements, a portable

[26] ASME Code for Pressure Piping, B31.4-2002, "Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids," The American Society of Mechanical Engineers, revision of ASME B31.4-1998, 2002.

[27] 49 CFR part 180.605, "Requirements for Periodic Testing, Inspection, and Repair of Portable Tanks," Department of Transportation, 64 FR 28052, May 24, 1999, as amended at 67 FR 15744, April 3, 2002.

tank must be inspected prior to further use if it shows evidence of a condition that might render it unsafe for use, has been damaged in an accident, has been out of service for more than a year, has been modified, or is in an unsafe operating condition. All tanks must receive an initial inspection prior to being placed into service and a periodic inspection or intermediate periodic inspection every two to five years. The timeframe between inspections depends upon the tank's specification.

Intermediate periodic inspections must include an internal and external examination of the tank and fittings, a leak test, and a test of the service equipment. The periodic inspection and test must include an external and internal inspection and a sustained air pressure leak test, unless exempted. For tanks that show evidence of damage or corrosion, an exceptional inspection and test is mandated. The extent of the inspection is dictated by the amount of damage or deterioration of the portable tank. Specification-60 tanks are further tested by filling them with water. Specification-IM or Specification-UN portable tanks must also be hydrostatically tested. Any tank that fails a test may not return to service until it is repaired and retested. An approval agency must witness the retest and certify the tank for return to service. The date of the last pressure test and visual inspection must be clearly marked on each IM or UN portable tank. A written record of the dates and results of the tests, including the name and address of the person performing the test, is to be retained by the tank owner or authorized agent.

Requirements for retest and inspection of Intermediate Bulk Containers (IBCs) are specified in 49 CFR 180.352. Requirements depend on the IBC shell material. For metal, rigid plastic, and composite IBCs, they include a leakproof test and external visual inspection every 2.5 years from the date of manufacture or repair. They also require an internal inspection every 5 years to ensure that the IBC is free from damage and capable of withstanding the applicable conditions. Flexible, fiberboard, or wooden IBCs must be visually inspected prior to first use and permitted reuse. Records of each test must be kept until the next test, or for at least 2.5 years from the date of the last test.

Design standards and specifications for initial qualification and reuse performance testing for portable tanks, drums, and IBCs are contained in 49 CFR part 178, Specifications for Packaging. See www.access.gpo.gov/cfr.

7.5.13 FAA Advisory Circular 150/5230-4A – Aircraft Fuel Storage, Handling, and Dispensing on Airports

FAA Advisory Circular 150/5230-4A – Aircraft Fuel Storage, Handling, and Dispensing on Airports[28] identifies standards and procedures for storage, handling, and dispensing of aviation fuel on airports. The Federal Aviation Administration (FAA) recommends the standards and procedures referenced in the Advisory Circular (AC) for all airports. The FAA accepts these standards as one means of complying with 14 CFR Part 139, Certification of Airports, as it pertains to fire safety in the

[28] FAA Advisory Circular 150/5230-4A, "Aircraft Fuel Storage, Handling, and Dispensing on Airports," Federal Aviation Administration, U.S. Department of Transportation, June 18, 2004.

safe storage, handling, and dispensing of fuels used in aircraft on airports but not in terms of quality control. Although airports that are not certificated under 14 CFR part 139 are not required to develop fuel safety standards, the FAA recommends that they do so.

This AC is not intended to replace airport procedures developed to meet requirements imposed because of the use of special equipment, nor to replace local regulations. For specific provisions, the other standards that are referenced in this AC are:

- For fuel storage, handling and dispensing, the National Fire Prevention Association's "Standard for Aircraft Fuel Servicing"
- For refueling and quality control procedures, the National Air Transportation Association's "Refueling and Quality Control Procedures for Airport Service and Support Operations." This provides information about fuel safety, types of aviation fuels, fueling vehicle safety, facility inspection procedures, fueling procedures, and methods for handling fuel spills. API also publishes documents pertaining to refueling and facility specifications.

The AC also requires fuel safety training for airports certificated under 14 CFR part 139. (See http://www.faa.gov/arp/publications/acs/5230-4A.pdf.)

7.5.14 FAA Advisory Circular 150/5210-20 – Ground Vehicle Operations on Airports

FAA Advisory Circular 150/5210-20 – Ground Vehicle Operations on Airports[29] provides "guidance to airport operators in developing training programs for safe ground vehicle operations and pedestrian control on the airside of an airport." Specifically, this advisory circular provides recommended operating procedures accompanied by two appendices containing samples of the training curriculum and training manual. With regard to the transportation and storage of oil, the vehicle operator requirements on the airside of an airport require that "no fuel truck shall be brought into, stored, or parked within 50 feet of a building. Fuel trucks must not be parked within 10 feet from other vehicles." (See http://www.faa.gov/arp/ACs/5210-20.pdf.)

7.5.15 Suggested Minimum Requirements for a PE-Developed Site-Specific Integrity Testing Program (Hybrid Testing Program)

Although EPA refers to certain industry standards for inspection and testing, it does not require that inspections and tests be performed according to a specific standard. The PE may use industry standards along with other good engineering principles to develop a customized inspection and testing program for the facility (a "hybrid inspection program"), considering the equipment type and condition, characteristics of products stored and handled at the facility, and other site-specific factors.

[29] FAA Advisory Circular 150/5210-20, "Ground Vehicle Operations on Airports," Federal Aviation Administration, U.S. Department of Transportation, June 21, 2002.

For example, a hybrid testing program may be developed in cases where no specific industry inspection standard exists to date, as is the case for tanks that contain certain products such as animal fats and vegetable oils, asphalt, or oils that have a specific gravity greater than 1.0. Although there are no industry standards specific to integrity testing of bulk storage containers containing vegetable oils at this time, some facilities with large animal fat and vegetable oil tanks follow API 653. Additionally, the U.S. Food and Drug Administration (FDA) sets requirements for food-grade oils, which would need to be followed in addition to EPA's integrity testing requirements.

The following provide recommendations of the minimum elements for a hybrid inspection program.

For shop-built tanks:

- Visually inspect exterior of tank;
- Evaluate external pitting;
- Evaluate "hoop stress and longitudinal stress risks" where corrosion of the shell is present;
- Evaluate condition and operation of appurtenances;
- Evaluate welds;
- Establish corrosion rates and determine the inspection interval and suitability for continued service;
- Evaluate tank bottom where it is in contact with ground and no cathodic protection is provided;
- Evaluate the structural integrity of the foundation;
- Evaluate anchor bolts in areas where required; and
- Evaluate the tank to determine it is hydraulically sound and not leaking.

For field-erected tanks:

- Evaluate foundation;
- Evaluate settlement;
- Determine safe product fill height;
- Determine shell corrosion rate and remaining life;
- Determine bottom corrosion rate and remaining life;
- Determine the inspection interval and suitability for continued service;
- Evaluate all welds;
- Evaluate coatings and linings;
- Evaluate repairs for risk of brittle fracture; and
- Evaluate the tank to determine it is hydraulically sound and not leaking.

EPA suggests that an appropriately trained and qualified inspector conduct a hybrid inspection and provide a detailed report of the findings. The qualifications of the tank inspector will depend on the condition and circumstances of the tank (e.g., size, field-erected or shop-built), and an inspector should only certify an inspection to the extent he/she is qualified to do so. A registered

PE may be able to perform the hybrid inspection, but could also have a certified inspector (e.g., STI or API) complete the inspection. Either way, the hybrid inspection should be reviewed and certified by a PE in accordance with §112.3(d). Note that industry inspection standards require the inspector's certification number on these reports.

EPA also recommends that the hybrid inspection program include frequent (e.g., monthly), visual examinations of the tank by the tank owner. Such an examination may include the following elements:

- Foundation: Structurally sound and there is adequate drainage away from tank (yes/no)
- Tank bottom: Shows visible signs of leakage (yes/no)
- Tank shell: Shows distortions, visible leaks, seepage at seam, external corrosion (yes/no)
- Condition of coatings and insulation (satisfactory/unsatisfactory)
- Roof: Hatches securely closed, roof distortions, visible signs of holes, external corrosion, adequate drainage (yes/no)
- Condition of coatings and insulation (satisfactory/unsatisfactory)
- Appurtenances: Thief hatch seals properly; thief hatch operational; vent valve operational; drain and sample valves do not leak; piping properly supported off tank; stairways, ladders, and walkways sound (yes/no)
- Miscellaneous: Cathodic protection and automatic tank gauging is operational, tank area is clean of trash and vegetation (yes/no)

The inspector may review checklists used by facility personnel to conduct the frequent (e.g., monthly) inspections.

Table 7-5 summarizes the facility components covered by select industry standards and recommended practices for tanks, valves, pipes, and appurtenances. Additional standards and/or manufacturers' standards may also apply. The recommended standards for facility personnel to use for inspecting and testing at a particular facility would be specified in the SPCC Plan by the PE preparing the Plan. All actions (e.g., visual inspection or testing) performed by facility personnel must be appropriately documented and maintained in permanent facility records as per §112.7(e).

Table 7-5. Checklist summary of industry standards for inspection, evaluation, and testing.

Facility Component(s) Covered in Standard or Recommended Practice	**Potentially Relevant Standards and Recommended Practices**								
	API 653	STI SP001	API 570	API RP* 575	API RP* 574	API 12R1	API 1110	ASME B31.3	ASME B31.4
New equipment						✔	✔	✔	✔
Equipment that has been in service	✔	✔	✔	✔	✔	✔	✔		✔
Shop-built AST	✔	✔		✔		✔			
Field-erected AST	✔			✔		✔			
Plastic tanks		✔							
Container supports or foundation	✔	✔		✔		✔			
Buried metallic storage tank									
Tank car or tank truck									
Diked area		✔							
Aboveground valves, piping, and appurtenances		✔	✔	✔	✔		✔	✔	✔
Underground piping			✔		✔				
Offshore valves, piping, and appurtenances									✔
Steam return and exhaust lines									
Field drainage systems, oil traps, sumps, and/or skimmers									

* Recommended practice.

Table 7-6, tank inspection checklist, provides an example of the type of information that may be included on an owner/operator-performed inspection checklist.

Table 7-6. Tank inspection checklist (from Appendix F of 40 CFR part 112).

I.	**Check tanks for leaks, specifically looking for:**	
	A.	Drip marks;
	B.	Discoloration of tanks;
	C.	Puddles containing spilled or leaked material;
	D.	Corrosion;
	E.	Cracks; and
	F.	Localized dead vegetation.
II.	**Check foundation for:**	
	A.	Cracks;
	B.	Discoloration;
	C.	Puddles containing spilled or leaked material;
	D.	Settling;
	E.	Gaps between tank and foundation; and
	F.	Damage caused by vegetation roots.
III.	**Check piping for:**	
	A.	Droplets of stored material;
	B.	Discoloration;
	C.	Corrosion;
	D.	Bowing of pipe between supports;
	E.	Evidence of stored material seepage from valves or seals; and
	F.	Localized dead vegetation.