ASTs: Checking for Clean Air Act Compliance

Ignorance can cost AST tank owners plenty when it comes to following air quality mandates. Robert L. Ferry and Philip E. Myers help to clear up the mysteries of air emissions regulations for tank owners, as well as the requirements and responsibilities that they face.

Floating roof tanks a case in point. . .
There is a common misconception among folks involved with tank construction that they do not need to be concerned with air emission issues. Tank owners will often include in their tank specifications a requirement that “new construction shall comply with applicable regulations”—thereby believing that they have passed responsibility for regulatory compliance to the tank builder. The tank builders, however, often respond by submitting drawings showing their standard details, believing that they have, thereby, passed back to the owner the responsibility of identifying any noncompliance. Thus, each party avoids addressing the regulations by relying on the mistaken belief that a compliance review is being undertaken by the other.

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Owning up to it

Both parties are perfectly happy with this arrangement until an inspector comes along and cites the owner for a violation. Then the finger pointing begins, and both parties wish they had been up to speed on regulatory issues before the tank was built.

This reluctance to come to grips with regulatory compliance is frequently rooted in the complexity of the rules. The US Environmental Protection Agency (EPA) regulates air emissions primarily under the Clean Air Act (CAA), although there are also air standards under the Hazardous Waste provisions of RCRA; this is the Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act.

In fact, as many as 16 separate air regulations may apply to a floating-roof tank at a petroleum refinery, and additional rules are pending. These rules tend to be written in a manner that is difficult to understand; they are thus subject to different interpretations. When these individually confusing rules are combined with numerous other overlapping or conflicting regulations, the result is a virtually incomprehensible jumble of requirements.

The applicability of the various regulations depends on factors such as the industrial classification (aka source category) of the facility at which the tank is located; the tank's storage capacity; the stored liquid's volatility and toxicity; and the date upon which tank construction commenced.

When controls are required, the bottom-line concern, from a construction viewpoint, is often whether a floating roof is to be used and, if so, what design features are specified in the governing regulation. This article will focus on the design requirements for floating roofs specified in various air regulations for petroleum storage tanks.

Going fishing

To unravel the hodgepodge of environmental regulations, it helps to outline the framework in which these regulations exist. The previously mentioned Clean Air Act (CAA) and the Resource Conservation and Recovery Act (RCRA) are acts of Congress. That is, they are federal laws passed by Congress that establish legal authority to enforce certain environmental mandates.

The provisions of a law are referred to as statutory requirements. These laws are then implemented by EPA through the issuance, or promulgation, of a series of standards that impose regulatory requirements. Thus Congress imposes a statutory (i.e., legally binding) obligation upon EPA to generate the body of standards, or regulations, with the specific requirements deemed necessary and appropriate to achieve the more general goals embodied in the Congressional acts.

To understand the relationship among Congress, EPA, the regulated community and the public, let's consider an overly simplified illustration. Imagine that a newly developed exclusive residential community has been built along a small river. The residents have become distressed over the occasional appearance of large numbers of dead fish and engage a lobbying group to pressure their Congressman to do something about it.

Congress then passes a law mandating that the quality of the water in that river be improved sufficiently so that the fish won't die. This law requires EPA to develop the regulations necessary to save the fish. EPA subsequently publishes regulations requiring controls on everything from wastewater discharges at the local mill to storm-water runoff at the new golf course, yet the fish continue to die.

People finally discover that the dead fish are a variety that swim upriver to spawn, and then die naturally. In fact, it seems that the ancient Indian name for this river means "place where fish come to die." Meanwhile, although the regulations are ineffective in preventing the dead fish, they continue to be enforced. Sometimes it seems that, while fish don't live forever, regulations do.

The scorecard

EPA's primary focus with respect to air emissions from the petroleum industry, prior to the 1990 CAA Amendments, was to control emissions of volatile organic compounds (VOCs). VOC emissions are regulated as an indirect attempt to reduce ozone in the lower atmosphere, which in turn is intended to reduce the formation of urban smog. These VOC regulations, authorized by Congress under Title I of the CAA, were promulgated by EPA under Part 60 of Title 40 of the Code of Federal Regulations (40 CFR Part 60).

These VOC regulations typically address a specific type of emission point, such as a storage tank or a process vent. The individual emission point is considered the source regulated by the rule. (EPA's Plain English Guide to the Clean Air Act defines a "source" as any place or object from which pollutants are released. An affected source is a source governed by a given rule.)

Some of these VOC rules apply to a type of emission point, regardless of the industry in which it is found (e.g., tanks storing volatile organic liquids), whereas others are specific to a particular industry (e.g., wastewater systems at petroleum refineries). There is an occasional overlap in the application of these standards. A tank storing slop oil skimmed from an oil-water separator, for example, may be subject to the standard for volatile organic liquids storage as well as the standard for petroleum refinery wastewater facilities.

While the regulation of VOCs under Title I is intended to reduce the formation of unhealthful byproducts of this pollutant in the atmosphere, Title III regulations address pollutants that are deemed harmful in and of themselves. That is, the Title III pollutants are considered toxic, whereas the Title I pollutants are considered to be contributors to unhealthful conditions.

Prior to the 1990 Amendments to the CAA, the regulations under Title III were chemical-specific. In other words, each regulation addressed a particular hazardous air pollutant (HAP). These rules, known as National Emission Standards for Hazardous Air Pollutants (NESHAP) standards, were promulgated under 40 CFR Part 61. This chemical-by-chemical approach was ineffective, however, in that it had only addressed seven pollutants before 1990.

Of the seven HAPs regulated by the Part 61 NESHAP standards, the only one stored at petroleum or petrochemical facilities was benzene. As with the Title I regulations, the source for the Part 61 NESHAP standards continued to be defined by the type of emission point, and separate standards were promulgated for benzene storage vessels and for benzene waste operations.

The "source" of the problem

The 1990 Amendments brought a revised approach to the control of Title III pollutants. Congress listed 189 chemicals as HAPs and charged EPA to identify the industries that release them. A given rule was to then address all of the listed HAPs released by a given industry, or source category, rather than have separate rules for each HAP.

The subsequent regulations are promulgated under 40 CFR Part 63 as NESHAP Standards for Source Categories. These rules require the use of maximum achievable control technology (MACT), and are referred to as MACT Standards. They define the entire facility as the source, rather than a particular type of emission point within the facility.

A given rule then typically governs all types of emission points at that facility. There is, then, a standard for gasoline terminals that includes provisions for storage tanks, as well the other types of emission points at gasoline terminals. There is also a standard for petroleum refineries that includes provisions for storage tanks, and a standard for the synthetic organic chemical manufac- turing industry (SOCMI) that includes provisions for storage tanks. The resulting array of CAA regulations governing storage tanks is outlined in Table 1.

Each of the CAA rules listed in Table 1 may apply to a given tank supplied to the petroleum industry. Furthermore, there are CAA rules for particulate emissions from asphalt tanks, as well as air rules under RCRA that may apply to certain tanks in the petroleum industry. This proliferation of regulations on storage tanks is overlapping, confusing and duplicative. No wonder tank manufacturers have difficulty maintaining a working knowledge of the design requirements imposed by these regulations.

Table 1: CAA Regulations Governing Storage Tanks in the Petroleum Industry

1. NSPS is EPA's acronym for the Standards of Performance for New Stationary Sources (aka New Source Performance Standards).
2. The term new tanks means tanks that are constructed, modified, or reconstructed after the effective date of the rule.
3. RACT rules are developed by the individual States, and must require the use of reasonably available control technology at least as stringent as that specified in the federal guidance documents. States must impose RACT rules in geographic areas determined to not attain the National Ambient Air Quality Standard (NAAQS) for ozone (i.e., nonattainment areas).
4. The term 'existing tanks' means tanks that were existing prior to the effective date of the rule (i.e., pre-existing).
5. CTG is the EPA acronym for Control Techniques Guidelines, which describe regulatory alternatives and specify minimum control levels required for State RACT rules.
6. ACT is the EPA acronym for Alternative Control Techniques document. This document describes regulatory alternatives in the same manner as a CTG, but does not specify a minimum level of control for RACT.

A simple solution?

EPA recently issued a standard that offers a simplified regulatory compliance approach. This rule was promulgated June 29, 1999, as part of the Generic MACT package. EPA issued the package as a set of "generic MACT standards" for individual types of emission points or control devices, with a separate standard that applied these generic standards to four industries:

- acetal resins production,
- acrylic and modacrylic fibers production,
- hydrogen fluoride production and
- polycarbonates production.

The generic standards include 40 CFR Part 63 subpart WW, National Emission Standards for Storage

Vessels (Tanks)—Control Level 2. The designation “control level 2” indicates the use of a floating roof as the control device, so this subpart is essentially a generic standard for floating roof tanks.

While the generic standards are expressly applicable only to the four industries cited above, EPA intends to invoke these standards as the control requirements in future rulemaking. Furthermore, EPA intends to revise storage tank regulations to allow compliance with the generic standard in lieu of the regulations. This would allow a facility to address all of its storage tanks under a single set of requirements, rather than attempt to unravel the labyrinth of rules summarized in Table 1.

This consolidation greatly simplifies the compliance burden. There is an associated cost of doing so, however, in that the generic standard may impose more stringent requirements than the existing rules.

When specifying or designing either a new tank or modifications to an existing tank, then, the generic standard offers a simplified set of requirements that may be used to assure compliance with all federal air regulations. Although EPA has not yet revised regulations to expressly allow compliance with the generic standard in lieu of the existing standards, EPA intended the generic standard to be at least as stringent as existing rules.

Table 2:
Rim Seal Design Requirements for Internal Floating-Roof Tanks

Comparisons of the floating-roof design requirements of the generic standard to the requirements of selected existing rules are shown in Tables 2 through 4. Refer to Figures 1 and 2 for typical internal and external floating-roof tanks.

A few caveats should be kept in mind on the use of the generic standard as an overriding single set of design requirements.

• First, the generic standard is deemed to be at least as stringent as existing federal requirements, but States and local jurisdictions may have more stringent requirements. For a given facility, the local rules and permit conditions should still be checked, even when complying with the generic standard.

• Second, while the design requirements of the generic standard are at least as stringent as existing regulations, the recordkeeping and reporting requirements are greatly simplified. Until EPA revises existing rules to allow compliance with the generic standard as an alternative, the recordkeeping and reporting requirements of each applicable rule should still be met.

• Third, there are operational and inspection requirements under the various rules. In this discussion, however, all of these other concerns shall be set aside in order to focus on design requirements.

Figure 1:
Internal Floating Roof

Figure 2:
External Floating Roof

Comparing design requirements

When comparing the requirements presented in Tables 2 through 4, bear in mind one thing. For the construction of new tanks, or any modifications to existing tanks that result in an increase in emissions, NSPS Subpart Kb takes precedence over any MACT rules that are less stringent. Furthermore, NSPS Subpart Ka applies only to tanks built, modified, or reconstructed between 1978 and 1984. These less stringent rules, then, would only apply to replacement-in-kind type of repairs for certain older tanks.

Rim seals

It is evident from Tables 2 and 3 that the generic standard requires the same types of rim seals as NSPS Kb and subsequent regulations. There are differences, however, in how these rim seals are described. Some rules use the term continuous, while others, including the generic standard, do not. This inconsistency illustrates some of the problems that arise with the proliferation of duplicative requirements.

Inevitably, when a given requirement is specified in more than one place, certain variations in wording will appear even when no difference is intended. The wording then diverges further as questions of interpretation are raised separately for the various rules in which the requirements appear. This separate evolution of rules with similar requirements results in an increasingly confusing regulatory framework.

In this case, the term continuous is at the heart of the problem. This term had been used initially to denote a seal that does not allow separation of adjacent parts, as distinguished from so-called flapper, shingle or finger seals. It was sometimes asserted, however, that a seal did not satisfy the requirement of being continuous if it had any splices. Some regulations, such as the generic standard, dropped the use of the troublesome term.

Other regulations addressed this by including a definition that expressly allows a continuous seal to have splices, such as the following from RCRA Subpart CC, section 265.1081: “Continuous seal means a seal that forms a continuous closure that completely covers the space between the edge of the floating roof and the wall of a tank. A continuous seal may be a vapor-mounted seal, liquid-mounted seal, or metallic shoe seal. A continuous seal may be constructed of fastened segments so as to form a continuous seal.”

Table 3:
Rim Seal Design Requirements for External Floating-Roof Tanks

What is intended to be disallowed is a seal design that is made up of multiple, independent segments. These designs use segments that may overlap and/or be arranged in multiple rows, but each segment can lift away from the adjacent segments. The problem is not that such designs are known to be inferior, but rather that the effectiveness of these segmented seals has not been demonstrated by testing. Until they are tested, their effectiveness is simply a matter of speculation. While the generic standard does not use the term continuous, it would be difficult to claim equivalency to other regulations unless a continuous seal were used.

There is another rim seal requirement found in certain other rules that is not expressly stated in the generic standard. It deals with the fit of internal floating-roof rim seals to the tank shell. The SOCMI HON rule specifies that there shall be no gaps in the fit of the rim seal that are visible from the top of the tank. For certain situations, such as a mechanical-shoe seal in a riveted tank, this may effectively dictate the use of a secondary seal. Again, while this requirement is not included in the generic standard, compliance with it may be necessary to claim equivalency with existing rules.

Table 4: Deck Fitting Design Requirements for Internal and External Floating-Roof Tanks

Deck fittings

It is apparent from Table 4 that there is far less consistency in the deck fitting requirements under the various rules than was observed for rim seals in Tables 2 and 3. The generic standard has several provisions not found in any existing rule.

Slotted guidepoles—A deck fitting that has been particularly controversial is the slotted guidepole, also referred to as a gauge pole, gauge pipe or stilling well. NSPS Subpart Kb does not specify any control for slotted guidepoles beyond a gasketed cover over the opening through the floating roof.

Certain imaginative and contentious interpretations, however, have inferred additional control requirements. The HON rule was the first federal standard to expressly require additional controls for slotted guidepoles, but it falls short of fully describing those controls that have been demonstrated to be effective.

A significant distinction of the generic standard is that it clearly specifies control device configurations that have been demonstrated to be effective. The options specified are a pole float (that extends up to the well cover) or a pole sleeve, in either case used in combination with a well gasket and pole wiper. These control devices are illustrated in Figure 3.

The generic standard also clarifies that guidepoles with slots only near the very bottom, where they remain submerged, would not be considered slotted. For purposes of this standard, a guidepole is only defined as slotted if it has slots or holes far enough up the guidepole to be above the liquid level at some time in the course of normal operations. This is established by the definition of a slotted guidepole, which is given as follows: “Slotted guidepole means a guidepole or gaugepole that has slots or holes through the wall of the pole. The slots or holes allow the stored liquid to flow into the pole at liquid levels above the lowest operating level.”

Gaps in the fit of the gasketed cover—The generic standard clarifies that the term gap, when used in the context of the fit of a cover or other closure device, refers to a space between “any deck fitting gasket, seal, or wiper (required by…this section) and any surface that it is intended to seal.” It further specifies that no such space or gap shall exceed one-eighth inch. The generic standard is thereby the first federal rule to impose a measurable criterion for the installation and inspection of deck-fitting gaskets, seals and wipers. This gap requirement applies only to the fit of those gaskets, seals, or wipers specified in the standard.

Figure 3:
Slotted Guidepole Control Options

Deck drains

Regulations have traditionally contained separate requirements for the control of deck fittings, depending upon whether the deck fittings are associated with an internal floating roof or an external floating roof. In that the separate sets of requirements have been quite similar, there has often been confusion with respect to which differences were inadvertent.

The generic standard simplifies this situation by containing only a single set of deck fitting requirements that applies to both internal and external floating-roof tanks. While this consolidation results in a simpler, easier to follow rule, it also imposes a require- ment that had not been specified in any previous rule—control of internal floating roof deck drains. The requirement is for the drain to be equipped with a device that covers at least 90 percent of the opening.

While there may not be any devices on the market to cover the small deck drains used on internal floating roofs, inventive personnel at an East Coast pipeline facility came up with an idea several years ago that may meet this rule: a simple cork ball, such as may be used for a fishing bobber, that is larger in diameter than the drain. When no liquid is on the top side of the deck, the cork ball rests on top of the drain and effectively covers it.

Should the deck be flooded with liquid, however, the cork ball floats off and allows the liquid to enter the drain. A wire through the cork ball secures it to the drain and guides it back into place when the liquid has receded. This device is illustrated in Figure 4.

Figure 4:
Internal Floating Roof Deck Drain

Covered (domed external) floating-roof tanks

External floating-roof tanks that have been covered with a fixed roof (see Figure 5) would effectively be converted to an internal floating-roof tank under most regulations, by the definition of an internal floating roof tank. The HON, however, contains separate provisions for this type of tank.

The HON refers to such a tank as an “external floating roof converted to an internal floating roof (i.e., fixed roof installed above external floating roof).” The HON requires these tanks to comply with the requirements for internal floating-roof tanks in every regard except deck fittings, for which they are to comply with the requirements for external floating-roof tanks. In that the generic standard removes all distinctions between the requirements for the deck fittings of external and internal floating-roof tanks, it returns to defining these covered (domed external) floating-roof tanks as “internal floating-roof tanks.”

Figure 5: Covered (domed external) Floating Roof Tank

A “generic” solution

While each of the rules nominally provides for alternatives, the generic standard is the first rule that references specific test methods for demonstrating equivalency. These methods were developed by the American Petroleum Institute (API) in cooperation with EPA, and are published as section 19.3 of API’s Manual of Petroleum Measurement Standards. Emission factors for internal floating- roof deck drain covers, for example, could be obtained by utilizing these testing procedures.

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