APPENDIX K: TANK INSPECTION STANDARD

STEEL TANK INSTITUTE STANDARD FOR INSPECTION OF IN-SERVICE SHOP FABRICATED ABOVEGROUND TANKS FOR STORAGE OF COMBUSTIBLE AND FLAMMABLE LIQUIDS SP001-00

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STEEL TANK INSTITUTE STANDARD FOR INSPECTION OF IN-SERVICE SHOP FABRICATED ABOVEGROUND TANKS FOR STORAGE OF COMBUSTIBLE AND FLAMMABLE LIQUIDS SP001-00

1.0 GENERAL
1.1 This standard covers the inspection of shop fabricated steel tanks built to a nationally recognized standard for aboveground storage tanks that are intended for the aboveground storage of noncorrosive, stable, flammable, and combustible liquids having a specific gravity not exceeding that of water.
1.2 The purpose of the inspection shall be to determine the condition of the tank and whether it is leaking.
1.3 The scope is limited to the tank foundation, supports, inner and outer walls, piping to the face of the first flange, the first threaded joint, or the first welded-end connections, including normal and emergency vents. Other accessories are not included.
1.4 This Standard is intended for use by organizations and/or individuals who are knowledgeable and experienced in aboveground tank inspection. Applicable federal, state and local laws, regulations and ordinances concerning tank inspection shall also be consulted.
1.5 Consult the tank manufacturer prior to making any alterations or repairs to a tank.

2.0 DEFINITIONS
2.1 Aboveground storage tank–a tank which is wholly aboveground, i.e. not partially buried. The tank may be resting on the ground, or set on supports, such as saddles, skids, legs, etc. It may be installed in an underground vault.
2.2 Primary tank–for tanks which are single-wall, it is the containment tank. For double-wall tanks, it is the inner tank.
2.3 Secondary tank–for tanks which are double-wall, it is the outer tank.
2.4 Double wall tank–an aboveground storage tank with a tank contained within a containment tank. This will form an interstitial (annular) space between the two tanks which is capable of being monitored for leakage into the space from either the interior or exterior walls.

2.5 Single-wall tank–an aboveground storage tank with only one wall or shell.
2.6 Secondary containment dike–a structure which is intended to contain product resulting from a spill, leak, or rupture of the tank. The tank may be either single wall or AST Inspection Standard September 2000 2
2.7 Manway–an opening in the tank designed to allow personnel entry.
2.8 Tank in contact with the ground–a tank which does not allow for the visual inspection of the exterior of the bottom of the tank. This includes a tank in contact with soil or in contact with a concrete foundation. It also includes a tank which is supported above the ground, but the conditions do not allow for a visual inspection of the exterior of the bottom of the tank.
2.9 Tank supports–structures designed to elevate a tank above the ground. These include saddles, skids, beams, legs, and similar structures.
2.10 Corrosion–the degradation of metals due to chemical reactions with their environment. In steel, this is commonly known as "rust."
2.11 Pitting–small but sharp cavities on a surface due to corrosion.
2.12 Interstice–in double wall tanks, the space between the primary tank and secondary tank. This space may be monitored by a vacuum or leak detection equipment.

3.0 TANK INSPECTOR QUALIFICATIONS
3.1 Periodic tank inspections are to be performed by the tank owner or his designate.
3.2 Qualified tank inspectors are to perform the certified tank inspections.
Qualified tank inspectors are those who are certified by one or more of the following sources:
3.2.1 American Petroleum Institute Certified Aboveground Storage Tank Inspector Contact: American Petroleum Institute, Aboveground Storage Tank Inspector Certification Program, 1220 L Street NW, Washington, DC 20005
3.2.2 STI trained and certified tank inspectors who have received their training by Steel Tank Institute (STI) Contact: STI, 570 Oakwood Rd., Lake Zurich, IL 60047. These inspectors shall be trained in accordance with the STI Standard "AST Inspector Qualification Procedure."double wall. The dike AST Inspection Standard September 2000 3

4.0 PERIODIC INSPECTION (PERFORMED BY TANK OWNER OR HIS DESIGNATE)
4.1 The following situations are considered Critical Situations. These REQUIRE IMMEDIATE ATTENTION. Inspect the tank for serviceability and make corrections as required prior to returning it to service.
4.1.1 Take a tank out of service immediately (within 24 hours) if a leak is found in the tank at any time. Repair or replace the tank. Consult the tank manufacturer prior to making any alterations or repairs to a tank.
4.1.2 If the tank has been exposed to a fire or other means which could cause possible damage, inspect the tank for serviceability and leaks prior to being put into service. Follow the inspection criteria described in paragraph 5.0 below. Make corrections and/or alterations or repairs to a tank.
4.1.3 Check for proper drainage during or after a major storm in accordance with paragraph 4.6 below.
4.2 Monthly, check the primary tank for the presence of water at the lowest possible point(s) inside the tank. In addition, check the secondary tank or secondary containment if the aboveground tank is so equipped. Remove any water found. Bacteria in the water can cause corrosion and plug filters. If water is found in a tank, check for the presence of corrosion inducing bacteria using a microbe detection kit. If bacteria are present, treat with a suitable bactericide. See the US Department of Energy BNL 48406, a report which provides additional information. Remove a tank from service that has a known leak in either the primary or secondary tank or secondary containment.
4.3 Monthly, inspect the interstice of a double wall tank for the presence of fuel. If tank is so equipped, check the leak detection system and replace or correct as necessary. Check groundwater wells if the tank is so equipped. Remove a tank from service that has a known leak in either the primary or secondary tank or secondary containment.
4.4 Monthly, inspect all pipe connections to the tank for evidence of leakage. Replace the gaskets in flanged connections, as necessary, with ones compatible with the stored fluid and rated to cover the temperature extremes of the tank environment. Tighten threaded connections if necessary.

4.5 Quarterly, perform a walk-around inspection to identify and repair areas of damage to the tank or its coating. Clean the exterior if necessary. Promptly repair any deficiencies that are found. It is important that the tank exterior be inspected periodically to ensure that the integrity of the coating is Maintained. May be either open or closed at the top. AST Inspection Standard September 2000 4
The frequency of periodic recoating (repainting) will be based upon environmental factors in the geographic area where the tank is located. Give special consideration when recoating to the selection of the coating, surface preparation and coating application. Select a coating of industrial quality that is compatible with the existing coating or else remove the existing coating prior to recoating.
4.6 Quarterly, inspect and clean normal operating vents and emergency vents on the primary tank (and secondary tank and secondary containment tank, if (applicable) and spill containers. Refer to Appendix for instructions.
4.7 Once a year, perform a walk-around inspection checking for proper drainage around the tank area. Proper site maintenance is vital to ensure drainage of surface water. Check for ground settling and puddling of water near the tank. Correct as necessary. If ground conditions change or settlement occur, correct the situation by providing drainage or regrading to prevent standing water from being in contact with the steel tank and its supports.
4.8 Once a year, check o-ring/gasket of emergency vents for damage or deterioration.
4.9 Once a year, inspect the tank supports to determine if there is damage or deterioration of the supports. Inspect the supports for signs of damage from vehicles, misuse, and corrosion. Damage may require replacement of the supports. Contact the tank manufacturer for their recommendation. If deterioration has occurred, more frequent inspections may be required. (See paragraph 6.0 for further details.) Periodic recoating of the supports may be necessary.
4.10 Once a year, inspect the tank foundation for signs of settlement, cracking, pitting, and spalling. Contact a qualified contractor for repair of concrete foundations. Observe the condition of the anchor bolts to determine if there has been distortion of the bolts or significant cracking around the bolts. Replace the bolts if they have deteriorated.
4.11 If a cathodic protection system has been installed on the tank to prevent corrosion of the bottom of the tank, perform periodic readings of the system to be sure that the protection remains adequate in accordance with local, state, and federal guidelines. This procedure shall be performed by a qualified cathodic protection tester. The criteria for protection shall be as defined by NACE RP-0285, “Corrosion Control of Underground Storage Tank Systems by Cathodic Protection.” AST Inspection Standard September 2000 5

5.0 CERTIFIED INSPECTION (PERFORMED BY QUALIFIED TANK INSPECTOR, AS DEFINED IN PARAGRAPH 3.2)
5.1 Every 10 years, or as determined in paragraph 6.0, inspect all tanks as follows:
5.1.1 Perform all monthly, quarterly, and yearly inspections listed in paragraphs 4.2 through 4.9 above.
5.1.2 Pressure test the tank for tightness. Consult tank manufacturer installation instructions or the Steel Tank Institute Recommended Practice R912-00, “Installation Instructions for Shop Fabricated Stationary Aboveground Storage Tanks for Flammable, Combustible Liquids. Air should not be used for a pressure test and an inert gas should be used instead. The introduction of a gas containing oxygen (such as air) to a tank which has previously held a petroleum product can pose a explosion hazard.

5.2 Every 10 years, or as determined in paragraph 6.0, inspect single wall horizontal, rectangular, or vertical tanks which are not in contact with the ground (as defined in paragraph 2.8 above) in one of the following ways:
5.2.1 If the tank is equipped with a manway, either conduct ultrasonic testing as described in paragraph 5.5 below, or visually examine the interior of the tank as described in paragraph 5.6 below.
5.2.2 If the tank is not equipped with a manway, another inspection method is necessary. Either use “Method C–Invasive Permanently Recorded Visual Inspection and Evaluation Including External Corrosion Assessment” described in ASTM G 158, “Standard Guide for Three Methods of Assessing Buried Steel Tanks” or use ultrasonic testing to determine the wall thickness of the tank as described in 5.5 below.
5.3 Every 10 years, or as determined in paragraph 6.0, inspect single wall (horizontal, rectangular, or vertical) tanks which are in contact with the ground (as defined in paragraph 2.8 above) in one of the following ways:

5.3.1 Inspect tanks which are constructed with a double bottom and include a vacuum on the interstice the same as double wall tanks (as described in paragraph 5.4 below).
5.3.2 If a cathodic protection system has been installed on the tank bottom to protect the exterior of the tank bottom the following steps shall be taken:
5.3.2.1 Examine the periodic readings which have been taken to be sure that the cathodic protection remains adequate in accordance with local, state, and federal guidelines. These periodic readings shall have been performed by a qualified cathodic protection tester. The criteria forAST Inspection Standard September 2000 6 protection shall be as defined by NACE RP-0285, “Corrosion Control of Underground Storage Tank Systems by Cathodic Protection.”
5.3.2.2 Inspect the interior of the tank per paragraph 5.1.1 or
5.1.2, as applicable.
5.3.3 If a cathodic protection system has not been installed on the tank bottom to protect the exterior of the tank bottom, determine the thickness of bottom using one of the following methods:
5.3.3.1 If the tank is equipped with a manway, use ultrasonic testing as described in paragraph 5.5 below.
5.3.3.2 If the tank is not equipped with a manway, take the tank out of service and inspect the bottom. This will require disconnecting associated piping and excavating or moving the tank so that the thickness of the tank bottom can be determined. Determine the remaining thickness per paragraph 5.5 below. Inspect the interior of the tank per paragraph 5.2.2 above.
5.4 Every 10 years, inspect double wall (horizontal, rectangular, or vertical) tanks, which are either in contact or not in contact with the ground as follows:
5.4.1 Verify that the leak detector equipment is operating if the tank is so equipped.
5.4.2 Check for water and fuel in the interstice.
5.5 Described below is the ultrasonic testing procedure. Determine the minimum remaining wall thickness.
5.5.1 This testing shall be performed by a qualified person in accordance with the American Society for Nondestructive Testing, ANSI/ASNT CP-189 “ASNT Standard for Qualification and Certification of Nondestructive Testing Personnel.”
5.5.2 Ultrasonic testing equipment that is capable of scanning the tank, rather than measuring only individual points, is the preferred method of performing the testing.
5.5.3 If using ultrasonic testing equipment which is capable of scanning the tank is not practical, use equipment which tests individual points. In this case, perform wall thickness measurements of the portion of the tank described in paragraph 5.5.4 below on at least 15 points in each 12 inch square area.
5.5.4 Test the bottom 60 E of a horizontal cylindrical tank. Test the bottom and the lower 12 inches of the sides of a vertical cylindrical or a rectangular tank.
5.5.5 Consider the construction of lap joints in all inspections. Lap joints which allow water to accumulate may lead to accelerated corrosion and therefore require special attention during inspections. AST Inspection Standard September 2000 7
5.6 Described below is the visual testing procedure. If corrosion and pitting is found, determine the minimum remaining wall thickness.
5.6.1 Do not enter a tank until you have determined that a breathable, non-explosive atmosphere exists within the tank. Follow OSHA requirements for confined space entry and see NFPA 326, “Standard for the Safeguarding of Tanks and Containers for Entry, Cleaning or Repair.”
5.6.2 Use sufficient light to illuminate the interior of the tank.
5.6.3 Check for the presence of water, excessive corrosion, and other forms of deterioration.
5.6.3.1 Measure the extent and depth of any pitting found.
5.6.3.2 Inspect all welds.
5.6.3.3 Determine the extent of general corrosion.
5.6.4 Consider the construction of lap joints in all inspections. Lap joints which allow water to accumulate may lead to accelerated corrosion and therefore require special attention during inspections.

6.0 CERTIFIED TANK INSPECTION CRITERIA
6.1 After the minimum remaining wall thickness is determined in paragraph 5, apply the following criteria to determine if the tank may remain in service:
6.1.1 If less than 5% of any 12 inch by 12 inch square area of the tank has a remaining wall thickness less than or equal to 50% of the original thickness, remove the tank from service and contact a qualified tank manufacturer to have these sections repaired. Bring the thickness of these areas back to the original

design thickness. Have the qualified inspector re-inspect the tank after the repairs have been made. Identify and correct the cause of corrosion. Re-inspect the tank in 5 years, or less as recommended by the qualified tank inspector.
6.1.2 If more than 5% of any 12 inch by 12 inch square area of the tank has a remaining wall thickness less than or equal to 50% of the original thickness, remove the tank from service and contact a qualified tank manufacturer to have these sections repaired. These sections must be repaired by cutting out these sections and replacing them with new steel of the original design thickness or else by welding new steel of the original design thickness over the damaged areas. These repairs must be made from the side that is corroded. Have the qualified inspector re-inspect the tank after the repairs have been made. Identify and correct the cause of corrosion. Re-inspect the tank in 5 years, or less as recommended by the qualified tank inspector.
6.1.3 If the remaining wall thickness is more than or equal to 50% but less than 75% of the original thickness, identify and correct the cause of corrosion. Re-inspect the tank in 5 years, or less asAST Inspection Standard September 2000 8 recommended by the qualified tank inspector.
6.1.4 If the remaining wall thickness is greater than or equal to 75% of the original thickness, re-inspect the tank in 10 years, or less as recommended by the qualified tank inspector.
6.2 Suggested methods of determining the original thickness are as follows:
6.2.1 Review the original tank documentation, such as drawings and packing lists.
6.2.2 Consult the tank manufacturer.
6.2.3 Examine the tank labels for evidence of a widely accepted tank standard, such as Underwriters Laboratories Standard UL 142, etc. Consult the referenced standard to determine the minimum design wall thickness.
6.2.4 Measure the tank thickness of several areas of the tank which have no visible corrosion or pitting. The smallest of these measurements will result in a minimum design thickness which can be used.

7.0 RECORD KEEPING
7.1 Keep records of Periodic Inspections (performed by tank owner or his designate) for the previous year and the current year or as required by local, state, and federal guidelines. Refer to the section of this document called, “Checklists” for suggested records format.
7.1.1 Keep results of the last two inspections of a cathodic protection system, if applicable.
7.2 Keep records of any “Critical Situation”, as defined in paragraph 4.1 above, for the entire life of the tank.
7.3 Keep records of the Certified Inspection (performed by Qualified Tank Inspector, as defined in paragraph 3.2) for the entire life of the tank. Refer to the section of this document called, “Checklists” for sugAST Inspection Standard September 2000 9

REFERENCES
American Petroleum Institute, API Standard 653, *Tank Inspection, Repair, Alteration, and Reconstructio*n, 1998.
American Society for Nondestructive Testing, ANSI/ASNT CP-189, *ASNT Standard for Qualification and Certification of Nondestructive Testing Personne*l, 1995.
American Society for Testing and Materials, ASTM G 158, *Standard Guide for Three Methods of Assessing Buried Steel Tank*s, 1998.
National Fire Protection Association, NFPA 326, *Standard for the Safeguarding of Tanks and Containers for Entry, Cleaning, or Repai*r, 1999
NACE International, NACE RP-0285, *Corrosion Control of Underground Storage Tank Systems by Cathodic Protectio*n, 1995.
Steel Tank Institute, STI-R893, *Recommended Practice For External Corrosion Protection of Shop Fabricated Aboveground Tank Floor*s, 1989.
Steel Tank Institute, STI-R912, *Installation Instructions for Shop Fabricated Stationary Aboveground Storage Tanks for Flammable, Combustible Liquid*s, 2000.
Underwriters Laboratories Inc., UL 142, *Steel Aboveground Tanks for Flammable and Combustible Liquid*s, 1998.
United States Environmental Protection Agency, EPA 510-K-95-002, *Musts for USTs–A Summary of Federal Regulations For Underground Storage Tank System*s, 1995.gested records format. AST Inspection Standard September 2000 10

APPENDIX

The diagram below is included to assist in the identification of the accessories of Aboveground Storage Tank which are to be inspected per paragraph 4. Any specific individual tank may include one or all of these accessories.

The purpose of these accessories is as follows:

1. Spill Container–This tank accessory is designed to catch any spills during tank filling operations. It typically has a lockable, hinged lid and allows any spilled fluid to drain into the tank.
2. Tank Vent (and Riser)–This tank accessory allows air to enter the tank when fluid is being withdrawn and also exhausts air when the tank is being filled. This prevents damage to the tank due to too much pressure. The vent is typically installed on a pipe which is 12 feet above the ground.
3. Emergency Vent (for Primary and Secondary Tank)–These tank accessories prevent damage to the tank by allowing excess pressure to be vented. They are designed to relieve excess pressure in the event of an emergency, such as a fire.
4. Monitor Pipe for Leak Detection–This pipe is installed in the air space (interstice) between the primary tank and secondary tank of a double wall tank. It is typically used with leak detection equipment to detect a leak in either the primary or secondary tank.
5. Tank Supports–These AST Inspection Standard September 2000 11

MAINTENANCE INSTRUCTION FOR SPILL CONTAINER

1. Quarterly, clean and inspect inside and outside of container.
2. Quarterly, check condition of hinge, locking mechanism, and drain apparatus. Replace if necessary.

MAINTENANCE INSTRUCTION FOR TANK VENT

1. Visual check daily for any obstruction on top of vents that would prevent operation.
2. Quarterly check the operation of vent by checking for any internal obstruction of the vent and screen if applicable. Clean as needed.

MAINTENANCE INSTRUCTION FOR EMERGENCY VENTS

1. Visual check daily for any obstruction on top of emergency vents that would prevent its operation.
2. Quarterly check the operation of the emergency vents by lifting the top and check for any internal obstruction of the emergency vent and screen if applicable.
3. Annually check o-ring/gasket for damage or deterioration.

Diagram of Emergency Vent structures are used to elevate the tank off the ground.
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