Confusion for Tank Owners: When Integrity Testing Finds Tank Deficiencies Not Directly Referenced in the SPCC Rule

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ABSTRACT

As consulting engineers working on Spill Prevention, Control, and Countermeasure (SPCC) Plans and tank design projects, we have encountered a number of oil tanks since 2002 for which owners have received certified tank integrity inspections citing numerous tank deficiencies not directly referenced in 40 CFR part 112. The citations were commonly associated with fire codes. Examples of these tank deficiencies include insufficient venting, venting indoors, inadequate tank support, and tank placement. These issues, while identified within industry guidance such as National Fire Protection Association (NFPA) 30, can be a surprise to tank owners who thought the purpose of the tank integrity testing was to ensure that the tanks meet spill requirements such as secondary containment, structural integrity, and overfill protection.

This paper addresses the confusion of tank owners when finding out that their tanks passed the structural integrity tests but were still out of compliance due to issues such as venting and tank location. The intent of this paper is threefold:

- Inform tank owners of the relationship between federal, state, and local regulations and industry guidance.

- Describe the confusion that tank owners may have when integrity testing discovers tank deficiencies not discussed in the SPCC Rule.
- Encourage companies that prepare SPCC Plans and perform integrity testing to more fully explain the relationship between the integrity test industry guidance they must adhere to and federal, state, and local regulations.

OVERVIEW OF REGULATIONS

The regulation of oil-containing aboveground storage tanks (ASTs) is a function of federal, state, and local governments. The regulations generally focus on environmental issues such as oil spill prevention and fire prevention. One area of confusion is the concept of "environmental" requirements versus "fire code" requirements for oil storage containers. This paper refers to these terms in a general sense because there is overlap between the two fields. A tank leak is generally considered an environmental issue, but it could also lead to oil reaching an ignition source. A tank with insufficient emergency venting capacity is both a fire hazard and an environmental spill risk if the tank ruptures from over-pressurization. The unclear overlap of environmental and fire code requirements are a source of confusion and provide the backdrop of this paper.

Provided below is a summary of government regulations and industry standards.

Federal Governmental Regulations

The two primary federal codes addressing oil-containing ASTs are 29 CFR part 1910 (§1910.106) and 40 CFR part 112 (§112), which is often referred to as the SPCC Rule. The SPCC Rule addresses oil pollution prevention for oil containers, while §1910.106 addresses the Occupational

Safety and Health Administration (OSHA) standards for flammable and combustible liquids. Section 112 requires the development and implementation of an SPCC Plan for non-transportation related facilities that have aboveground storage capacity greater than 1,320 gallons of petroleum-based products (e.g., oil)[1] in containers that hold 55 gallons or more, and could reasonably be expected to discharge oil in quantities that may be harmful into or upon the navigable waters of the United States. SPCC Plans are discussed in more detail in the next section. The OSHA regulation is applicable to any business with containers storing materials covered by §1910. This includes many types of petroleum products based on flammability and combustibility definitions, including gasoline and diesel fuel.

State Governmental Regulations

AST regulations vary from state to state, but generally address tank installation and registration (if tank or facility capacity is above a threshold), inspections, spill containment, release reporting, corrective action procedures, and tank closure requirements. The regulations typically cover fire prevention and environmental issues. Depending on the state, the AST regulations are either codified together under one AST subchapter, or codified separately under a fire prevention subchapter and an environmental management subchapter.

Local Governmental Regulations

Many local governments also have oil-containing AST requirements. The fire marshal is usually the responsible party within the local government. It is important to note the critical role that state and local fire marshals have in enforcing fire codes.

[1] Oil will hereafter refer to all petroleum-based products covered under the SPCC rule.

Industry Standards and Codes

It is common for industry standards to be partially or wholly adopted by state or local government oil control programs. The standards themselves are not legally enforceable unless adopted or referenced by an applicable government regulation. In addition, an industry guidance referenced by an SPCC Plan or other tank engineering document (e.g., tank installation specifications) must be adhered to.

Industry standards are available for fabrication, installation, operation, and inspection of oil-containing ASTs.[2] Some of the more commonly referenced industry standards include:

Fire prevention issues:

- NFPA 1, *Uniform Fire Code*
- NFPA 30, *Flammable and Combustible Liquids*
- International Code Counsel (ICC), *International Fire Code*

Tank fabrication, installation, and testing

- American Petroleum Institute (API) 650, *Welded Steel Tanks for Oil Storage*
- Underwriters Laboratories (UL) 142, *Steel Aboveground Tanks for Flammable and Combustible Liquids*
- UL 2080, *Standard for Fire Resistant Tanks for Flammable and Combustible Liquids*
- UL 2085, *Standard for Protected Aboveground Tanks for Flammable and Combustible Liquids*

[2] The term industry standard will hereafter be used to refer to industry standards, codes, and recommended practices.

Tank and associated piping inspection

- Steel Tank Institute (STI) SP001, *Standard for the Inspection of Aboveground Storage Tanks*
- API 653, *Tank Inspection, Repair, Alternation, and Reconstruction*
- API 570, *Piping Inspection Code, Inspection, Repair, Alternation, and Rerating of In-Service Piping Systems*
- API RP 575, *Inspection of Atmospheric & Low Pressure Storage Tanks*

SPCC PLANS

On December 11, 1973, the Environmental Protection Agency (EPA) first issued regulations establishing procedures, methods, equipment, and other requirements to prevent the discharge of oil from non-transportation-related onshore and offshore facilities into or upon the waters of the United States. The regulations are identified as 40 CFR part 112, revised 1987, "Oil Pollution Prevention; Non-Transportation-Related Onshore and Offshore Facilities." On October 22, 1991, the EPA published proposed rules including further revisions. A new revision of the SPCC rule was published in the Federal Register on July 17, 2002 and became effective August 16, 2002. The EPA published a final rule amending the SPCC rule in the Federal Register on February 17, 2006. This action extends the SPCC compliance dates (revise Plan and implement Plans) in §112.3(a), (b), and (c) for all facilities until October 31, 2007.

The primary purpose of the SPCC Rule is spill prevention, but Part 112(7)(j) requires that the Plan include a discussion of conformance with the applicable state rules, regulations, and guidelines. Because most states have fire prevention regulations for ASTs, the Professional Engineer (P.E.) preparing the SPCC Plan should consider the applicability of the state fire code.

COMPLIANCE OF OIL TANKS WITH FIRE CODE REGULATIONS

Based on the number of documented tank failures, discussions with regulatory and industry entities, and project tank experience; there is a potentially significant number of aboveground tank systems that have deficiencies with respect to regulatory or industry standards. These tank deficiencies are due to a variety of causes such as structural integrity failure, improper installation, tank placement, poor maintenance, and missing or broken tank equipment. Figure 1 presents an example of required equipment for a U.L. 142 double-wall tank. Figure 2 presents a photo of an installed U.L. 2085 tank with dual dispensers and a fuel management system.

The revised SPCC Rule appears to have resulted in greater awareness of oil AST environmental issues spill containment, security, overfill alarms, and tank inspections. However, oil tank owners

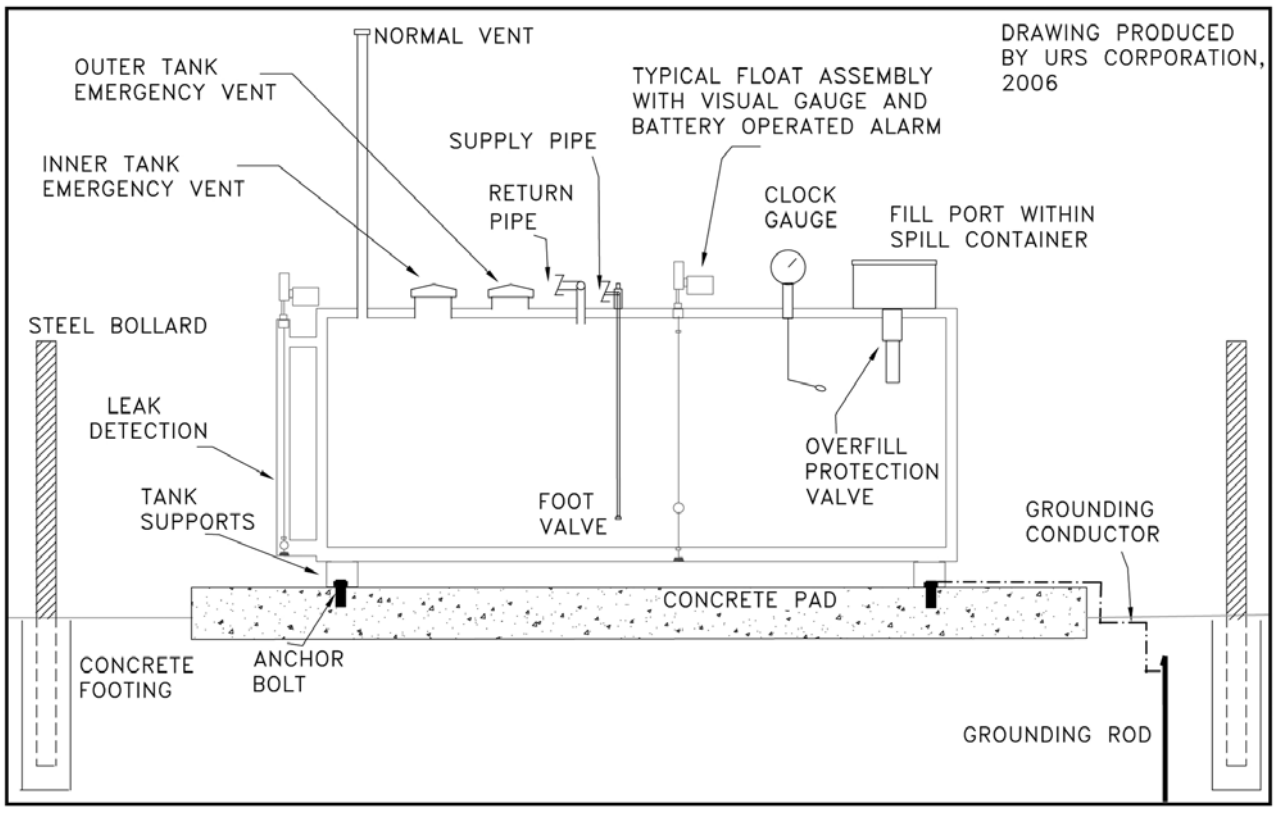

Figure 1
Typical U.L. 142 Double-wall Aboveground Storage Tank

Photo courtesy of Core Engineered Solutions

Figure 2
Dual Compartment Convault Protected AST (U.L. 2085)

and SPCC Plan preparers may be less aware of fire code issues with which tanks must comply. In our experience, tank deficiencies are usually discovered one of the following ways:

- Tank failure or other emergency
- Tank inspection by government inspector
- Certified integrity inspections per the SPCC Rule or state regulations
- Tank evaluation as part of a facility Environmental Site Assessment, tank registration, tank repair/upgrade, or SPCC Plan preparation

The large number of SPCC Plan revisions and certified inspections to be performed over the next several years should be a significant route through which fire code deficiencies are discovered. The next section describes tank inspections in detail.

TANK INSPECTIONS

A critical component of any oil tank program is inspection, including integrity testing inspections. As discussed below, integrity testing (visual inspection combined with another testing technique) for aboveground bulk storage containers will be required by the SPCC rule when the compliance date arrives in 2007. Currently, an operator may opt to use visual inspection alone. However, there are many issues within the scope of integrity testing that relate to fire code deficiencies. Presented below is an overview of integrity testing regulations and industry guidance.

Federal (this requirement is not in effect until October 31, 2007)

Under §112.108(c)(6), for bulk storage containers the owner must "*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 …"*

Page 47119 of the July 17, 2002 Federal Register provides an analysis of §112.108(c)(6). It defines integrity testing as "*any means to measure the strength (structural soundness) of the container shell, bottom, and/or floor to contain oil and may include leak testing to determine whether the container will discharge oil. It includes, but is not limited to, testing foundations and supports of containers…*" This analysis also states that industry standards may assist an owner or operator with integrity testing.

On December 2, 2005, EPA released the *SPCC Guidance for Regional Inspectors*. The document is intended to assist regional inspectors in reviewing a facility's implementation of the SPCC Rule. Section 7 of the EPA Guidance provides detailed information on inspections and integrity testing.

EPA provided examples of environmentally equivalent protection for certain tanks with regard to integrity testing as required in the 2002 SPCC Rule. As discussed in the March 2004 EPA document *EPA Settlement Issues*, for shop-built containers with a shell capacity of 30,000 gallons or less, combining visual inspection with either (1) elevation of the container in a manner that decreases corrosion potential and makes all sides of the container visible, or (2) placement of a non-permeable barrier between the container and ground, would be considered equivalent to non destructive testing methods. For tanks that meet these conditions and where a P.E. has made an environmental equivalence determination, the P.E. can determine the appropriate method of integrity testing that is needed to meet the standard of good engineering practices. For example, the P.E. must decide whether a rectangular, double-wall tank sitting on the ground meets the criteria, even if the outer tank floor cannot be inspected and may corrode over time. However, the decision-making process should be rooted in best management practices, including industry standards. At a minimum, periodic visual inspections are needed by a qualified inspector. The P.E. must decide if certified inspections are needed.

It is important to note that regardless of the facility’s oil-containing capacity, only a P.E. can make an environmental equivalence determination. Therefore, the December 12, 2005 EPA proposed SPCC amendment of self-certification for facilities with less than 10,000 gallons of oil storage capacity would not allow for equivalent protection in place of certified integrity testing.

In summary, under the new SPCC Rule, bulk oil containers will need certified integrity testing or an environmentally equivalent method (as discussed above). The scope and interval of the certified integrity testing will depend on factors such as tank type, configuration, age, and condition. If no baseline data on the tank is available, Section 7 of the *SPCC Guidance for Regional Inspectors* states that, initially, more frequent integrity testing may be needed. The suitability of a tank (with no baseline data) for continued service can be determined from certified inspections using guidance in API 653 or STI SP001. In addition, all bulk storage containers lacking secondary containment and for which an impracticability determination has been made must have certified integrity testing.

State/Local

On the state/local level, integrity testing regulations are in some cases more stringent than §112 and must be followed as applicable. It is important to note that site inspections by state and local inspectors and fire marshals will likely focus on both environmental and fire code issues.

Industry Guidance

When the SPCC Plan states that a certified inspection is required, the inspector must perform the inspection in compliance with the standards referenced in the Plan. Three of the most commonly used inspection guidance documents are API 653, API 570, and STI SP001. Note, the latest revision of STI SP001 (July 2005) contains major revisions from the 2003 version.

Section 5 of STI SP001 provides an inspection schedule. The inspection intervals and scope are based on the tank size and configuration. For instance, STI SP001 does not require formal certified inspections for elevated tanks 5,000 gallons or less if complete visual inspection is possible and the

tank has secondary containment. Formal external inspections and a leak test, both performed by a certified inspector, should be conducted at least every 10 years for a single-wall tank sized 1,101 to 5,000 gallons in contact with the ground but with spill control (STI-SP001, July 2005).[3] All ASTs sized above 5,000 gallons require a formal external inspection every 5 to 20 years, with the time interval depended on the tank size and configuration.

API 653 and API RP 575 both require certified inspections based on a tank's service history with certified inspection intervals of 5 to 20 years depending on the tank size and configuration.

Performance of a certified inspection requires the specialized experience of personnel certified by the Steel Tank Institute or the American Petroleum Institute. An STI- or API-certified tank inspector *must* perform the inspection per the guidance for which they are certified. Both the STI and API guidance require that the integrity inspection include the evaluation of many aspects of the tank and its equipment to address tank integrity, secondary containment, spill prevention, and fire code related issues. Section 7 of SP001 contains the minimum inspection requirements for formal external inspections that must be conducted by a certified inspector. Integrity testing includes hydrostatic techniques, visual inspections, non-destructive shell-thickness testing, or a combination of these methods based on equipment design. The tank foundation and supports are included in the testing. SP001 states that inspections should cover the AST secondary containment, drain valves, ancillary equipment, piping, vents, gauges, grounding system, stairways, and coatings. The inspector examines these tank components according to the industry guidance to which it was designed, such as UL 142 or API 650.

[3] The reader should refer to these standards; this information for discussion purposes only.

COMMON TANK DEFICIENCIES

Tank deficiency regulatory citations that arise from government inspections or integrity testing could be referenced from §112, §1910.106, state/local regulations, or industry standards. Having established the relationship between the regulations and industry standards, this section provides examples of potential tank deficiencies. Common deficiencies are presented below and grouped under environmental issues and fire code issues. However, many of the environmental issues could lead to fire hazards and the fire code issues could lead to a spill. Note some of these issues may not be applicable depending on the tank placement, stored oil classification, and State/local regulations.

Environmental Issues:

- Failure of structural integrity or tightness test
- Malfunctioning overfill or leak detection alarms
- No or undersized secondary containment for tank or piping
- General surface corrosion/paint failure
- Evidence of leak / overfill
- Broken tank gauge
- No spill control
- Tank equipped with improper fittings
- No integrity test program or baseline tank data

Fire Code Issues:

- Tank or pipe unprotected from damage by vehicular traffic
- Not anchored to floor/foundation
- Tank support structure inadequate
- Venting indoors
- No grounding
- No emergency vent
- Vent/vent pipe not adequately sized
- Vent shared by two tanks
- Pipe not properly supported

Fire Code Issues (continued):

- Support legs of tank too long
- Tank too close to adjacent tank
- Combustible material (trash, leaves) in the dike area

TANK OWNER CONFUSION AND POTENTIAL CONSEQUENCES OF TANK DEFICIENCIES

EPA estimates that 618,000 facilities are currently regulated under the SPCC Rule (EPA, *SPCC Guidance for Regional Inspectors*, 2005). Once an SPCC Plan has been developed and signed by a P.E., the next step is for the owner / operator to implement the Plan in order to be in compliance with the SPCC Rule. This may include tank system upgrades, such as new secondary containment and tank alarms, as well as employee training and integrity testing. As discussed previously in Tank Inspections, formal certified inspections are required when specified by the facility SPCC Plan. However, because fire code issues are not generally discussed in SPCC Plans, there may be no expectations on the part of the tank owner that fire code issues are relevant. The result is that the tank owner is making cost and schedule decisions based on incomplete understanding of all the tank upgrades that may be needed. The problems for a tank owner whose tank does in fact have fire code type deficiencies are discussed in more detail below.

Incorrect expectations and confusion concerning integrity testing: Many SPCC Plans may lack sufficient detail about integrity testing to allow a clear understanding of the tests to be performed by the certified inspector. The simple fact that the certified inspection requires more than just a structural integrity test may be a surprise to many tank owners. A certified inspection report is likely to discuss tank deficiencies in terms of industry codes but may not provide a direct link

between the applicable regulations and the industry standard which covers the actual deficiency. A report that does not explain why the upgrades must be performed leads to confusion and questions concerning the legal necessity to install the upgrades. This is especially true for deficiencies not directly referenced in §112. An inability to clarify the regulatory authority for upgrades can be especially problematic for the employee tasked with SPCC implementation.

Potential tank failure: A tank with deficiencies such as insufficient emergency venting capacity or no grounding is a fire hazard. A generator tank that fails to supply fuel to the generator could result in loss of backup power during a power outage. The cost for AST upgrades is typically a fraction of the cost for spill response and clean-up of an oil spill. A tank fire or loss of backup power is an immediate risk to personnel.

Possible fines from government inspections for fire code violations: If the fire code deficiencies are discovered during a government inspection, it is possible that fines will be administrated (especially if the problems are not quickly resolved). Tank installation and upgrade work is a specialty field dominated by small businesses. In the mid-Atlantic region, tank contractors have been very busy the last several years due to new development, UST removals, and tank replacements. Tanks and tank components are periodically in short supply and usually require several weeks for delivery. Being forced to upgrade a tank system immediately to avoid fines can place significant stress and increased costs on a tank owner. In addition, fines and code violations may cause increased premiums or cancellation of an owner's tank insurance. An insurance carrier is likely to reject a claim for a tank that has outstanding fines or code violations.

Underestimated and inefficient spending for tank upgrades: Having an understanding of the complete cost for tank upgrades helps a tank owner better plan for expenditures and allows for more effective use of funds. In some cases, the decision to upgrade a tank or replace it could change based on additional upgrades required to meet fire codes. Many tank owners have different funding mechanisms for environmental versus fire code issues and having a sense of all the problems up front can help with funding strategy.

COSTS FOR TANK UPGRADE COMPARED TO INSTALLATION OF NEW TANK

As discussed above, in some cases, the decision to upgrade a tank or replace it requires an understanding of all deficiencies. Presented below are typical estimated costs for tank repairs and tank replacement. For reference, the cost to perform a certified external integrity test (assumes ultrasonic thickness test) and produce a report for a 500-gallon tank and associated piping can often range between $800 to $1,500. The costs presented herein are approximate and based on industry unit cost literature, vendor cost lists, and professional experience.

Tank Replacement: The cost to remove of an outdoor 500-gallon AST that failed a tightness test and replace it with a new 500-gallon double-wall steel AST is approximately $11,000 to $15,000.

Tank Repairs: The estimated cost to install new tank equipment or make tank repairs is presented in the table below for an outdoor 500-gallon steel AST.

- Install 5-gallon spill bucket	$ 500
- Install 2-inch diameter automatic shut-off overfill protection valve	$ 1,150
- Install 2-inch visual tank clock gauge	$ 630
- Install bollard (each)	$ 650
- Anchor tank to floor / foundation	$ 520
- Install grounding cable for tank	$ 550
- Install 4-inch diameter emergency vent	$ 330
- Install pipe support (each)	$ 300

CONCLUSION

The intent of this paper is to explain the relationship between regulations and industry guidance for oil-containing ASTs in terms of both environmental issues and fire prevention codes. The revised SPCC Rule appears to have resulted in greater awareness of the environmental issues for oil containing ASTs. Certified inspections should be a significant route through which tank deficiencies are discovered. However, a general understanding of fire code issues during the SPCC Plan stage will better enable owners to address tank deficiencies and thus avoid subsequent problems. Specific actions that could help address these issues are provided below.

1. It should not be assumed that the majority of tank owners and SPCC Plan preparers are aware of how fire prevention issues relate to actions driven by environmental regulations (i.e., integrity testing). Government agencies, industry associations, and trade groups play a significant role in alerting their members to tank issues and are in a position to disseminate the most up-to-date information.

2. Professional Engineers developing SPCC Plans should have at least a basic understanding of fire code regulations relevant for a facility. In our experience, clients are in a much better position to address tank upgrade requirements when alerted to the potential environmental *and* fire code deficiencies during the SPCC Plan process. Of course, Plan developers should know when to refer the tank owner to a certified tank inspector. However, alerting the client to potential fire code issues would in many cases be appropriate. Problems such as a lack of emergency venting, venting indoors, and tanks situated too close to each other can be pointed out as potential problems.

3. SPCC Plans need sufficient information about integrity testing to allow a clearer understanding of the required scope of work that will be performed by the certified inspector. This will also give the owner a better idea of what to expect and provide a more concise scope of work for the inspector. The EPA *SPCC Guidance for Regional Inspectors* and the latest versions of STI SP001 and other standards provide useful guidance for the Plan preparer.

4. Companies that perform certified integrity testing should explain to their clients the relationship between the integrity test industry guidance they must adhere to and federal, state, and local regulations.

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