Allegato 6

Stralcio API 653

Stabilimento di Mantova

Section 6—Inspection

6.1 General

Periodic in-service inspection of tanks shall be performed as defined herein. The purpose of this inspection is to assure continued tank integrity. Inspections, other than those defined in 6.3 shall be directed by an authorized inspector.

6.2 Inspection Frequency Considerations

6.2.1 Several factors must be considered to determine inspection intervals for storage tanks. These include, but are not limited to, the following:

a) the nature of the product stored;

b) the results of visual maintenance checks;

c) corrosion allowances and corrosion rates;

d) corrosion prevention systems;

e) conditions at previous inspections;

f) the methods and materials of construction and repair;

g) the location of tanks, such as those in isolated or high risk areas;

h) the potential risk of air or water pollution;

i) leak detection systems;

j) change in operating mode (e.g. frequency of fill cycling, frequent grounding of floating roof support legs);

k) jurisdictional requirements;

l) changes in service (including changes in water bottoms);

m)the existence of a double bottom or a release prevention barrier.

6.2.2 The interval between inspections of a tank (both internal and external) should be determined by its service history unless special reasons indicate that an earlier inspection must be made. A history of the service of a given tank or a tank in similar service (preferably at the same site) should be available so that complete inspections can be scheduled with a frequency commensurate with the corrosion rate of the tank. On-stream, nondestructive examination methods shall be considered when establishing inspection frequencies.

6.2.3 Jurisdictional regulations, in some cases, control the frequency and interval of the inspections. These regulations may include vapor loss requirements, seal condition, leakage, proper diking, and repair procedures. Knowledge of such regulations is necessary to ensure compliance with scheduling and inspection requirements.

6.3 Inspections from the Outside of the Tank

6.3.1 Routine In-service Inspections

6.3.1.1 The external condition of the tank shall be monitored by close visual inspection from the ground on a routine basis. This inspection may be done by owner/operator personnel, and can be done by other than authorized

inspectors as defined in 3.4. Personnel performing this inspection should be knowledgeable of the storage facility operations, the tank, and the characteristics of the product stored.

6.3.1.2 The interval of such inspections shall be consistent with conditions at the particular site, but shall not exceed one month.

6.3.1.3 This routine in-service inspection shall include a visual inspection of the tank's exterior surfaces. Evidence of leaks; shell distortions; signs of settlement; corrosion; and condition of the foundation, paint coatings, insulation systems, and appurtenances should be documented for follow-up action by an authorized inspector.

6.3.2 External Inspection

6.3.2.1 All tanks shall be given a visual external inspection by an authorized inspector. This inspection shall be called the external inspection and must be conducted at least every five years or $RCA/4N$ years (where RCA is the difference between the measured shell thickness and the minimum required thickness in mils, and N is the shell corrosion rate in mils per year) whichever is less. Tanks may be in operation during this inspection.

6.3.2.2 Insulated tanks need to have insulation removed only to the extent necessary to determine the condition of the exterior wall of the tank or the roof.

6.3.2.3 Tank grounding system components such as shunts or mechanical connections of cables shall be visually checked. Recommended practices dealing with the prevention of hydrocarbon ignition are covered by API 2003.

6.3.3 Ultrasonic Thickness Inspection

6.3.3.1 External, ultrasonic thickness measurements of the shell can be a means of determining a rate of uniform general corrosion while the tank is in service, and can provide an indication of the integrity of the shell. The extent of such measurements shall be determined by the owner/operator.

6.3.3.2 When used, the ultrasonic thickness measurements shall be made at intervals not to exceed the following.

a) When the corrosion rate is not known, the maximum interval shall be five years. Corrosion rates may be estimated from tanks in similar service based on thickness measurements taken at an interval not exceeding five years.

b) When the corrosion rate is known, the maximum interval shall be the smaller of $RCA/2N$ years (where RCA is the difference between the measured shell thickness and the minimum required thickness in mils, and N is the shell corrosion rate in mils per year) or 15 years.

6.3.3.3 Internal inspection of the tank shell, when the tank is out of service, can be substituted for a program of external ultrasonic thickness measurement if the internal inspection interval is equal to or less than the interval required in 6.3.3.2 b).

6.3.4 Cathodic Protection Surveys

6.3.4.1 Where exterior tank bottom corrosion is controlled by a cathodic protection system, periodic surveys of the system shall be conducted in accordance with API 651. The owner/operator shall review the survey results.

6.3.4.2 The owner/operator shall assure competency of personnel performing surveys.

6.4 Internal Inspection

6.4.1 General

6.4.1.1 Internal inspection is primarily required to do as follows.

a) Ensure that the bottom is not severely corroded and leaking.

b) Gather the data necessary for the minimum bottom and shell thickness assessments detailed in Section 4. As applicable, these data shall also take into account external ultrasonic thickness measurements made during in-service inspections (see 6.3.3). 18

c) Identify and evaluate any tank bottom settlement.

6.4.1.2 All tanks shall have a formal internal inspection conducted at the intervals defined by 6.4.2. The authorized inspector shall supervise or conduct a visual examination and assure the quality and completeness of the nondestructive examination (NDE) results. If the internal inspection is required solely for the purpose of determining the condition and integrity of the tank bottom, the internal inspection may be accomplished with the tank in-service utilizing various ultrasonic robotic thickness measurement and other on-stream inspection methods capable of assessing the thickness of the tank bottom, in combination with methods capable of assessing tank bottom integrity as described in 4.4.1. Electromagnetic methods may be used to supplement the on-stream ultrasonic inspection. If an in-service inspection is selected, the data and information collected shall be sufficient to evaluate the thickness, corrosion rate, and integrity of the tank bottom and establish the internal inspection interval, based on tank bottom thickness, corrosion rate, and integrity, utilizing the methods included in this standard. 18

6.4.2 Inspection Intervals

Initial and subsequent inspection intervals shall be in compliance with the requirements of 6.4.2.1 and 6.4.2.2.

For existing tanks, tank owner/operators shall review the internal inspection interval and be in compliance with this section within 5 years from date of first publication of API 653, Fourth Edition, Addendum 2, January 2012. 18

6.4.2.1 Initial Internal Inspection Interval

The initial internal inspection intervals for newly constructed tanks or existing tanks with a newly installed bottom shall be established either per 6.4.2.1.1 or 6.4.2.1.2. Alternatively, the next internal inspection interval for existing tanks where a new bottom has been installed may be determined per 6.4.2.2, if all the following conditions are satisfied. 18

a) Inspection data has been obtained from the previous tank bottom.

b) Inspection data obtained is deemed applicable to the new tank bottom or corrosion rates (product or soil side) for the new tank bottom are not expected to be greater than the corrosion rates of the previous tank bottom. 18

c) Corrosion rate applicability to the new tank bottom shall be verified by a storage tank engineer experienced in materials or corrosion or by consulting with appropriate specialist.

d) The owner/operator shall agree and follow the guidelines in 6.4.2.2 in order to use the subsequent internal inspection interval as the next inspection interval for the new tank bottom. 18

6.4.2.1.1 The interval from initial service date until the first internal inspection shall not exceed 10 years unless a tank has one or more of the leak prevention, detection, corrosion mitigation, or containment safeguards listed in Table 6.1. The maximum initial internal inspection interval shall be based on 10 years plus incremental credits for the additional safeguards in Table 6.1, which are cumulative. 19

The initial internal inspection interval shall not exceed 20 years for tanks without a Release Prevention Barrier, or 30 years for tanks with a Release Prevention Barrier.

The limits of Table 4.4 do not apply when establishing the initial internal inspection interval in accordance with Section 6.4.2.1.1 and Table 6.1.

Table 6.1—Tank Safeguard

Tank Safeguard	Add to Initial Interval
i. Fiberglass-reinforced lining of the product-side of the tank bottom installed per API RP 652.	5 yrs
i Installation of an internal thin-film coating as installed per API RP 652.	2 yrs
iii. Cathodic protection of the soil-side of the tank bottom installed, maintained, and inspected per API RP 651.	5 yrs
18 iv. Release prevention barrier installed per API 650, Annex I.	10 yrs
19 v. Initial bottom thickness > 0.25 in.	(Initial bottom thickness - 0.25 in.)/ corrosion rate*
vi. Bottom constructed from stainless steel material that meets requirements of API 650, Annex SC, and either Annex S or Annex X; and internal and external environments have been determined by a qualified corrosion specialist to present very low risk of cracking or corrosion failure.	10 yrs
18 * Corrosion rate to be 15 mpy, or as determined from Annex H, Similar Service.	

19 For example, the maximum initial internal inspection interval for a $^{5}/_{16}$ in. thick bottom that has a release prevention barrier and a fiberglass-reinforced lining would be determined as follows:

Credit for initial bottom thickness > 0.25 in. = (0.3125 in. – 0.25 in.) / 0.015 in./year = 4.2 years

Maximum initial internal inspection interval = 10 years (initial) + 5 years (fiberglass-reinforced lining) + 10 years (release prevention barrier) + 4.2 years (credit for initial bottom thickness > 0.25 in.) = 29.2 years.

6.4.2.1.2 As an alternative to establishing the initial interval in accordance with 6.4.2.1 and Table 6.1, the initial internal inspection date and reassessment can be established using Risk Based Inspection (RBI) assessment per 6.4.2.2.2.

These assessments may establish an initial inspection interval exceeding 10 years but shall not exceed 20 years for tanks without a Release Prevention Barrier, or 30 years for tanks with a Release Prevention Barrier except as follows.

If an RBI assessment has been performed, the maximum initial internal inspection interval does not apply to tanks storing the following.

1) Highly viscous substances which solidify at temperatures below 110 °F, (some examples of these substances are: asphalt, roofing flux, residuum, vacuum bottoms and reduced crude), or;

2) Any substance or mixture that is:

   a) not identified or regulated either as a hazardous chemical or material under the applicable laws of the jurisdiction; and

   b) that the owner/operator has determined will not adversely impact surface or groundwater beyond the facility or affect human health or the environment.

6.4.2.2 Subsequent Internal Inspection Interval

The interval between subsequent internal inspections shall be determined in accordance with either the corrosion rate procedures of 6.4.2.2.1 or the risk based inspection procedures as outlined in 6.4.2.2.2.

6.4.2.2.1 The subsequent inspection interval (beyond the initial inspection) can be determined using the measured tank bottom corrosion rate and the minimum remaining thickness in accordance with 4.4.5. During any examination to determine corrosion rates the owner/operator should ensure they understand the effectiveness of the inspection techniques employed for detecting and measuring potential damage mechanisms.

When changing service, an owner/operator may decide to use internal corrosion rates obtained from similar service assessment (performed per Annex H) when setting subsequent internal inspection dates. 18

When using the corrosion rate procedures of 6.4.2.2.1 the maximum subsequent internal inspection interval shall be 20 years for tanks without a Release Prevention Barrier, or 30 years for tanks with a Release Prevention Barrier.

6.4.2.2.2 An owner/operator can establish the subsequent internal inspection interval using risk based inspection (RBI) procedures in accordance with API RP 580 and the additional requirements of this section.

The results of the RBI assessment shall be used to establish a tank inspection strategy that defines the most appropriate inspection methods, appropriate frequency for internal, external and in-service inspections, and prevention and mitigation steps to reduce the likelihood and consequence of tank leakage or failure.

An RBI assessment shall consist of a systematic evaluation of both the likelihood of failure and the associated consequences of failure, in accordance with API RP 580. The RBI assessment shall be thoroughly documented, clearly defining all factors contributing to both likelihood and consequence of tank leakage or failure.

The RBI assessment shall be performed by a team including inspection and engineering expertise knowledgeable in the proper application of API RP 580 principles, tank design, construction, and modes of deterioration. The RBI assessment shall be reviewed and approved by a team as above at intervals not to exceed 10 years or more often if warranted by process, equipment, or consequence changes.

The applied RBI methodology (not every individual assessment) shall have a documented validation review to demonstrate that it has all the key elements defined in API RP 580 and this section. The validation should be performed by an entity external to the RBI assessment team. 18

If corrosion rates are based on prior inspections, they shall be derived from either high or medium inspection effectiveness as defined by the owner/operator procedures. Refer to API RP 581 for examples of high and medium inspection effectiveness. Corrosion rates from low inspection effectiveness such as spot UT shall not be used in the RBI process. 18

A tank shall be removed from service when the risk exceeds the acceptable risk criteria established per the owner/operator procedure. 18

NOTE API does not recommend running tank bottoms to failure, or operating tanks indefinitely with known or suspected bottom leaks.

6.4.2.2.2.1 Likelihood factors that shall be evaluated in tank RBI assessments, in addition to the likelihood factors in API RP 580 include, but are not limited to, the following:

a) original thickness, weld type, and age of bottom plates;

b) analysis methods used to determine the product-side, soil-side and external corrosion rates for both shell and bottom and the accuracy of the methods used;

c) inspection history, including tank failure data;

d) soil resistivity;

e) type and design quality of tank pad/cushion including quality control at construction;

f) water drainage from berm area;

g) type/effectiveness of cathodic protection system and maintenance history;

h) operating temperatures;

i) effects on internal corrosion rates due to product service;

j) internal coating/lining/liner type, age and condition;

k) use of steam coils and water draw-off details;

l) quality of tank maintenance, including previous repairs and alterations;

m) design codes and standards and the details utilized in the tank construction, repair, and alteration (including tank bottoms);

n) materials of construction;

o) effectiveness of an inspection includes examination methods and scope which are to be determined by the inspector;

p) functional failures, such as floating roof seals, roof drain systems, etc.;

q) settlement data;

r) quality assurance/control during tank construction, including pad cleanliness, slope of bottom, foundation installation, document/records to show how the tank was built, etc.

6.4.2.2.2.2 Consequence factors that shall be evaluated in tank RBI assessments include, but are not limited to, the following:

a) tank bottom with a Release Prevention Barrier (RPB) details (single, double, RPB, internal reinforced linings, etc.);

b) product type and volume;

c) mode of failure, (i.e. slow leak to the environment, tank bottom rupture or tank shell brittle fracture);

d) identification of environmental receptors such as wetlands, surface waters, ground waters, drinking water aquifers, and bedrock;

e) distance to environmental receptors;

f) effectiveness of leak detection systems and time to detection;

g) mobility of the product in the environment, including, for releases to soil, product viscosity and soil permeability;

h) sensitivity characteristics of the environmental receptors to the product;

i) cost to remediate potential contamination;

j) cost to clean tank and repair;

k) cost associated with loss of use;

l) impact on public safety and health;

m) dike containment capabilities (volume and leak tightness).

6.5 Alternative to Internal Inspection to Determine Bottom Thickness

In cases where construction, size, or other aspects allow external access to the tank bottom to determine bottom thickness, an external inspection in lieu of an internal inspection is allowed to meet the data requirements of Table 4.4. However, in these cases, consideration of other maintenance items may dictate internal inspection intervals. This alternative approach shall be documented and made part of the permanent record of the tank.

6.6 Preparatory Work for Internal Inspection

Specific work procedures shall be prepared and followed when conducting inspections that will assure personnel safety and health and prevent property damage in the workplace (see 1.4).

6.7 Inspection Checklists

Annex C provides sample checklists of items for consideration when conducting in-service and out-of-service inspections.

6.8 Records

6.8.1 General

Inspection records form the basis of a scheduled inspection/maintenance program. (It is recognized that records may not exist for older tanks, and judgments must be based on experience with tanks in similar services.) The owner-operator shall maintain a complete record file consisting of three types of records, namely: construction records, inspection history, and repair/alteration history. 18

6.8.2 Construction Records

Construction records may include nameplate information, drawings, specifications, construction completion report, and any results of material tests and analyses.

6.8.3 Inspection History

The inspection history includes all measurements taken, the condition of all parts inspected, and a record of all examinations and tests. A complete description of any unusual conditions with recommendations for correction of details which caused the conditions shall also be included. This file will also contain corrosion rate and inspection interval calculations.

6.8.4 Repair/Alteration History

The repair/alteration history includes all data accumulated on a tank from the time of its construction with regard to repairs, alterations, replacements, and service changes (recorded with service conditions such as stored product temperature and pressure). These records should include the results of any experiences with coatings and linings.

6.9 Reports

6.9.1 General

For each external inspection performed per 6.3.2 and each internal inspection performed per 6.4, the authorized inspector shall prepare a written report. These inspection reports along with inspector recommendations and

documentation of disposition shall be maintained by the owner/operator for the life of the tank. Local jurisdictions may have additional reporting and record keeping requirements for tank inspections.

6.9.2 Report Contents

Reports shall include at a minimum the following information:

a) date(s) of inspection;

b) type of inspection (external or internal);

c) scope of inspection, including any areas that were not inspected, with reasons given (e.g. limited scope of inspection, limited physical access;

d) description of the tank (number, size, capacity, year constructed, materials of construction, service history, roof and bottom design, etc.), if available;

e) list of components inspected and conditions found (a general checklist such as found in Annex C may be used to identify the scope of the inspection) and deficiencies found;

f) inspection methods and tests used (visual, MFL, UT, etc.) and results of each inspection method or test;

g) corrosion rates of the bottom and shell;

h) settlement survey measurements and analysis (if performed);

i) recommendations per 6.9.3.1;

j) name, company, API 653 certification number and signature of the authorized inspector responsible for the inspection;

k) drawings, photographs, NDE reports and other pertinent information shall be appended to the report.

6.9.3 Recommendations

6.9.3.1 Reports shall include recommendations for repairs and monitoring necessary to restore the integrity of the tank per this standard and/or maintain integrity until the next inspection, together with reasons for the recommendations. The recommended maximum inspection interval and basis for calculation of that interval shall also be stated. Additionally, reports may include other less critical observations, suggestions and recommendations.

18

6.9.3.2 It is the responsibility of the owner/operator to review the inspection findings and recommendations, establish a repair scope, if needed, and determine the appropriate timing for repairs, monitoring, and/or maintenance activities. Typical timing considerations and examples of repairs are:

a) *prior to returning the tank to service*—repairs critical to the integrity of the tank (e.g. bottom or shell repairs);

b) *after the tank is returned to service*—minor repairs and maintenance activity (e.g. drainage improvement, painting, gauge repairs, grouting, etc.);

c) *at the next scheduled internal inspection*—predicted or anticipated repairs and maintenance (e.g. coating renewal, planned bottom repairs, etc.);

d) *monitor condition for continued deterioration*—(e.g. roof and/or shell plate corrosion, settlement, etc.).

The owner/operator shall ensure that the disposition of all recommended repairs and monitoring is documented in writing and that reasons are given if recommended actions are delayed or deemed unnecessary.

6.10 Nondestructive Examination (NDE)

Personnel performing NDE shall meet the qualifications identified in 12.1.1.2, but need not be certified in accordance with Annex D. The results of any NDE work, however, must be considered in the evaluation of the tank by an authorized inspector.