

DATE: February 1, 2005

TITLE: Similar Service Assessment

AGENDA ITEM: 653-204

PURPOSE: To provide industry with performance based guidance on conducting a similar service assessment.

IMPACT: Currently, there is no definition for similar service and no clear guidance on conducting a similar service assessment. This effort contributes significantly to helping to ensure the safety of the public, protection of the environment and operational reliability by providing industry with performance based guidance on conducting a similar service assessment.

SOURCE: API Standard 653 (a proposed new appendix)

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PROPOSAL: See Attached.

H.1 Scope

This appendix provides guidance for conducting a similar service assessment to establish inspection intervals for tanks for which corrosion rates have not been directly measured as referenced in 6.4.2.

H.2 Definitions

Control Tank: The tank for which corrosion rates and other relevant service history are known and documented.

Candidate Tank: The tank for which corrosion rates are not known.

Similar Service Assessment: The process by which corrosion rates and inspection intervals are established for a Candidate Tank(s) using corrosion rates and other relevant service history of the Control Tank(s) for the purpose of establishing the next inspection interval.

Product-Side Corrosion: Corrosion of the top side of the bottom plate that is caused by the stored liquid product.

Soil-Side Corrosion: Corrosion of the bottom side of the bottom plate that is caused by elements or conditions in the materials under the tank bottom.

H.3 Similar Service Assessment

Several criteria must be evaluated to determine whether the Candidate Tank is in Similar Service with the Control Tank. This assessment requires a sufficient amount of data collection, integration and analysis and needs to be performed in a comprehensive and thorough fashion. The Similar Service Assessment is conducted using design, construction, operation, maintenance and inspection data. This data includes direct and indirect examination such as MFL and UT inspection and product corrosivity, CP levels, soil pH, etc., respectively. These criteria are listed in the “Similar Service Assessment - Data Sheet”. Typically, there will not be an exact match of all criteria. When there is not an exact match between one or more criteria, additional evaluation will be necessary to determine whether the tanks can be considered to be in similar service. Figure 1.0 illustrates the steps in conducting a Similar Service Assessment. The “Similar Service Assessment – Data Sheet” is to facilitate the comparison of data for the two tanks. If the criteria for the Control Tank and Candidate Tank match, the Candidate Tank may be considered in similar service as the Control Tank for that particular criterion.

H.3.1 ADDITIONAL ASSESSMENT

When additional assessment is required because an individual criterion does not match, the table references the section describing additional factors that must be assessed. If the additional factors in the specified reference section are assessed to be sufficiently similar, the tanks are considered in similar service for that factor. If all additional provisions are satisfied, the tanks are considered in similar service.

H.3.1.1 Year Tank Erected: If the criteria for the Control Tank and Candidate Tank do not match, the following additional provisions must be satisfied to consider both tanks in similar service:

- a. The difference in ages of the tanks must be considered in the corrosion rate calculations, and
- b. Any substantive differences in the design and/or construction standards to which the tanks were constructed must be considered in the similar service evaluation.

H.3.1.2 Bottom Material Specification: If the criteria for the Control Tank and Candidate Tank do not match, the following additional provisions must be satisfied to consider both tanks in similar service:

- a. The bottom material of the candidate tank must have similar soil-side and product-side corrosion-resistance properties as the bottom material of the control tank.
- b. The candidate tank, or both the candidate and the control tanks, utilize a suitable lining to prevent corrosion of the product side, and
- c. The potential for soil-side corrosion is assessed to be similar for both tank bottom materials.

H.3.1.3 Shell Material Specification: If the criteria for the Control Tank and Candidate Tank do not match, the following additional provisions must be satisfied to consider both tanks in similar service:

- a. The shell material of the candidate tank must have similar product-side corrosion-resistance properties as the shell material of the control tank.
- b. The candidate tank, or both the candidate and the control tanks, utilize a suitable lining to prevent corrosion of the product side

H.3.1.4 Corrosion Allowance, Bottom/Shell: If the criteria for the Control Tank and Candidate Tank do not match, the difference in corrosion allowance should be accounted for in the remaining life and inspection interval calculations to consider both tanks in similar service.

H.3.1.5 Bottom Lining Type/Thickness/Age: If the criteria for the Control Tank and Candidate Tank do not match, the differences in the bottom lining systems must be assessed. The provisions of API RP 652 should be

used to assess the relative corrosion protection provided by the different lining systems.

H.3.1.6 Cathodic Protection: If the criteria for the Control Tank and Candidate Tank do not match, the following additional provisions shall apply:

- a. If the Candidate Tank is protected with a functional cathodic protection system, and the Control Tank is not, the Candidate Tank may be considered to be in similar service with respect to cathodic protection.
- b. If the Control Tank is protected with a functional cathodic protection system, and the Candidate Tank is not, the Candidate Tank may not be considered to be in similar service with respect to cathodic protection.
- c. If both the Control and the Candidate Tanks are protected with similar, and functional, cathodic protection systems, the tanks may be considered to be in similar service with respect to cathodic protection.

H.3.1.7 Double Bottom: If the tank has a double bottom, the similar service assessment of soil-side corrosion should be based on the material that is in contact with the primary (upper) bottom plate

H.3.1.8 Soil/Material in Contact With Bottom Plate: Any differences in the following factors between the Control and the Candidate Tank must be assessed by the tank owner's engineer in determining whether the Candidate Tank is in similar service as the Control Tank:

- a. Soil or material type
- b. pH
- c. Alkalinity
- d. Moisture
- e. Salinity
- f. Conductivity

H.3.1.9 Ambient Conditions: Any differences in the following factors between the Control and the Candidate Tank must be assessed by the tank owner's engineer in determining whether the Candidate Tank is in similar service as the Control Tank:

- a. Low one day mean temperature
- b. Exposure to salt air or other corrosive elements

H.3.1.10 Current Service Conditions: Any differences in the following factors between the Control and the Candidate Tank must be assessed by the tank owner's engineer in determining whether the Candidate Tank is in similar service as the Control Tank:

- a. Product classification (Table 1.0)
- b. Specific Gravity of Liquid
- c. Reid Vapor Pressure at 60°F
- d. Normal Operating Temperature
- e. Inert gas blanket, if used
- f. Water bottom, if used
- g. Sulfur content

- h. Length of time in service
- i. Product corrosivity

H.3.1.11 Previous Service Conditions: If the Control Tank and/or Candidate Tank have previously been used for different services than the current service, the same factors described in H.3.1.10 should be evaluated for the previous service conditions.

H.3.1.12 Product Classification: Table 1.0 classifies a wide variety of liquids commonly stored in aboveground storage tanks.

H.3.1.13 Additional Considerations: In addition to the factors summarized in Table 1.0, the following data, if available for the Control and the Candidate Tank should be assessed by the tank owner's engineer in determining whether the Candidate Tank is in similar service as the Control Tank:

- a. MFE or MFL data for the tank bottom
- b. Ultrasonic thickness (UT) measurement data
- c. Fiber optic monitoring system data
- d. Cathodic protection monitoring tube data
- e. Tank bottom integrity testing data

H.4 Example of Remaining Life Determination

Figure 2.0 illustrated one method of determining the time interval in which a tank shell course will reach its limit of deterioration, beyond which the tank should be repaired or removed from service. In this example, the original metal thickness was 1/2 inch when the tank was constructed in 1980. The limit of deterioration of the top shell course was calculated to be 1/4 inch. At the time of this evaluation (November 15, 1992), the tank was in sweet gasoline service. Previous services included nearly 7 years in sweet crude and nearly 3 years in sour crude service. Based on thicknesses measured at periodic inspections and corrosion rates calculated from them, the remaining life, or time to reach the deterioration limit of 1/4 inch is projected to be approximately 4 years, or August 1, 1996.

TABLE 1.0 - SIMILAR SERVICE PRODUCT CLASSIFICATION

Classification	Description
A	Low Sulfur Light Oils (< 1% sulfur)
B	High Sulfur Light Oils (>1% sulfur)
C	Sweet Sulfur Heavy Oils (< 1% sulfur)
D	Sweet Sulfur Heavy Oils (>1% sulfur)
E	Slops & Process Waters
F	Finished Lube Oils
G	Sludges
H	Crude Oils
I	Additives
J	Solvents
K	Chemicals

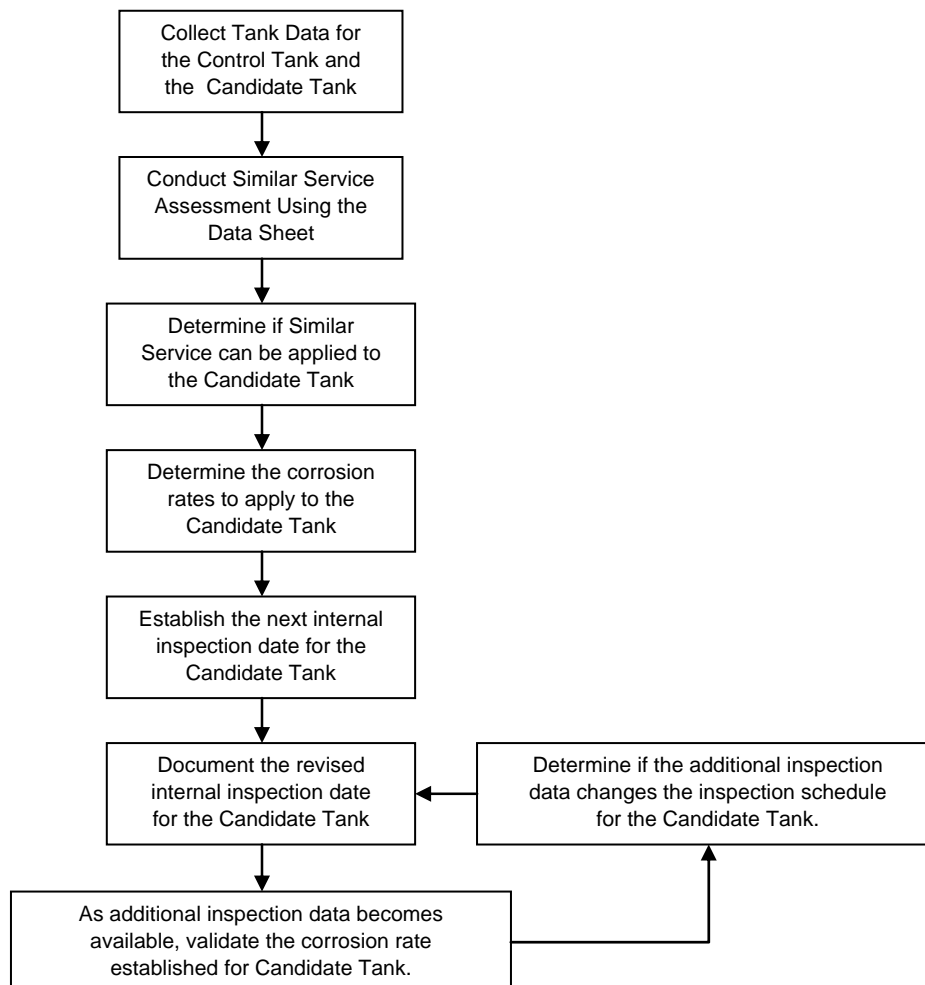
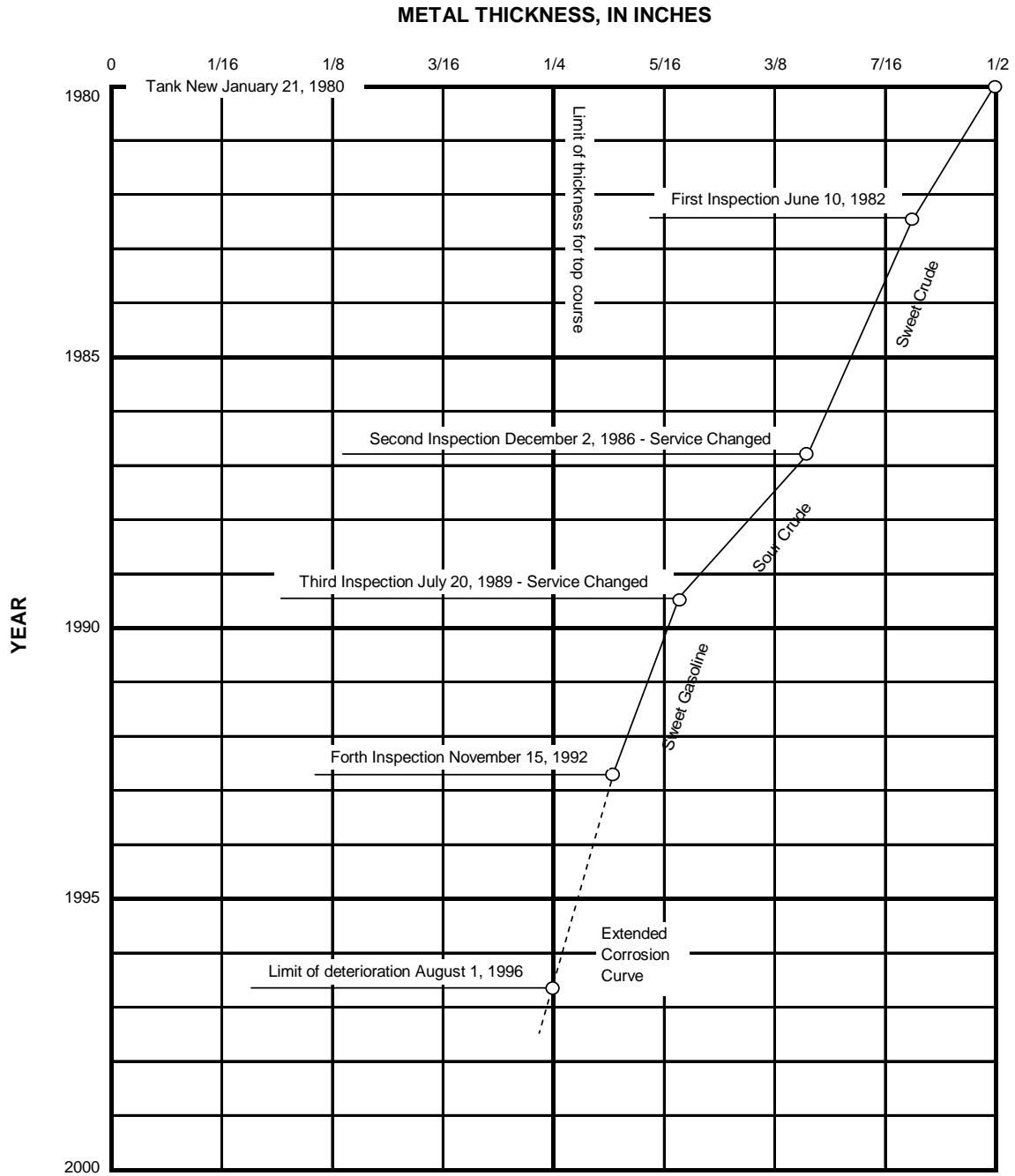
FIGURE 1.0 – STEPS IN CONDUCTING A SIMILAR SERVICE ASSESSMENT

FIGURE 2.0 – EXAMPLE CORROSION RATE CURVES FOR TOP COURSE OF STORAGE TANK



SIMILAR SERVICE ASSESSMENT - DATA SHEET

CONTROL TANK ID: _____ LOCATION: _____
 DIAMETER (FT): _____ HEIGHT (FT): _____ CAPACITY: _____ BBLs

CANDIDATE TANK ID: _____ LOCATION: _____
 DIAMETER (FT): _____ HEIGHT (FT): _____ CAPACITY: _____ BBLs

H.1 TANK CHARACTERISTICS

	Control Tank ¹	Candidate Tank ²	MATCH ³		IF NO, SEE SEC. ⁴
			Yes	No	
a. YEAR TANK ERECTED	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.1
b. BOTTOM MAT'L SPECIFICATION	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.2
c. SHELL MATERIAL SPECIFICATION	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.3
d. CORROSION ALLOWANCE	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.4
e. BOTTOM LINING TYPE/THICK/AGE	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.5
f. CATHODIC PROTECTION	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.6
g. DOUBLE BOTTOM	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.7

H.2 SOIL/MATERIAL IN CONTACT WITH BOTTOM PLATE

	Control Tank ¹	Candidate Tank ²	MATCH ³		IF NO, SEE SEC. ⁴
			Yes	No	
a. SOIL TYPE	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.8
b. SOIL pH	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.8
c. SOIL ALKALINITY	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.8
d. SOIL MOISTURE	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.8
e. SOIL SALINITY	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.8
f. SOIL CONDUCTIVITY	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.8

H.3 AMBIENT CONDITIONS:

	Control Tank ¹	Candidate Tank ²	MATCH ³		IF NO, SEE SEC. ⁴
			Yes	No	
a. LOW ONE DAY MEAN TEMP.	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.9
b. EXPOSURE TO SALT AIR	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.9

H.4 CURRENT SERVICE CONDITIONS:

	Control Tank ¹	Candidate Tank ²	MATCH ³		IF NO, SEE SEC. ⁴
			Yes	No	
a. CURRENT PRODUCT NAME	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.10
b. PRODUCT CLASSIFICATION	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.10
c. SPECIFIC GRAVITY OF PRODUCT	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.10
d. REID VAPOR PRESSURE @ 60°F	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.10
e. NORMAL OPERATING TEMP.	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.10
f. INERT GAS BLANKET?	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.10
g. WATER BOTTOM?	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.10
h. SULFUR CONTENT	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.10
i. TIME IN THIS SERVICE	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.10
j. PRODUCT CORROSIVITY	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.10

H.5 PREVIOUS SERVICE CONDITIONS

	Control Tank ¹	Candidate Tank ²	MATCH ³		IF NO, SEE SEC. ⁴
			Yes	No	
a. PREVIOUS PRODUCT NAME	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.10
b. PRODUCT CLASS. (TABLE 1.0)	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.10
c. SPECIFIC GRAVITY OF PRODUCT	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.10
d. REID VAPOR PRESSURE @ 60°F	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.10
e. NORMAL OPERATING TEMP.	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.10
f. INERT GAS BLANKET?	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.10
g. WATER BOTTOM?	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.10
h. SULFUR CONTENT	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.10
i. TIME IN THIS SERVICE	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.10
j. PRODUCT CORROSIVITY	_____	_____	<input type="checkbox"/>	<input type="checkbox"/>	H.3.1.10

SIMILAR SERVICE ASSESSMENT - DATA SHEET**H.6 CONCLUSIONS**

- a. Based on the criteria reviewed in this Similar Service evaluation,
Similar Service Is OR is NOT recommended for this tank (check appropriate box)
- b. The corrosion rate to be applied to this tank bottom is: _____ mpy.
- c. The corrosion rate to be applied to this tank shell is: _____ mpy.
- d. Based on the corrosion rates applied, the next internal inspection for this tank will be completed in Year _____.

COMMENTS:

NOTE: THE DATA SHEET SHALL BE MAINTAINED IN THE RECORD FILE AS PER SEC. 6.8.

SUBMITTED BY: _____ DATE: _____

APPROVED BY: _____ DATE: _____

NOTES:

1. The Control Tank is the tank for which service conditions and corrosion rates are well known.
2. The Candidate Tank is the tank to be compared to the Control Tank to determine if similar service concepts apply.
3. "Y" or "Yes" indicates that the Candidate Tank criterion essentially matches the Control Tank .
4. If the Candidate Tank criterion does not match the Control Tank criterion, reference this section.