

**ABOVEGROUND STORAGE TANKS OF  
LIQUID FERTILIZER**

**RECOMMENDED INSPECTION  
GUIDELINES**



**The Fertilizer Institute  
501 Second Street, N.E.  
Washington, D. C. 20002**

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## **PREAMBLE**

In recent years, some large non-pressurized liquid fertilizer tanks have experienced failures. These failures have prompted fertilizer companies to begin an aggressive assessment of large tanks in their inventory in an effort to determine whether these tanks are fit for service. In addition, as the result of these failures, several State regulatory agencies have begun to examine current regulations for the aboveground storage of liquid fertilizer, and, where no regulations exist, to consider promulgating such regulations.

The Fertilizer Institute (TFI) is the national trade association representing the fertilizer industry. At the direction of the TFI Executive Committee, a Tank Integrity Work Group was established in September 2000 to look at the issue of inspection and maintenance of large non-pressurized liquid fertilizer tanks.

The guidelines herein represent the consensus of the Tank Integrity Work Group and set forth suggested, uniform industry inspection and maintenance guidelines. As recognized, site-specific conditions may require deviations from these guidelines. Ultimately, it is the responsibility of the tank owner and operator, in consultation with a qualified inspector, to implement the appropriate inspection and maintenance protocols to ensure the tank integrity. Neither TFI, the members of the Tank Integrity Task Force nor the inspectors, are liable for any damages or injuries resulting from a company or individual using these suggested guidelines.

In general, the Tank Integrity Work Group recommends that all new tanks should be designed and built to American Petroleum Institute (API) Standard 650 and inspections of existing tanks should be based upon API Standard 653, but with modifications for the unique characteristics of a tank storing liquid fertilizer. API Standard 653 can be used as a general guideline for inspection of any aboveground storage tank. For example, tanks that were not built to API Standard 650 criteria or that have been modified subsequently such that they now do not comply with API Standard 650, may still be inspected under the API Standard 653 inspection guidelines. Whether or not the tank was built to API Standard 650 criteria, inspectors of aboveground storage tanks should advise whether the owner/operator may continue service without modification or whether the owner/operator must make repairs to the tank or have the tank further evaluated prior to continuing service.

## 1.0 PURPOSE

- 1.1 To provide the fertilizer industry with a suggested uniform program to evaluate the condition of large (100,000 gallons or greater) non-pressurized aboveground liquid fertilizer storage tanks.
- 1.2 These guidelines represent the knowledge and experience of professional technical personnel in the fertilizer industry.

## 2.0 DEFINITIONS

**Aboveground Storage Tank (AST)** – Any storage tank used for liquid fertilizer that is flat bottom, cylindrical, vertical with a fixed roof and constructed of carbon steel, stainless steel, or aluminum.

**API** – American Petroleum Institute is the national trade association representing the petroleum industry in areas of exploration and production, transportation, refining, and marketing.

**API 650** – Standard 650 of the American Petroleum Institute, titled, “Welded Steel Tanks for Oil Storage.”

**API 653** – Standard 653 of the American Petroleum Institute, titled, “Tank Inspection, Repair, Alteration and Reconstruction.”

**Authorized Inspection Agency** - One of the following types of organizations that employs certified API AST inspectors:

1. The inspection organization operated by the jurisdiction in which the AST is operated.
2. The inspection organization operated by an insurance company licensed or registered to provide AST insurance at the location in question.
3. An owner/operator organization that maintains its own inspection activities relating to ASTs it controls.
4. An independent organization (company or individual) that contracts AST inspection services to an owner/operator as allowed by the local jurisdiction using API Authorized Inspectors.

**Authorized Inspector** – An employee of an Authorized Inspection Agency that is certified as an AST Inspector per API Standard 653 requirements.

**Baseline Inspection** – An initial, complete API 653 out-of-service internal and external inspection performed to establish the condition of an existing AST and to determine the AST's suitability for continued service.

**Bladders** - A non-adhering liner physically attached to the AST and constructed of synthetic material to provide physical separation of liquid product from the tank floor and sidewalls. Bladders are constructed of materials that are compatible with the contact materials.

**Coatings** - An applied material that is chemically/physically bonded to the substance being covered, e.g., the inside of an AST. Coatings include, but are not limited to, paint, epoxy coatings (such as coal tar epoxy), attached fiberglass coverings, and other such products.

**In-house Inspector** - The designated representative of the owner/operator organization who is responsible for various quality control and assurance functions and has working knowledge of API 653 inspection requirements and experience with fertilizer storage tanks.

### **3.0 SCOPE**

- 3.1 This document represents suggested minimum guidelines for the inspection and maintenance of ASTs, 100,000 gallons or greater, used to store liquid fertilizer and constructed of carbon or stainless steel, or aluminum.
- 3.2 These guidelines shall not be used in conflict with any jurisdictional requirements. If any provision presents a conflict with any statutory regulation, the regulation shall govern. If these guidelines are more stringent than the requirements of the regulation, following these guidelines are suggested.
- 3.3 For ASTs 100,000 gallons or greater, used to store fertilizer, and known to be built to API Standard 650 (or its predecessor API Standard 12C), the minimum acceptable external or internal inspection criteria will be in accordance with the guidelines and recommendations of API Standard 653. In addition, consideration should be given to other ancillary criteria as itemized in Sections 4, 5, 6, and 7 regarding fertilizer-specific issues.

- 3.4 For ASTs 100,000 gallons or greater, used to store fertilizer and of unknown design or built to known criteria other than API Standard 650, inspection criteria will be in accordance with the guidelines and recommendations of API Standard 653 to the extent possible. An authorized inspector, or an authorized inspector in conjunction with a tank design engineer, may modify the inspection in consideration of original construction details that do not meet API Standard 650 design criteria. The result of the inspection must be equivalent to the API Standard 653. In addition, consideration should be given to other ancillary criteria as itemized in Sections 4, 5, 6, and 7 regarding fertilizer-specific issues.
- 3.5 The frequency and extent of inspection of ASTs of 100,000 gallons or greater used to store fertilizer will depend on operating conditions and history, past inspections, repair history, or other conditions of an individual tank and should follow the guidelines given in Section 8.
- 3.6 A tank owner may determine that additional or modified inspections are necessary based on operating conditions and history, past inspections, repair history, or other conditions of an individual tank.
- 3.7 Tank owners/operators should consult with product manufacturer/supplier to insure product compatibility with tank construction and appurtenance materials.
  - a. Copper and brass should not be used in tank construction or in appurtenances where they will come in contact with liquid fertilizer.
  - b. Aluminum is not compatible with some liquid fertilizer products including but not limited to, phosphate-based liquid fertilizers or liquid fertilizers containing potassium chloride.

## **4.0 INSPECTION CONSIDERATIONS**

### **4.1 Exterior Considerations**

- 4.1.1 The owner should consider painting the storage tanks a light or reflective color to reduce radiant heating, particularly when increased temperatures in the vapor zones are a concern.

- 4.1.2 Carbon steel tanks should be painted to minimize corrosion.
- 4.1.3 Tanks should be set on a proper foundation to prevent moisture or debris from gathering at the base of the tank (e.g., set above grade, drainage away from tank). Base material should not be allowed to build up above the level of the tank bottom edge.
- 4.1.4 Tanks set on a concrete foundation should be sealed around the tank floor to foundation interface to provide a moisture barrier.
- 4.1.5 When making repairs to the tank shell, the qualification of welding procedures should be based upon the code or standard to which the tank was originally built. When the original code of construction is unknown, the qualification of welding procedures should be based upon API-653, including the impact toughness requirements of API-650.
- 4.1.6 Shell repair materials should be selected according to the code or standard to which the tank was originally built. When the original code of construction is unknown, repair materials should be selected according to the requirements of API-653, and the impact toughness requirements of API-650.

## **4.2. Interior Considerations**

- 4.2.1 The condition of the weld seams and weld heat-affected zones (HAZs) are of particular concern because these areas tend to be more quickly affected by exposure to liquid fertilizer products.
- 4.2.2 Under tank floor corrosion is a potential problem area and should be considered for additional inspection.

- 4.2.3 After any washing of an AST, residue and sludge should be pumped out and the floor should be dried thoroughly.

## **5.0 BLADDERS**

### **5.1 General Matters**

- 5.1.1 Complete data on the bladder -- including the manufacturer of the liner material, its corrosion resistance properties, date of installation, method of attachment, and installation contractor -- should be maintained as part of the permanent record on the tank.
- 5.1.2 The condition of the bladder or lining may need to be established during an internal inspection as a means of assessing continuing integrity. Additional or alternative internal inspection criteria may need to be established where such bladders or linings are known to be present.

### **5.2 Inspection Criteria for API Inspected Tanks with Bladders**

- 5.2.1 All tanks should have an initial inspection by an API qualified inspector immediately before the installation of a bladder unless they are new construction and were previously inspected in accordance with the new construction design code.
- 5.2.2 Tanks with bladders should have the bladder inspected within two years after the initial installation and if no failure indications are found at five-year intervals thereafter. The bladder inspection should be conducted by the original bladder installer or someone familiar with bladder installations. The bladder inspection should include but not be limited to the Bladder Inspection Criteria of Appendix A.
- 5.2.3 Tanks should be internally inspected within five years of any detection and repair of a bladder leak unless the tank is inspected at the time of the bladder repairs.

5.2.4 External inspections shall be conducted on the same schedule as for tanks without bladders (see Section 8).

5.2.5 Following any leak repair, the bottom of the tank should be flushed with fresh water to remove corrosive product.

### **5.3 Inspection Criteria for Non-API Inspected Tanks with Bladders**

5.3.1 Tanks with bladders already installed should have an initial baseline inspection by an API qualified inspector within two years.

5.3.2 Tanks with bladders should have the bladder inspected within two years after the initial installation and if no failure indications are found at five-year intervals thereafter. The bladder inspection should be conducted by the original bladder installer or someone familiar with bladder installations. The bladder inspection should include but not be limited to the Bladder Inspection Criteria of Appendix A.

5.3.3 Such tanks should be internally inspected within five years of any repair of a bladder leak

5.3.4 External inspections shall be conducted on the same schedule as for existing tanks without bladders (see Section 8).

5.3.5 Following any leak repair, the bottom of the tank should be flushed with fresh water to remove corrosive product.

## **6.0 FLAMMABILITY**

6.1 Fertilizers are generally non-flammable in nature. As such, considerations in API Standard 653 regarding flammability and toxicity may be modified according to the nature of the specific liquid fertilizers used in the tank except where liquid hydrocarbons are used as a fertilizer interface seal.

## **7.0 GRAVITY**

- 7.1 ASTs designed for liquid fertilizer storage utilize a product specific gravity usually exceeding 1.0. This difference in product gravity needs to be properly incorporated in the evaluation of any liquid fertilizer tank.

## **8.0 INSPECTIONS**

### **8.1 Inspection Intervals**

8.1.1 The following inspection frequency guidelines are suggested for liquid fertilizer ASTs, unless excepted under Section 4 above. These guidelines are, in some cases, more frequent than API Standard 653.

- a. For tanks that have been inspected by an API authorized inspector within the last ten years, the date of that inspection shall become the “baseline inspection” date for purposes of these guidelines so long as the inspection met the definition of “baseline inspection” in Section 2.0.
- b. For tanks that have not been inspected by an API authorized inspector within the last ten years, a baseline inspection should be conducted by an API authorized inspector within two years of adoption of these guidelines.
- c. Monthly visual, “walk around” inspections should be conducted by an in-house inspector.
- d. Yearly external inspection, using the API 653 inspection checklist, should be conducted by an in-house inspector.
- e. For non-lined, non-bladder tanks only, an internal inspection, using the API 653 checklist, should be conducted by an in-house inspector every three years, beginning three

years after the date of the baseline inspection.

- f. Every nine years, beginning within ten years of the baseline inspection, an internal inspection should be conducted by an API authorized inspector.

## **8.2 Inspectors**

8.2.1 The baseline inspection must be done by an API authorized inspector.

8.2.2 The monthly visual, yearly external, and three-year internal inspections can be done by an in-house inspector.

8.2.3 The ten-year inspection must be done by an API authorized inspector.

## **9.0 RECORDKEEPING**

9.1 When a tank is evaluated, repaired, altered, or reconstructed in accordance with these guidelines, the following information, as applicable, shall be made a part of the owner/operator's records for the tank:

9.1.1 Calculations for:

- a. Component evaluation for integrity, including brittle fracture consideration.
- b. Re-rating (including liquid level).
- c. Repair and alteration considerations.

9.1.2 Construction and repair drawings.

9.1.3 Additional support data including, but not limited to, information pertaining to:

- a. Inspections (including component thickness readings).
- b. Material test reports/certification.
- c. Tests performed/results.

- d. Radiographs (should be retained for five years).
- e. Brittle fracture considerations.
- f. Original tank construction data (date, original standard).
- g. Location and identification (owner/operator's number, serial number).
- h. Description of the tank (diameter, height, service).
- i. Design conditions (liquid level, specific gravity, allowable stress, and unusual design load).
- j. Shell material and thickness by course.
- k. Tank perimeter elevations.
- l. Construction completion record.
- m. Basis for hydrostatic test exemption.

9.2 Detailed monitoring records on the tank leak detection system shall be maintained for ten years.

## **10.0 REFERENCES**

API 650, "Welded Steel Tanks for Oil Storage," current edition.

API 653, "Tank Inspection, Repair, Alteration and Reconstruction," current edition.

API 653, "Tank Inspection, Repair, Alteration and Reconstruction, Check List for Tank Inspection", Appendix C

## Appendix A

### Bladder Inspection Criteria

The tank bladder inspection should include but not be limited to the following:

- a. Check bladder flexibility.
- b. Visually inspect bladder for signs of discoloration and surface cracking.
- c. Visually inspect bladder support system for compliance with original installation.
- d. Check all bladder interface connections (flanges, roof columns, manways, etc.).
- e. Check sump boot and boot-to-floor seam.
- f. Check all leak monitoring port valves.
- g. Verify that operating liquid level has not exceeded bladder design height.
- h. Exercise extreme care while inspecting and when entering or exiting tank.