Manual of Petroleum Measurement Standards Chapter 17—Marine Measurement

Section 8—Guidelines for Pre-Loading Inspection of Marine Vessel Cargo Tanks

FIRST EDITION, AUGUST 1998

American Petroleum Institute

Helping You Get The Job Done Right.SM

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Section 8—Guidelines for Pre-Loading Inspection of Marine Vessel Cargo Tanks

1 Introduction

The shipment of crude oil, petroleum products, and petrochemicals requires stringent quality control during the loading, transport, and discharge operations. Consequently, it is important to determine whether the vessel's tanks and associated cargo-loading equipment are sufficiently clean so that the intended cargo will not be contaminated.

Cargoes of crude oil, petroleum and petrochemicals have varying tolerances regarding the extent to which they are affected by on board quantities (OBQ) or residues after tank cleaning operations. These guidelines for pre-loading inspection of a vessel's tanks are intended to minimize the risk of contaminating the cargo to be loaded.

Tank inspection activities performed on board a vessel shall be accomplished in the presence of, or with the express permission of, the vessel's master or other appropriate authority. For safety reasons, only appropriate and approved equipment shall be used.

2 Scope

These guidelines specify procedures for determining that the cargo tanks and associated loading equipment of marine vessels are in a suitably clean condition to receive the intended cargo. They apply to vessel tanks intended to load crude oil, petroleum, and petrochemical cargoes. The extent of pre-loading tank inspection will vary depending on the nature of the cargo to be loaded. These guidelines recommend the extent of inspection that should be instituted for certain general types of cargoes and an example of a format that may be used for reporting the findings of tank inspections. Because of the wide variety of conditions that may exist when performing pre-loading tank inspections, this guideline is not intended to restrict the judgment of the person performing the inspection.

3 Referenced Publications

The following API documents are referenced in the text of this chapter.

API

Manual of Petroleum Measurement Standards

Chapter 8	*Sampling*
Chapter 17.1	*Guidelines for Marine Cargo Inspection*
Chapter 17.4	*Method for Quantification of Small Volumes on Marine Vessels (OBQ/ROB)*
Chapter 17.6	*Guidelines for Determining Fullness of Pipelines Between Vessels and Shore Tanks*
RP 1141	*Guidelines for Confined Space Entry on Board Tank Ships in the Petroleum Industry*
RP 2003	*Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents*
Publ 2217A	*Guidelines for Work in Inert Confined Spaces in the Petroleum Industry*

ICS/OCIMF[1]

International Safety Guide for Oil Tankers and Terminals

4 Definitions

4.1 first-foot sample (also, test portion sample or first-in sample): a sample taken after approximately 1 ft. (0.3 m) of cargo has been loaded into a vessel's tank.

4.2 gas-free: A tank, compartment or container is gas-free when sufficient fresh air has been introduced into it to lower the level of any flammable, toxic or inert gas to that required for a specific purpose, e.g., hot work, entry, etc.

4.3 wall wash test: The procedure for washing selected areas, such as the interior bulkheads, tank bottoms and sumps of cargo tanks, with an appropriate wash liquid; and, subsequently, testing the wash liquid for the presence of material which might contaminate cargo to be loaded.

4.4 wipe test: The procedure of physically wiping any interior surface (bulkheads, steam coils, etc.) of the vessel's tanks with absorbent white rags. This procedure is used to test the wiped surfaces for possible color contamination.

5 General Information

The procedures in this guideline should be performed only by properly trained and experienced personnel using appropriate and safe methods and equipment.

All procedures described and recommended in this publication shall be accomplished with strict adherence to the safety requirements that are specified in the *International Safety Guide for Oil Tankers & Terminals (ISGOTT)* or other specific requirements of vessel and terminal operators, and regulatory authorities.

[1]Oil Companies International Marine Forum, 15th Floor, 96, Victoria Street, London SW1E 5JW, United Kingdom.

6 Safety and Health Considerations

6.1 GENERAL

Due consideration must always be given to applicable safety and health procedures. Considerations should include—but are not limited to—possible electrostatic and other fire and explosion hazards, protection from potential dangers to personnel (for example, various protective clothing and equipment requirements and work practices), and potential explosive, fire, toxic, and oxygen deficiency hazards associated with a cargo tank's environment. The physical characteristics of the cargo and existing operating conditions should be evaluated carefully, and applicable international, federal, state, and local regulations should be strictly observed. Safety procedures designated by the employer, the vessel's operator, and other concerned parties also must be observed. The *ISGOTT*, and appropriate OCIMF and API publications should be consulted for additional safety information.

Petroleum vapors and associated substances—including hydrogen sulfide vapors from "sour" crude and heavy fuel oils—also may involve potential toxicity. Petroleum vapors with high concentrations of hydrogen sulfide may cause unconsciousness or death. During and after the opening of the inspection or gauge hatch, all personnel should stand far enough away to minimize the inhalation of vapor.

Since toxic vapors or oxygen deficiency cannot be detected safely by smell, visual inspection, or judgment, appropriate precautions should be taken to ensure protection. Provisions should be made for appropriate exposure monitoring, protective equipment for personnel, and emergency rescue procedures. When it is necessary, personnel should have suitable respiratory protection prior to entering the tank inspection site or the tank.

6.2 PHYSICAL CHARACTERISTICS AND FIRE CONSIDERATIONS

Personnel who handle petroleum-related substances, as well as other chemical materials, should be familiar with their physical and chemical characteristics—including potential for fire, explosion and reactivity—and with potential toxicity and health hazards and emergency procedures. Personnel should be alert to avoid potential sources of ignition and should keep containers of materials closed when not in use. Information regarding particular materials and conditions should be obtained from the employer, the manufacturer, or the supplier of that material, or from the material safety data sheet (MSDS).

6.3 SPECIAL SAFETY CONSIDERATIONS

API Recommended Practice 1141, *ISGOTT*, and any applicable regulations should be consulted when tank inspection requires entry into compartments on board tank ships or barges.

CAUTION: Special attention is required while taking samples associated with vessel tank inspections. Care must be taken to allow an appropriate relaxation period prior to sampling some products to prevent the discharge of an electrostatic spark. Metal equipment must be carefully grounded. Under no circumstances should samples of any product be taken until pumping has been stopped (Reference *ISGOTT* (Fourth Edition, 20.5.2 and 20.5.3) and API RP 2003).

7 Prior to Performing Pre-Loading Tank Inspection

7.1 VESSEL RESPONSIBILITIES

Vessel personnel have the following responsibilities regarding the cleanliness of nominated cargo tanks and the tank inspection procedure:

a. Ensure that designated cargo tanks are in a suitably clean condition to begin loading upon arrival at the loading location.
b. Discuss tank inspection procedures at the key meeting. (Reference API *MPMS* Chapter 17.1) and know the safety requirements unique to the extent of the inspection being performed.
c. Facilitate the inspection process and provide the necessary assistance and personnel to expedite the inspection procedure safely.
d. Supply safe access to gauge hatches or other inspection access points.
e. Load cargo only into those tanks that have surfaces or coatings compatible with the intended cargo.
f. Ensure, when personnel tank entry may be required, that tanks are gas-free.

7.2 KEY MEETING

(Refer to Flow Chart for Key Meeting, Appendix A-1.)

The following tank inspection items, if applicable, should be discussed at the pre-loading key meeting:

a. Tank number, capacity and intended cargo volume of each cargo tank.
b. Identification and nature of at least the last three cargoes in each tank.
c. Identity and particulars of the cargo to be loaded.
d. Composition and general condition of tank surfaces or coatings.
e. Contents of adjacent compartments or tanks.
f. Condition and compatibility of the inerting method.
g. Number and identity of people who will enter the tank together.
h. Method used to clean the cargo tanks, lines and pumps.
i. The possible need to slow or stop pumping and the means of communication to control pumping.
j. Lockout/tagout procedure for valves leading to tanks to be entered.

k. Means of communication between terminal and vessel.
l. The need to load tanks in a certain sequence (loading plan).
m. The condition of the vessel's pumps, strainers or filters, heating coils, heat exchangers, and sea chests.
n. The line fill and cleanliness condition of vessel and shore lines (Reference API *MPMS* Chapter 17.6).
o. Special requirements, such as first-foot sampling, line sampling, or wall wash testing.
p. Sealing tank valves, crossovers, etc., to ensure isolation.
q. Type of equipment to be used by the tank inspection personnel.
r. Agreement on safety and emergency procedures to be followed.
s. The assignment of qualified on-deck standby personnel.
t. Whether any cargo on board will be moved while a tank is occupied by personnel
u. Type of tank inspection (deck level or tank entry).

8 Deck Level Inspection Procedures

(Refer to Flow Chart for Deck Level Inspection, Appendix A-2)

Vessel personnel should open the tank valve for each tank nominated to receive cargo. Request that the vessel's personnel drain the deck lines into one specified cargo tank per grade of cargo, if practical, or into slop tanks. Measure the amount of material in the receiving tank(s) before and after line draining and sample the material if a sufficient quantity exists (Reference API *MPMS* Chapter 17.4).

If the quantity and nature of the OBQ is agreed by the appropriate parties to be acceptable, inspection personnel shall inform vessel personnel that the tank has passed inspection.

If it is suspected that OBQ or other cleanliness problems in the tank could contaminate the intended cargo, then one or more of the following actions should be considered:

a. Take a sample of the OBQ for appropriate examination or testing (Reference API *MPMS* Chapter 17.4).
b. Perform additional stripping or tank cleaning procedures.
c. Load and sample a 1 ft. (0.3 m) test portion for appropriate examination or testing.
d. Designate alternative tanks to receive the cargo.
e. Obtain a release from the responsible parties and proceed with loading.
f. Other appropriate actions as agreed by all parties.

After completing inspection of each tank, inspection personnel shall report results to the appropriate parties. The time of acceptance or rejection of the tank should be recorded.

Vessel personnel are responsible to initiate whatever additional stripping and/or cleaning activities that are necessary. Vessel personnel are responsible to notify inspection personnel when the vessel is ready for re-inspection.

If re-inspection indicates that the cleanliness condition of the tanks is acceptable, an OBQ Report (or written tank inspection report) shall be issued indicating that the tank is suitably clean to receive the intended cargo.

Note: A deck level inspection is the least effective form of tank inspection. Significant amounts of OBQ can remain undetected in the vessel's lines, on bulkheads and in other areas that are not visible or are not accessible to gauging equipment.

9 Tank Entry Inspection

9.1 TANK ENTRY PRECAUTIONS

At a minimum, the requirements in API RP 1141, *Guidelines for Confined Space Entry on Board Tank Ships in the Petroleum Industry,* shall be followed before entering a vessel tank.

A qualified standby person shall be stationed at the tank hatch at all times while personnel are in a tank.

It is strongly recommended that a form or forms containing at least the amount of information contained in the *Sample Confined Space Entry Permit,* Appendix C, Table C-1, be used.

9.2 TANK ENTRY INSPECTION PROCEDURE

(Refer to Flow Chart for Tank Entry Inspection, Appendix A-3)

Prior to any tank entry inspection, all pipelines leading to the tank should be verified, to the extent possible, to be empty and free of potential contaminants, and an examination of accessible pipelines, including pump drains and manifolds, should be completed. Any open tank valves should be closed, locked and tagged. The tank atmosphere should be tested for safe entry after any changes in valve settings (Reference API RP 1141). If required, heating coils should be either drained or blown and blanked off, or should be tested for tightness prior to entering the tank.

As the inspector climbs down the ladder to enter the tank, all tank surfaces should be visually checked for possible areas of contamination, loose or deteriorated tank coating, and flaking or loose rust.

Once inside the tank, the following inspection procedures should be performed and recorded:

a. All tank surfaces—including internal pumps, sumps, heating coils, and all pipe surfaces—should be examined for residues, rust flakes or debris.
b. Tank coating should be examined for signs of deterioration—such as blistering, flaking or areas where the metal beneath the coating is visible.
c. If required, take samples of any loose rust flakes on the bulkheads and place them into clean containers, marked to indicate where in the tank the rust samples originated.

CAUTION: To avoid possible release of hazardous materials, blisters in the tank coating should be investigated with caution. Piles of rust or debris on the tank floor should be left

undisturbed. Removal of such scale, rust or detached tank coating should be done by vessel personnel.

9.3 WIPE TESTING AND WALL WASH TESTING

A wipe test may be performed on any tank surface. If wall wash testing is required, follow the Wall Wash Testing Procedures in Appendix B.

9.4 REPORTING TANK ENTRY INSPECTION RESULTS

After completing inspection of each tank, inspection personnel shall report results to the appropriate parties. The time of acceptance or rejection of the tank should be recorded.

When tank inspection procedures have been completed, inspection personnel shall prepare a written Tank Inspection Report (see Appendix C for an example).

9.5 LINE SAMPLE

If a vessel line sample is required prior to cargo entering any tank, the sample should be obtained at the point nearest the cargo line drop into the tank.

9.6 FIRST-FOOT SAMPLE PROCEDURE

If a first-foot sample is required, it should be taken when approximately 1 ft. (0.3 m) of cargo has been loaded into the tank. A sample is then drawn from the tank (see 6.3 Special Safety Considerations). The sample should be examined or tested to determine conformity with cargo specifications. If the sample indicates potential contamination, no additional cargo shall be loaded into the tank until the problem is resolved. (Reference *ISGOTT* 20.5.2 and 20.5.3.)

APPENDIX A—FLOW CHARTS

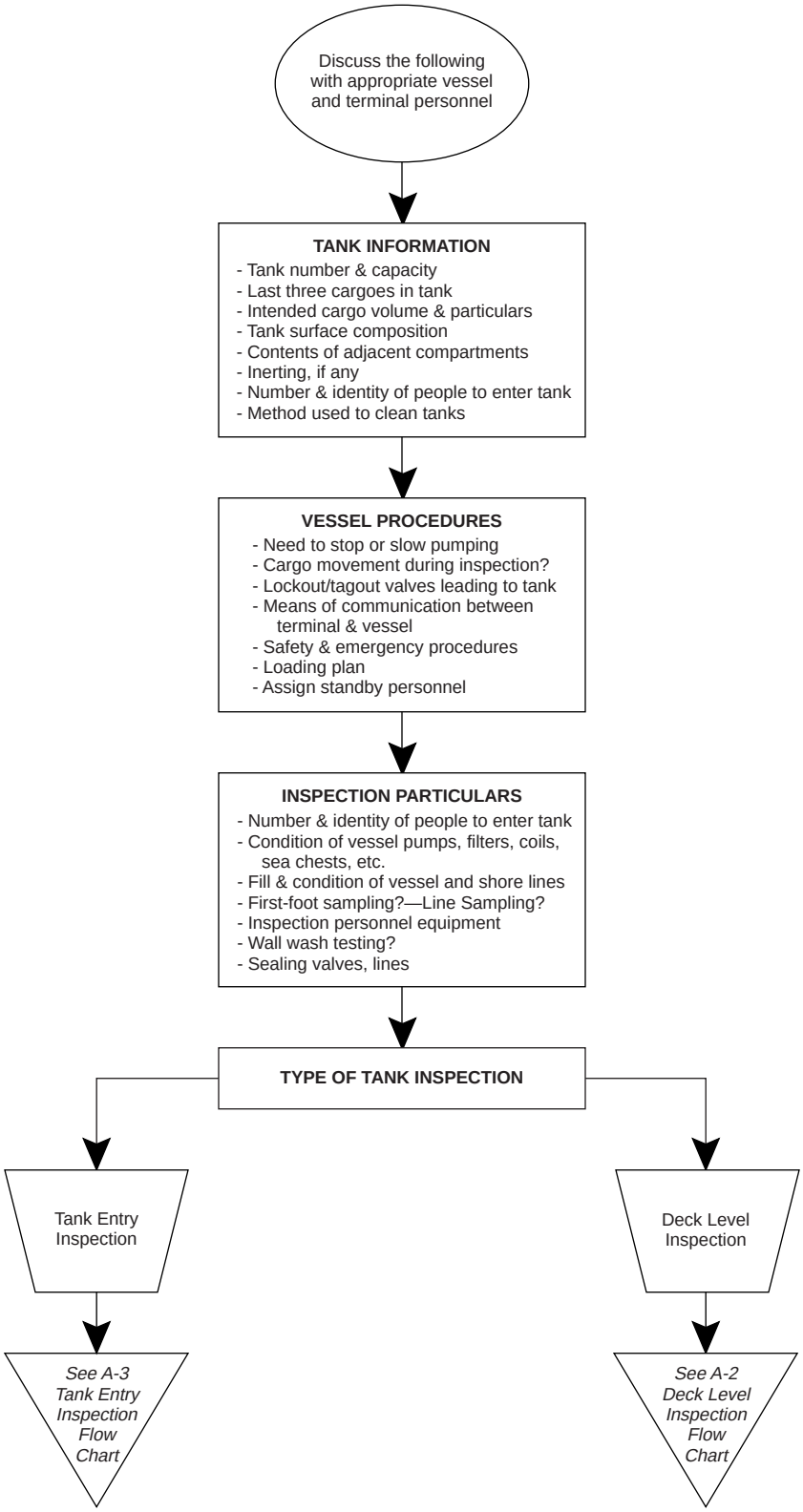

Figure A-1—Flow Chart for Key Meeting

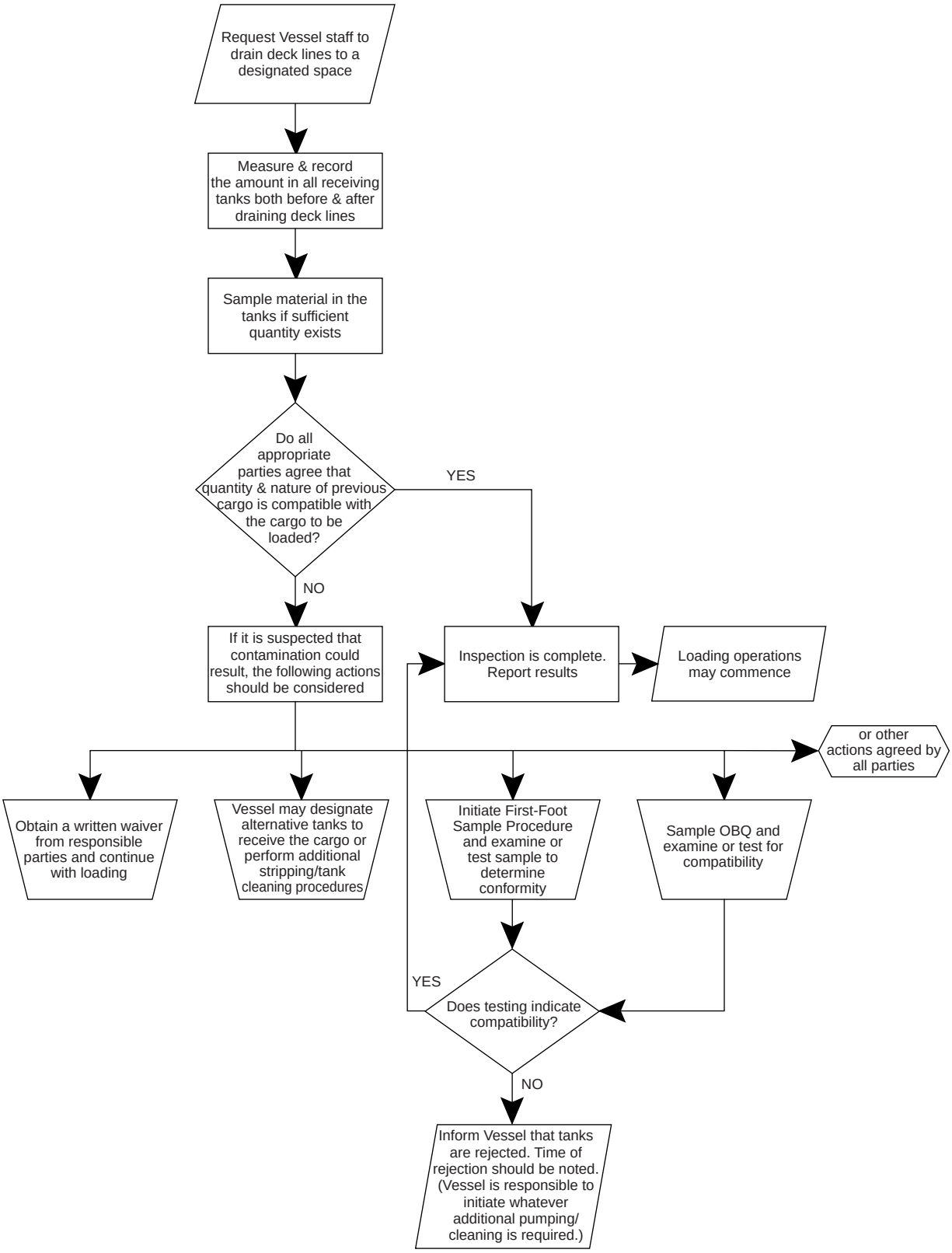

Figure A-2—Deck Level Inspection Flow Chart

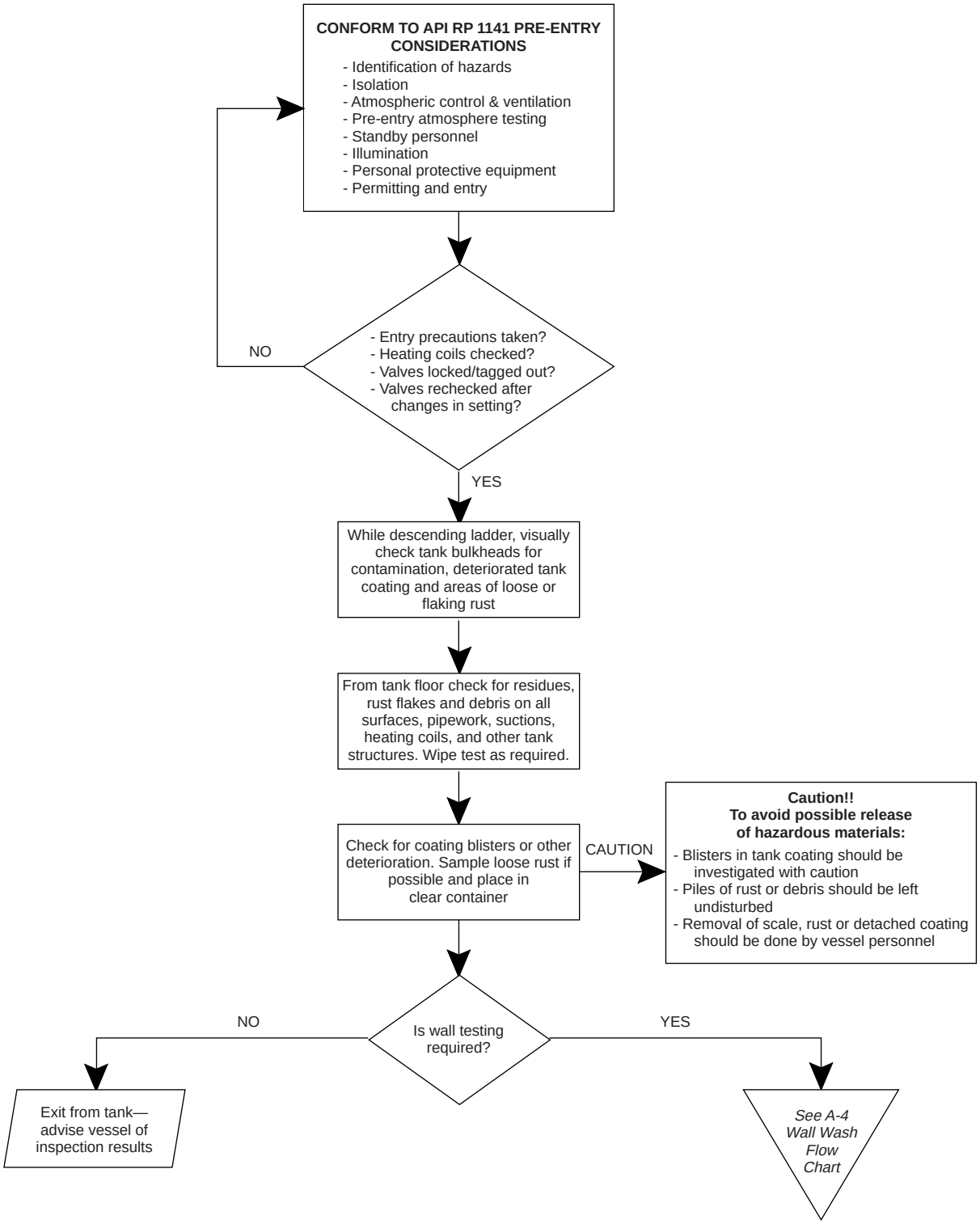

Figure A-3—Tank Entry Inspection Flow Chart

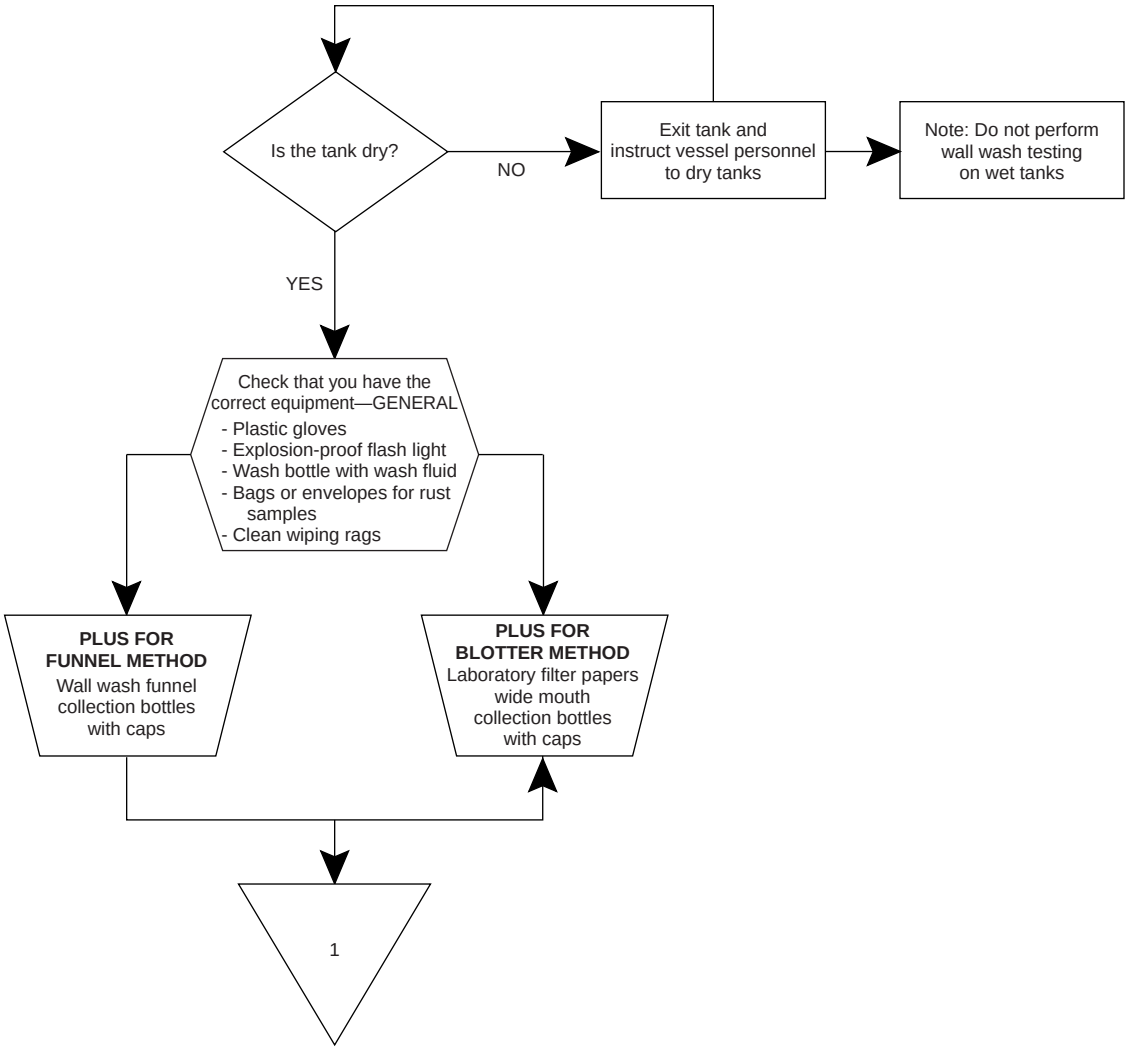

Figure A-4—Wall Wash Flow Chart (1 of 3)

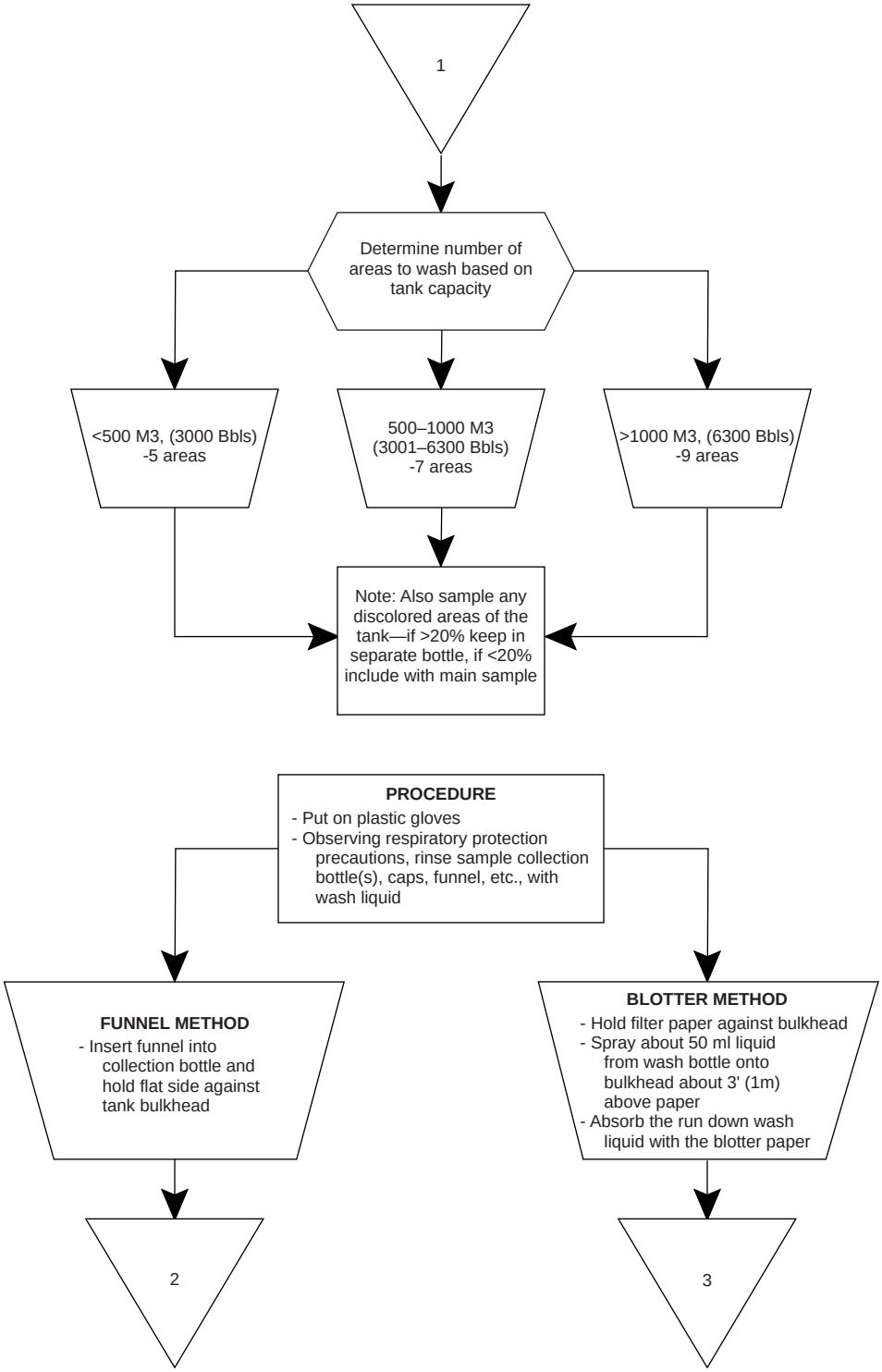

Figure A-4—Wall Wash Flow Chart (2 of 3)

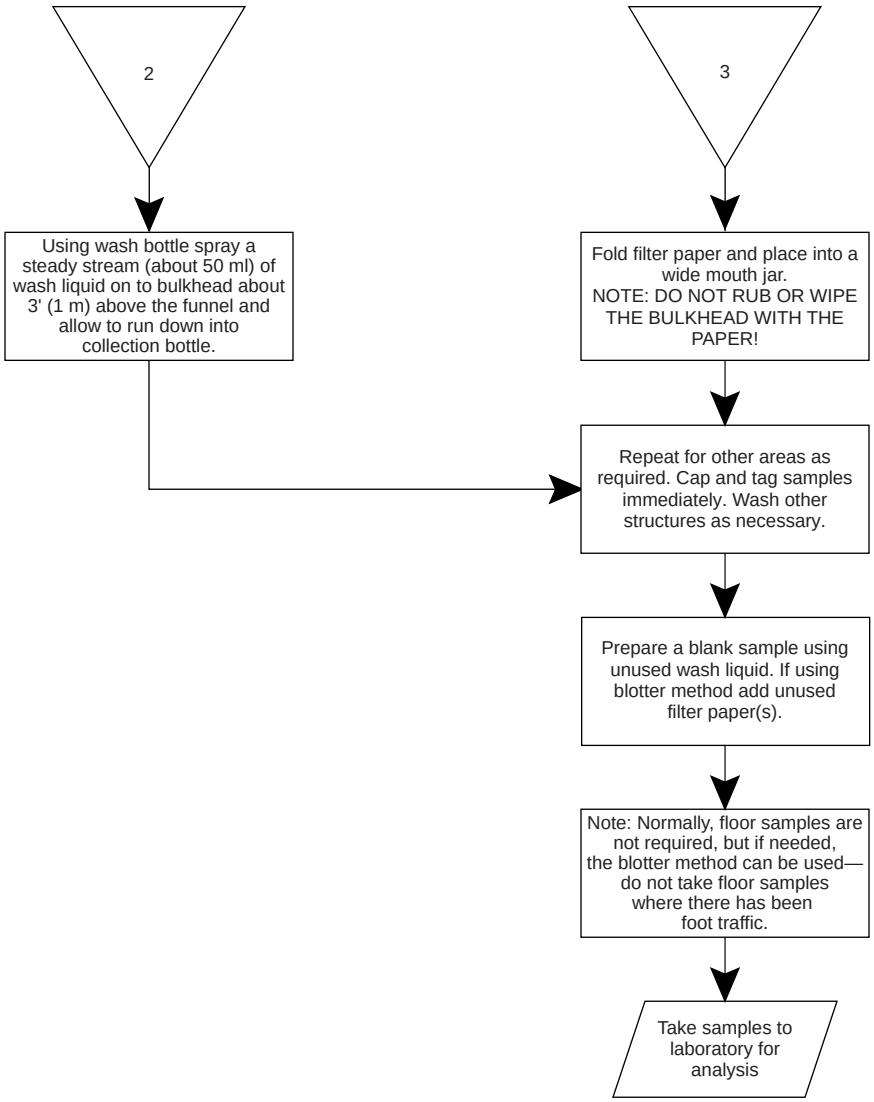

Figure A-4—Wall Wash Flow Chart (3 of 3)

APPENDIX B—PROCEDURES

B.1 Wall Wash Procedures

B.1.1 EQUIPMENT

a. Plastic gloves (for skin protection and to prevent chloride contamination of sample).

b. Explosion-proof flashlight.

c. Laboratory wash bottle.

d. Wall wash funnel.

e. Wall wash sample collection bottles with poly-seal caps (for Funnel Method).

f. Wide-mouth sample collection bottles with plastic-lined caps (for Blotter Method).

g. Small, clean plastic bags (or clean paper envelopes) for rust samples.

h. Laboratory filter papers.

CAUTION: Since all filter papers in the same container may not be free of contaminants, or may not have the same level of contaminants, the result of laboratory tests of wall wash samples could be adversely affected by the filter papers.

i. Sufficient wash liquid (usually reagent-grade Methanol).

CAUTION: Any liquid used for wall washing must first be determined to be safe for use in a confined space.

j. Clean wiping rags.

Note: Clean plastic gloves, forceps, or tweezers should be used to handle filter papers.

B.1.2 GENERAL PROCEDURES

Prior to tank entry, wall wash personnel shall be equipped with safety equipment (such as gloves, masks, and respiratory protection equipment) whenever the liquid used for wall washing may adversely affect the gas-free condition of the tank interior.

Use the following chart to determine the minimum number of areas to be selected for wall washing in any tank.

Table B-1—Wall Washing Tanks

Tank Capacity	Minimum No. Areas to Wash
<500 M^3 (3000 bbl)	5
500–1000 M^3 (3000–6300 bbl)	7
>1000 M^3 (>6300 bbl)	9

The following procedures are recommended for all tank wall washing operations:

a. Do not perform wall washes on wet tanks. Request vessel personnel to dry the tanks.

b. Each washed area should be about 3 ft. (1m) wide and 6 ft. (2m) high from the bottom of each tank. Higher areas that can be safely accessed may also be washed.

c. Discolored patches, tank coating breaks, or exposed sections, and all other non-typical areas on the tank walls of tanks and tank floors must be noted on the report and tested as follows:

1. In any tank where the non-typical area is less than about 20% of the total surface area of the tank, include the wall washings with those from the rest of that tank.
2. When the non-typical area exceeds 20% of the tank surface area, keep wall washings from these areas in a separate bottle and perform separate analysis.

Note: If you are in doubt about the size of nontypical areas, keep wall washings separate and report the approximate size of the tank and of the nontypical areas represented by the sample.

d. Tank bottoms (floors) often do not require wash testing. However, if wash testing is required, use the Blotter Method.

e. The laboratory must be informed in advance if analysis is required on wall wash samples. The laboratory is responsible to communicate test results promptly to inspection personnel.

B.1.3 FUNNEL WALL WASH PROCEDURE

a. Put on plastic gloves prior to starting the test.

b. Rinse wash bottle, funnel, and sample bottle with a small amount of washing liquid.

c. Place the spout of the funnel into the sample bottle and hold the flat side of the funnel firmly against the surface to be tested.

CAUTION: To avoid possible contamination of samples with suspended matter, care must be taken not to scrape zinc tank coatings with the edge of the funnel.

d. Using the wash bottle, spray a steady stream of the washing liquid on the surface of the tank wall, about 3 ft. (1m) above the funnel, with the wash bottle held about 18 in. (0.5m) away from the wall. Allow the wash liquid to run down the wall into the funnel and into the sample bottle (see Figure B-1).

e. Continue spraying until about 50 ml of wash liquid has been used.

f. Repeat steps c through e until a sufficient quantity of wall washing liquid has been received into the sample bottle for the entire tank. Samples must also be taken from horizontal pipelines, large baffles, dividers and superstructures.

g. Rinse the inside of the bottle cap with a small amount of wash liquid and place securely onto the bottle.

h. Prepare a blank sample (an unused portion of the wash liquid before it was used for wall washing).

i. Tag each wall wash sample and the blank sample immediately to avoid losing the identity of the samples.

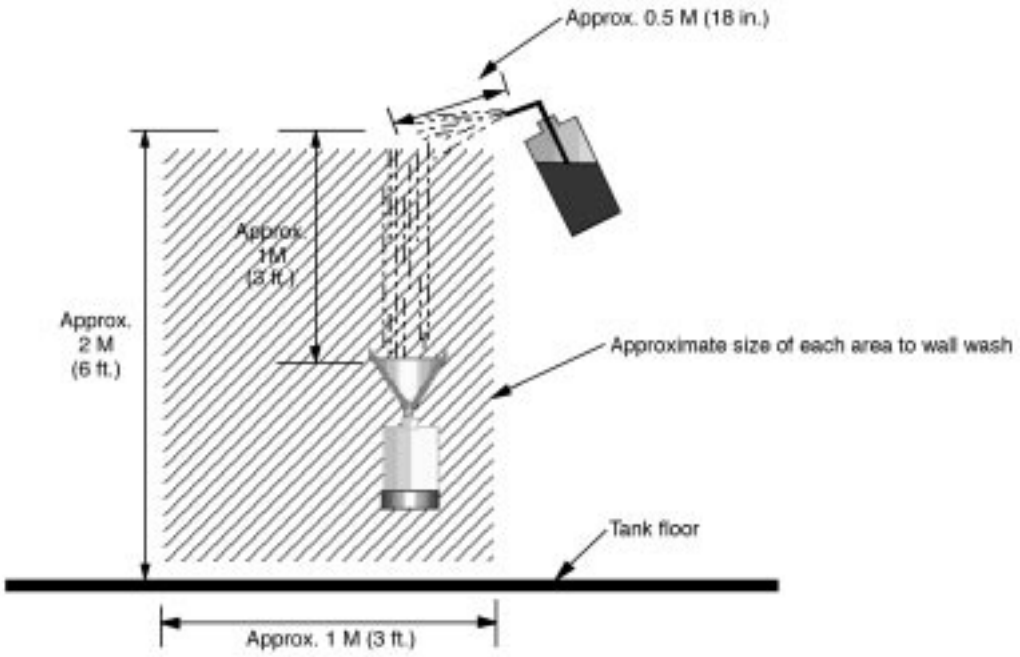

Figure B-1—Wall Wash Procedures

j. Submit to the laboratory for required analysis.

k. Wall wash reports should specify where each wash sample was taken in the tank.

B.1.4 BLOTTER WALL WASH PROCEDURE

Note: Since filter papers are not consistent in chemical composition, the blotter wall wash procedure should be used only when it is not practical to use the funnel wall wash procedure.

a. Put on plastic gloves prior to starting the testing.

b. Rinse wide-mouth sample bottle with a small amount of wash liquid.

c. Hold a piece of laboratory filter paper against the surface of the wall a few inches above the floor. Use the laboratory wash bottle to spray about 50 ml of wash liquid onto the test section, about 3 ft. (1 m) above the floor, in a stream about 4 in. (0.1 m) wide. Allow the wash liquid to run down the wall and be absorbed by the filter paper being held near the floor. *Do not rub or wipe the filter paper on the tank wall.*

Note: Clean plastic gloves, forceps, or tweezers should be used to handle filter papers.

d. As the test papers are saturated, carefully fold and place them in the wide-mouth bottle.

CAUTION: Perspiration will contaminate the samples. Do not permit perspiration to drop into the sample bottle or onto the filter papers.

e. If required, wash the tank bottom by placing a filter paper on a spot wetted with the wash liquid. Then lift the filter paper carefully, fold it, and place into the wide-mouth bottle. *Do not take tank bottom samples where there has been foot traffic.*

f. Rinse the inside of the plastic cap with a small amount of wash liquid and cap the bottle containing the wall wash filter papers.

Note: The following steps may be performed after leaving the tank.

g. Prepare a blank sample as follows: Rinse a wide-mouth bottle with a small amount of the wash liquid. Take an unused filter paper from the box and place it into the rinsed wide-mouth bottle. Add wash liquid from the wash liquid spray bottle. Rinse the plastic cap with wash liquid and securely cap the bottle containing the blank sample and filter paper.

h. Immediately identify both samples with appropriate sample tags and deliver promptly to the laboratory.

APPENDIX C—SAMPLE PERMIT/REPORT

Table C-1—Confined Space Entry Permit (sample format; other formats are permitted)

1.	Vessel	Space to be entered	Date/time
2.	Previous contents	Purpose of entry	Permit expires
3.	Oxygen content (%)	Oxygen Meter: Mfrs. Serial No.	Date meter calibrated
4.	Combustible gas (% LEL)	Gas Meter: Mfrs. Serial No.	Date meter calibrated
5.	Toxicity (ppm, toxin, exposure limit, reading)	Toxicity test method	Mfrs. Serial No.
6.	Toxicity (ppm, toxin, exposure limit, reading)	Toxicity test method	Mfrs. Serial No.
7.	Toxicity (ppm, toxin, exposure limit, reading)	Toxicity test method	Mfrs. Serial No.
8.	Toxicity (ppm, toxin, exposure limit, reading)	Toxicity test method	Mfrs. Serial No.
9.	Date & time of tests (line 3-8 above)	Remarks:	
10.	Confined space preparation procedure (e.g., washing)		
11.	Confined space isolation (e.g., blanks, lockout/tagout)		
12.	Ventilation procedures used:		
13.	Confined space ventilation commenced (date/time): 1. Must be continuous when person are in compartment. 2. Must be stopped for atmospheric testing.		
14.	Illumination provided (Yes/No):		
15.	Standby person at confined space entrance: Name _____ 1. Standby person equipped with (Circle if applicable) 2 SCBAs Communication equipt. Rescue equipt.		
16.	Communication established between person entering confined space and (Name) _____		

17.	**THIS CONFINED SPACE HAS BEEN EVALUATED AND (IS) (IS NOT) SAFE FOR ENTRY**	
18.	Qualified Person (name and signature):	Master or Chief Officer (name and signature):
19.	MY SIGNATURE BELOW VERIFIES THAT I HAVE READ AND UNDERSTAND THE CONTENTS OF THIS PERMIT, THAT I HAVE HAD SUFFICIENT TRAINING IN CONFINED SPACE ENTRY, AND I AGREE TO WEAR ALL NECESSARY PROTECTIVE CLOTHING AND USE ALL NECESSARY PROTECTIVE EQUIPMENT.	
20.	Print Name:	Signature:
21.	Print Name:	Signature:
22.	Print Name:	Signature:

Table C-2—Tank Inspection Report (sample format; other formats are permitted)

Vessel Name:	Terminal/Berth:	Load Port Location:

TANK / VESSEL DATA

1. Tank history below was submitted by ____ and not independently verified by tank inspection personnel.
2. Information obtained from vessel's officers or vessel's logs cannot be guaranteed accurate, and therefore no liability can be assumed for errors resulting from improper information supplied. This report, of necessity, is based on such information. The responsibility for improper information must remain with the vessel and her officers.
3. To minimize any contamination that could be caused by vessel's pipelines or conditions that cannot be checked by visual examination, it is recommended that "first-foot" samples be taken and checked.
4. If any vessel's tanks are coated, this statement of opinion covers only the cleanliness of the coating and offers no judgment regarding the suitability of the coating to protect or damage the cargo.
5. All tanks inspected are subject to a final inspection immediately prior to loading.

TANK INSPECTION DATA			
Vessel Compartment:	Last Cargo:	2nd Last Cargo:	3rd Last Cargo:
Deck Level -or- Tank Entry Inspection (circle one)	Tank Surface or Coating:	Cleaning Method:	First-foot Samples taken: YES NO
Tank Accepted Tank Rejected (circle one)	Date and Time:	Location of Vessel for Inspection:	

TANK INSPECTION DATA			
Vessel Compartment:	Last Cargo:	2nd Last Cargo:	3rd Last Cargo:
Deck Level -or- Tank Entry Inspection (circle one)	Tank Surface or Coating:	Cleaning Method:	First-foot Samples taken: YES NO
Tank Accepted Tank Rejected (circle one)	Date and Time:	Location of Vessel for Inspection:	

TANK INSPECTION DATA			
Vessel Compartment:	Last Cargo:	2nd Last Cargo:	3rd Last Cargo:
Deck Level -or- Tank Entry Inspection (circle one)	Tank Surface or Coating:	Cleaning Method:	First-foot Samples taken: YES NO
Tank Accepted Tank Rejected (circle one)	Date and Time:	Location of Vessel for Inspection:	

Tank Inspected by:

(Print Name) ____ (Signature) ____

Inspection report received for the vessel by:

(Print Name) ____ (Signature) ____

Date and time received:____________________________________

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