Permit No. WA1170023419
U.S. Navy
Naval Undersea Warfare Center
Keyport, Washington

Attachment Part 1 -
Section A to Section D

Rev. _____, Date _____

Dangerous Waste Permit Application Part A Form

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Date Received	Reviewed by:	Date:
Month Day Year	Approved by:	Date:
	Please refer to instructions for completing this form.	

I. This form is submitted to: (place an "X" in the appropriate box)

☐	Request modification to a final status permit (commonly called a "Part B" permit)
☐	Request a change under interim status
☒	Apply for a final status permit. This includes the application for the initial final status permit for a site or for a permit renewal (i.e., a new permit to replace an expiring permit).
☐	Establish interim status because of the wastes newly regulated on: (Date)
	List waste codes:

II. EPA/State ID Number

W	A	1	1	7	0	0	2	3	4	1	9

III. Name of Facility

Naval Undersea Warfare Center Division Keyport

IV. Facility Location (Physical address not P.O. Box or Route Number)

A. Street

610 Dowell Street, (Attn: Building 1051 - Code 1023)

City or Town	State	ZIP Code
Keyport	WA	98345-7610

County Code (if known)	County Name
0 3 5	Kitsap

B. Land Type	C. Geographic Location Latitude (degrees, mins, secs)	Longitude (degrees, mins, secs)	D. Facility Existence Date Month / Day / Year
F	47 41 49 N	122 37 30	11 / 30 / 1980

V. Facility Mailing Address

Street or P.O. Box

610 Dowell Street, (Attn: Building 1051 - Code 1023)

City or Town	State	ZIP Code
Keyport	WA	98345-7610

Distribution Statement A: Approved for Public Release; Distribution is unlimited. NUWC Keyport #17-053

VI. Facility contact (Person to be contacted regarding waste activities at facility)		
Name (last)	**(first)**	
Hunt	Dale	
Job Title	**Phone Number (area code and number)**	
Dangerous Waste Program Manager	360-396-2320	
Contact Address		
Street or P.O. Box		
610 Dowell Street, (Attn: Building 1051 - Code 1023)		
City or Town	**State**	**ZIP Code**
Keyport	WA	98345-7610

VII. Facility Operator Information		
A. Name	**Phone Number (area code and number)**	
Commanding Officer, Naval Undersea Warfare Center Division Keyport	360-396-5666	
Street or P.O. Box		
610 Dowell Street		
City or Town	**State**	**ZIP Code**
Keyport	WA	98345-7610
B. Operator Type	F	
C. Does the name in VII.A reflect a proposed change in operator? If yes, provide the scheduled date for the change:	☐ Yes ☒ No	Month / Day / Year:
D. Is the name listed in VII.A. also the owner? If yes, skip to Section VIII.C.	☒ Yes ☐ No	

VIII. Facility Owner Information		
A. Name	**Phone Number (area code and number)**	
Commanding Officer, Naval Undersea Warfare Center Division Keyport	360-315-5666	
Street or P.O. Box		
610 Dowell Street		
City or Town	**State**	**ZIP Code**
Keyport	WA	98345-7610
B. Operator Type	F	
C. Does the name in VII.A reflect a proposed change in operator? If yes, provide the scheduled date for the change:	☐ Yes ☒ No	Month / Day / Year:

IX. NAICS Codes (5/6 digit codes)	
A. First	**B. Second**
9 2 8 1 1 0	
C. Third	**D. Fourth**

X. Other Environmental Permits (see instructions)

A. Permit Type	B. Permit Number												C. Description
E	S	T	7	3	5	3							State Wastewater Discharge Permit
E	1	4	0	7	9								PSCAA Registered Facility – Synthetic Minor (GRO 8258)
N	W	A	R	0	5	F	0	0	3				EPA Multi-Sector General Permit for Industrial Activities
N	W	A	S	0	2	9	6	6	4	2			EPA Municipal Separate Storm Sewer System (MS4) Permit

XI. Nature of Business (provide a brief description that includes both dangerous waste and non-dangerous waste areas and activities)

The Facility, as defined in accordance to WAC 173-303-040, is the Permitted Part B Facility, Building 1051, also known as the Treatment, Storage, and Disposal Facility (TSD Facility), including the contiguous property within the attached fence-line to the building structure.

NUWC Division, Keyport is a tenant command on the Naval Base Kitsap Keyport (NBK Keyport) Installation. The Part B Permitted Facility is operated by the tenant command and the EPA/State ID number that is assigned to NUWC Division, Keyport is used for all commands and contractors located on the NBK Keyport Installation, including the TSD Facility.

NUWC Division, Keyport performs testing, evaluation, and refurbishing of underwater systems and components. Dangerous waste generation occurs at designated shops and laboratories throughout the installation where wastes are accumulated in Central Accumulation Areas (CAAs) and then transferred to the TSD Facility. Other dangerous wastes, generated on the NBK Keyport Installation and other Regional Navy Installations are received for storage and treatment at the TSD Facility.

Dangerous and non-dangerous waste activities performed at the TSD Facility may include but not limited to: container storage, lab packing, tank storage, separation, filtration, disinfection, dewatering, drum de-heading, consolidation/volume reduction, drum shredding, triple rinsing, and drying.

EXAMPLE FOR COMPLETING ITEMS XII and XIII (shown in lines numbered X-1, X-2, and X-3 below): A facility has two storage tanks that hold 1200 gallons and 400 gallons respectively. There is also treatment in tanks at 20 gallons/hr. Finally, a one-quarter acre area that is two meters deep will undergo *in situ vitrification.*

Section XII. Process Codes and Design Capacities								**Section XIII. Other Process Codes**								
Line Number		**A. Process Codes** (enter code)			**B. Process Design Capacity**		**C. Process Total Number of Units**	**Line Number**		**A. Process Codes** (enter code)			**B. Process Design Capacity**		**C. Process Total Number of Units**	**D. Process Description**
					1. Amount	**2. Unit of Measure** (enter code)							**1. Amount**	**2. Unit of Measure** (enter code)		
X	**1**	**S**	**0**	**2**	**1,600**	**G**	**002**	**X**	**1**	**T**	**0**	**4**	**700**	**C**	**001**	**In situ vitrification**
X	**2**	**T**	**0**	**3**	**20**	**E**	**001**									
X	**3**	**T**	**0**	**4**	**700**	**C**	**001**									
	1	S	0	1	85,180	G	18		**1**							
	2	S	0	2	45,000	G	9		**2**							
	3	T	0	1	1,000	U	2		**3**							
	4								**4**							
	5								**5**							
	6								**6**							
	7								**7**							
	8							**1**	**8**							
	9							**1**	**9**							
1	**0**							**1**	**0**							
1	**1**							**1**	**1**							
1	**2**							**1**	**2**							
1	**3**							**1**	**3**							
1	**4**							**1**	**4**							
1	**5**							**1**	**5**							
1	**6**							**1**	**6**							
1	**7**							**1**	**7**							
1	**8**							**1**	**8**							
1	**9**							**1**	**9**							
2	**0**							**2**	**0**							
2	**1**							**2**	**1**							
2	**2**							**2**	**2**							
2	**3**							**2**	**3**							
2	**4**							**2**	**4**							
2	**5**							**2**	**5**							

XIV. Description of Dangerous Wastes																		

Example for completing this section: A facility will receive three non-listed wastes, then store and treat them on-site. Two wastes are corrosive only, with the facility receiving and storing the wastes in containers. There will be about 200 pounds per year of each of these two wastes, which will be neutralized in a tank. The other waste is corrosive and ignitable and will be neutralized then blended into hazardous waste fuel. There will be about 100 pounds per year of that waste, which will be received in bulk and put into tanks.

Line Number			A. Dangerous Waste No. (enter code)				B. Estimated Annual Quantity of Waste	C. Unit of Measure (enter code)	D. Processes									
									(1) Process Codes (enter)									(2) Process Description [If a code is not entered in D (1)]
X	**1**		**D**	**0**	**0**	**2**	**400**	**P**	**S**	**0**	**1**	**T**	**0**	**1**				
X	**2**		**D**	**0**	**0**	**1**	**100**	**P**	**S**	**0**	**2**	**T**	**0**	**1**				
X	**3**		**D**	**0**	**0**	**2**												**Included with above**
		1	D	0	0	1	750,000	P	S	0	1	S	0	2	T	0	1	
		2	D	0	0	2												Included with above
		3	D	0	0	3												Included with above
		4	D	0	0	4												Included with above
		5	D	0	0	5												Included with above
		6	D	0	0	6												Included with above
		7	D	0	0	7												and so on
		8	D	0	0	8												
		9	D	0	0	9												
	1	**0**	D	0	1	0												
	1	**1**	D	0	1	1												
	1	**2**	D	0	1	2												
	1	**3**	D	0	1	3												
	1	**4**	D	0	1	4												
	1	**5**	D	0	1	5												
	1	**6**	D	0	1	6												
	1	**7**	D	0	1	7												
	1	**8**	D	0	1	8												
	1	**9**	D	0	1	9												
	2	**0**	D	0	2	0												
	2	**1**	D	0	2	1												
	2	**2**	D	0	2	2												
	2	**3**	D	0	2	3												
	2	**4**	D	0	2	4												
	2	**5**	D	0	2	5												
	2	**6**	D	0	2	6												
	2	**7**	D	0	2	7												
	2	**8**	D	0	2	8												
	2	**9**	D	0	2	9												
	3	**0**	D	0	3	0												
	3	**1**	D	0	3	1												
	3	**2**	D	0	3	2												
	3	**3**	D	0	3	3												
	3	**4**	D	0	3	4												
	3	**5**	D	0	3	5												
	3	**6**	D	0	3	6												
	3	**7**	D	0	3	7												
	3	**8**	D	0	3	8												
	3	**9**	D	0	3	9												
	4	**0**	D	0	4	0												
	4	**1**	D	0	4	1												

	4	**2**	D	0	4	2												Included with above
	4	**3**	D	0	4	3												Included with above
	4	**4**	F	0	0	1												Included with above
	4	**5**	F	0	0	2												and so on
	4	**6**	F	0	0	3												
	4	**7**	F	0	0	4												
	4	**8**	F	0	0	5												
	4	**9**	F	0	0	6												
	5	**0**	F	0	0	8												
	5	**1**	F	0	0	9												
	5	**2**	P	0	1	0												
	5	**3**	P	0	1	2												
	5	**4**	P	0	1	5												
	5	**5**	P	0	1	8												
	5	**6**	P	0	2	9												
	5	**7**	P	0	9	8												
	5	**8**	P	1	0	6												
	5	**9**	P	1	0	8												
	6	**0**	P	1	1	9												
	6	**1**	P	1	2	0												
	6	**2**	P	1	2	1												
	6	**3**	U	0	0	1												
	6	**4**	U	0	0	2												
	6	**5**	U	0	0	8												
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	7	**5**	U	0	4	3												
	7	**6**	U	0	4	4												
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	9	**2**	U	0	7	8												
	9	**3**	U	0	7	9												
	9	**4**	U	0	8	0												
	9	**5**	U	0	8	3												
	9	**6**	U	0	8	4												
	9	**7**	U	0	9	6												

	9	**8**	U	1	0	2												Included with above
	9	**9**	U	1	0	7												Included with above
1	**0**	**0**	U	1	0	8												Included with above
1	**0**	**1**	U	1	1	2												and so on
1	**0**	**2**	U	1	1	5												
1	**0**	**3**	U	1	1	6												
1	**0**	**4**	U	1	1	7												
1	**0**	**5**	U	1	2	1												
1	**0**	**6**	U	1	2	2												
1	**0**	**7**	U	1	2	8												
1	**0**	**8**	U	1	3	4												
1	**0**	**9**	U	1	3	5												
1	**1**	**0**	U	1	4	0												
1	**1**	**1**	U	1	5	1												
1	**1**	**2**	U	1	5	4												
1	**1**	**3**	U	1	5	8												
1	**1**	**4**	U	1	5	9												
1	**1**	**5**	U	1	6	0												
1	**1**	**6**	U	1	6	1												
1	**1**	**7**	U	1	6	2												
1	**1**	**8**	U	1	6	5												
1	**1**	**9**	U	1	6	7												
1	**2**	**0**	U	1	6	8												
1	**2**	**1**	U	1	6	9												
1	**2**	**2**	U	1	8	8												
1	**2**	**3**	U	1	9	0												
1	**2**	**4**	U	1	9	6												
1	**2**	**5**	U	2	0	1												
1	**2**	**6**	U	2	0	2												
1	**2**	**7**	U	2	0	8												
1	**2**	**8**	U	2	0	9												
1	**2**	**9**	U	2	1	0												
1	**3**	**0**	U	2	1	1												
1	**3**	**1**	U	2	1	3												
1	**3**	**2**	U	2	1	7												
1	**3**	**3**	U	2	1	9												
1	**3**	**4**	U	2	2	0												
1	**3**	**5**	U	2	2	3												
1	**3**	**6**	U	2	2	5												
1	**3**	**7**	U	2	2	6												
1	**3**	**8**	U	2	2	7												
1	**3**	**9**	U	2	2	8												
1	**4**	**0**	U	2	3	9												
1	**4**	**1**	U	3	5	9												
1	**4**	**2**	W	P	C	B												
1	**4**	**3**	W	P	0	1												
1	**4**	**4**	W	P	0	2												
1	**4**	**5**	W	S	C	2												
1	**4**	**6**	W	T	0	1												
1	**4**	**7**	W	T	0	2												

XV. Map

Attach to this application a topographic map of the area extending to at least one (1) mile beyond property boundaries. The map must show the outline of the facility; the location of each of its existing and proposed intake and discharge structures; each of its dangerous waste treatment, storage, recycling, or disposal units; and each well where fluids are injected underground. Include all springs, rivers, and other surface water bodies in this map area, plus drinking water wells listed in public records or otherwise known to the applicant within ¼ mile of the facility property boundary. The instructions provide additional information on meeting these requirements.

See Attachment A.

XVI. Facility Drawing

All existing facilities must include a scale drawing of the facility (refer to Instructions for more detail).

See Attachment B.

XVII. Photographs

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment, recycling, and disposal areas; and sites of future storage, treatment, recycling, or disposal areas (refer to Instructions for more detail).

Photo 1: North Loading Area, December 2017

Photo 2: NW Corner, December 2017


Photo 3: SW Corner, December 2017


Photo 4: South Loading Area, December 2017

Photo 5: SE Corner, December 2017

Photo 6: SE Storage Area, December 2017

Photo 7: East Storage Area, December 2017

Photo 8: Drum Shredder, December 2017

Photo 9: NE Corner, December 2017

Photo 10: Truck Load/Unload Hose Station, December 2017

Photo 11: Lab (Rm 116), December 2017

Photo 12: Weight Scale (Rm 123), December 2017


Photo 13: Receiving Area (Rm 123), December 2017


Photo 14: Tank Storage Area (Rm 124), December 2017

Photo 15: Universal Waste Storage (Rm 126), December 2017

Photo 16: Drum Washing/Paint Consolidation (Rm 128), December 2017

Photo 17: Oxidizer Storage (Rm 129), December 2017

Photo 18: Acid Storage (Rm 130), December 2017

Photo 19: Reactive When Wet (Rm 131), December 2017

Photo 20: Poisons Storage (Rm 132), December 2017

Photo 21: ORG PER Storage (Rm 133), December 2017

Photo 22: Flammables Storage (Rm 134), December 2017

Photo 23: Flammables Class 1A (Rm 136), December 2017


Photo 24: Alkaline Room (Rm 138), December 2017

Photo 25: Used Oil Storage (Rm 139), December 2017

Photo 26: Shipping Area (Rm 140), December 2017

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XVIII. Certifications

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

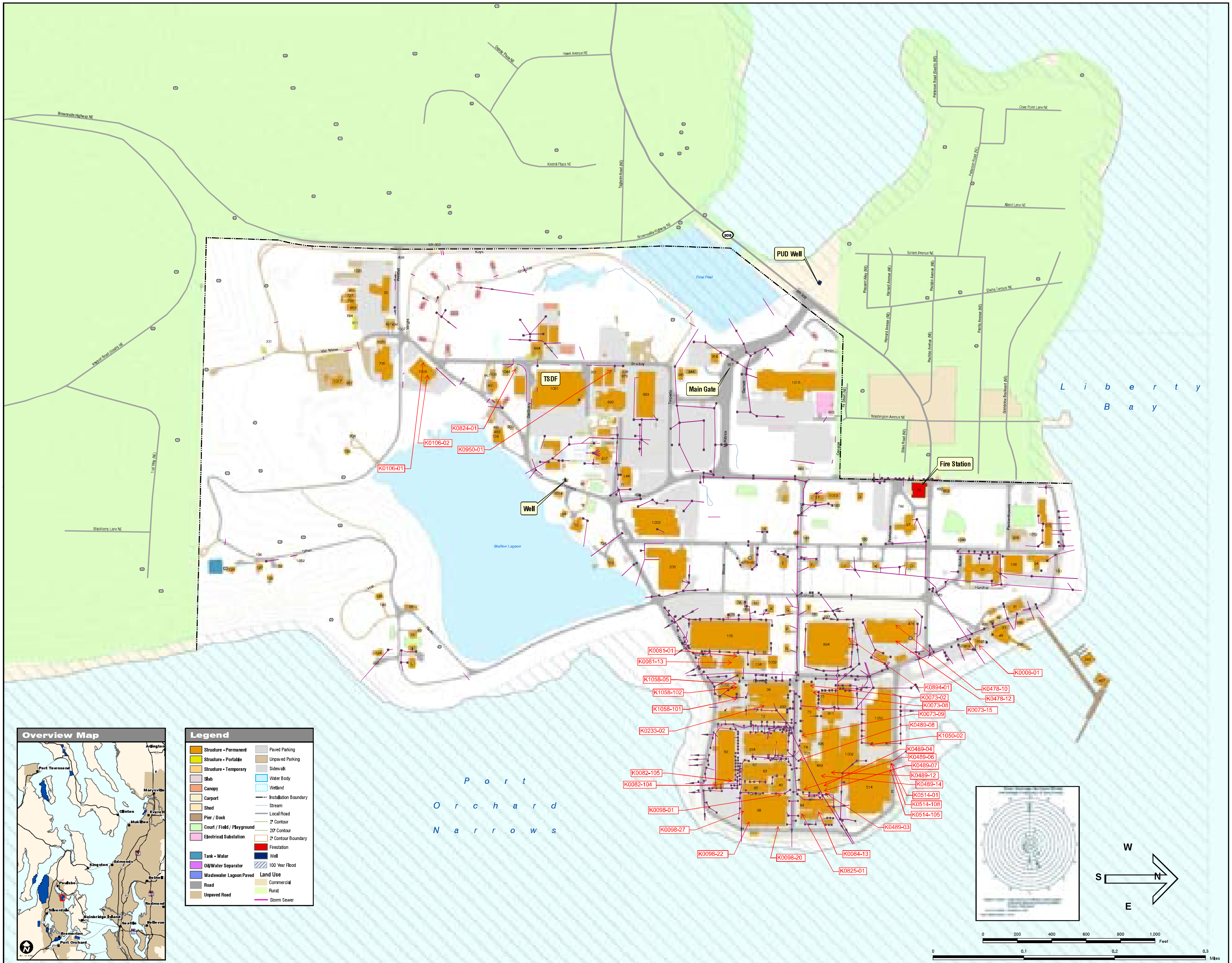
Operator Name and Official Title (type or print)	**Signature**	**Date Signed**
Captain C. P. Hoskins Commanding Officer, Naval Undersea Warfare Center Division, Keyport		
Facility/Property Owner Name and Official Title (type or print)	**Signature**	**Date Signed**
Captain C. P. Hoskins Commanding Officer, Naval Undersea Warfare Center Division, Keyport		

XIX. Comments

PART A

ATTACHMENT A

- **Section XV. Map**



Submit questions, requests, or updates to the RSIMS Center of Excellence: (360) 396-6047 http://www.rsims.navy.mil

SCALE
1 in = 200 ft

SIZE
37 in x 32 in

IF SHEET IS LESS THAN 37" X 32" IT IS A REDUCED PRINT AND THE SCALE IS REDUCED ACCORDINGLY

DEPARTMENT OF THE NAVY

NAVY REGION NORTHWEST

TITLE

NBK KEYPORT INSTALLATION TOPOGRAPHIC MAP

RSIMS DOCUMENT NUMBER
09 - KP - xxxxx

PRINT DATE
15 FEB 2017

PROJECTION
STATE PLANE, WA NORTH ZONE, DATUM NAD 83, FEET

FOR OFFICIAL USE ONLY

PART A

ATTACHMENT B

- **Section XVI. Facility Drawing**

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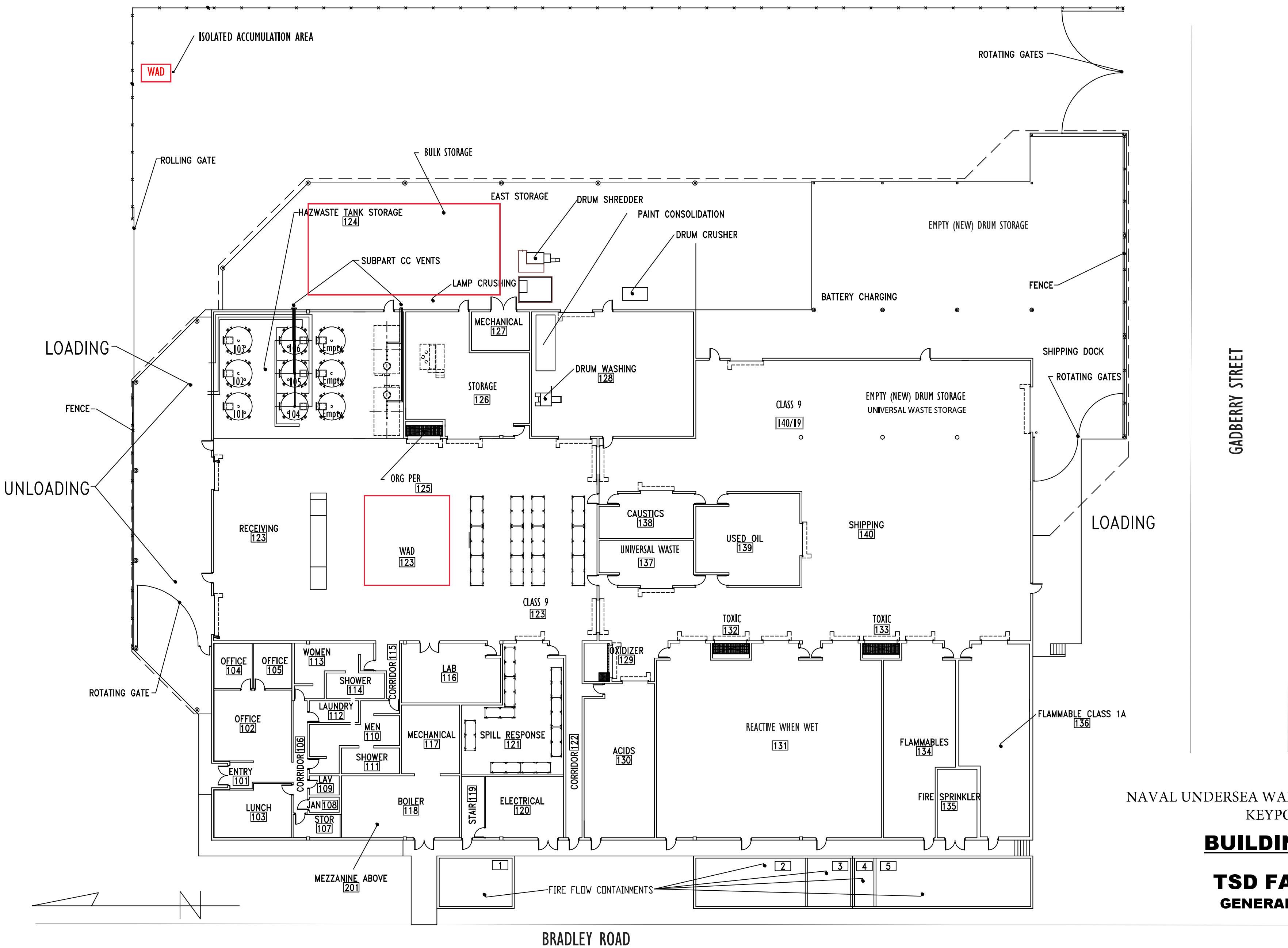

NAVAL UNDERSEA WARFARE CENTER DIVISION
KEYPORT, WA

BUILDING 1051

TSD FACILITY

GENERAL LAYOUT

SECTION B

FACILITY DESCRIPTION AND GENERAL PROVISIONS

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TABLE OF CONTENTS

LIST OF TABLES

APPENDICES

Appendix

B. FACILITY DESCRIPTION AND GENERAL PROVISIONS

WAC 173-303-806(4)(a)(i), (xi), (xviii)

B1. GENERAL FACILITY DESCRIPTION

WAC 173-303-690; -691; -692

B1.1 FACILITY OPERATIONS

B1.1.1 FACILITY LOCATION

Naval Undersea Warfare Center (NUWC) Division, Keyport is a tenant command on the Naval Base Kitsap Keyport (NBK Keyport) Installation. NBK Keyport will herein be referred to as the installation. NUWC Division Keyport manages all waste generated on the installation, owns the EPA/State ID number for the site, and owns and operates the Part B Permitted Facility. The installation occupies 343 acres, including tidelands, on a small peninsula near the town of Keyport, Washington. It is bordered by Liberty Bay on the east and north and by Port Orchard Reach on the southeast. Dogfish Bay, an extension of Liberty Bay, and the tide flats lie just to the west. Nearby communities include the town of Keyport, which is immediately adjacent to the installation; Poulsbo, which is about two miles north across Liberty Bay; and Silverdale, which is about six miles southwest. Most land use in the vicinity is low-density residential, commercial and light industrial.

The TSD Facility is located on the corner of Gadberry Street and Bradley Road. Gadberry Street borders it on the south, Bradley Road on the west, Buildings 951 and 820 to the north, and a large parking area to the east. The building is situated 50 feet from the centerline of Gadberry Street and Bradley Road.

Mailing Address:
Naval Undersea Warfare Center (NUWC) Division, Keyport
Code 1023 (Building 1051)
610 Dowell Street
Keyport, WA 98345-7610

B1.1.2 OWNERSHIP AND MANAGEMENT

Commanding Officer
Naval Undersea Warfare Center (NUWC) Division, Keyport

Environmental Director, NUWC Division, Keyport

Dangerous Waste Program Manager, NUWC Division, Keyport

B1.1.3 DANGEROUS WASTE CATEGORIES MANAGED

Table B1-1 lists the dangerous waste categories and processes managed at the installation.

Table B1-1. Waste stream Categories and Waste Process

Waste stream Category	Waste Process
Acids	S01,
Caustics	S01
Oil/Oily Process Waste	S01, S02, T01
Flammables and Combustibles	S01, S02, T01
Reactive when Wet	S01
Solids and Sludges	S01
Reactives and Oxidizers	S01
Fuel Wastes	S01, S02
Industrial Wastewaters	S01, S02
PCB Wastes	S01
Toxic/Carcinogenic Wastes (Not Otherwise Classified)	S01
Contaminated Debris	S01
Universal Wastes	S01

B1.1.4 PRODUCTION PROCESSES

Production processes that contribute to the dangerous waste streams at the installation include:

1. Machining
2. Painting
3. Plating
4. Assembly and Disassembly
5. Fueling and Defueling
6. Cleaning and Metal Preparation
7. Wastewater Treatment
8. Process Support

These processes are described in Section B1.2.1.

B1.1.5 OPERATIONS TO TREAT AND/OR STORE DANGEROUS WASTES

Central Accumulation Areas (CAAs) and Satellite Accumulation Areas (SAAs) are located throughout the installation. Locations of all CAAs are shown on the Topographic map located in Part A Form, Attachment A, and identified in appendix B-3.

The Industrial Waste Treatment Plant (IWTP) located on the installation is regulated by the WA Department of Ecology State Wastewater Discharge Permit #7353 and qualifies as a

Wastewater Treatment Unit (WWTU) in accordance to the Permit By Rule (PBR) provisions. PBR and Treatment By Generator (TBG) are further described in Section B1.2.5 and B1.3

Waste operations at the TSD Facility include:

A. Dangerous Waste Operations

    1. Container storage
    2. Tank storage
    3. Loose packing

Consolidation

B. Other Activities
    1. Drum de-header
    2. Consolidation/Volume Reduction/Compaction
    3. Oily wastewater separation
    4. Dewatering
    5. Aerosol can puncture
    6. Drum Shredding
    7. Triple Rinsing
    8. Disinfection
    9. Filtration
    10. Drying
    11. Separation

B1.1.6 WASTE MANAGEMENT PROCESSES THAT GENERATE WASTES

All waste generated at the installation and the TSD Facility is managed in accordance with NUWC Division Keyport Directives. These Directives are available to all employees on the installation intranet. Waste tracking is accomplished using a server-based computer database accessible to all dangerous waste management personnel. A detailed description of this waste tracking system is provided in Section C (Waste Analyses).

B1.1.7 HISTORY AND LOCATION OF UNITS REGULATED UNDER THE DANGEROUS WASTE REGULATIONS

The Installation has Sixty Solid Waste Management Units (SWMUs) and nine Areas of Concern (AOCs) that were identified in the NUWES, Keyport RCRA Facility Assessment draft report on 29 January 1992. The location of these SWMUs and AOCs are shown on an installation-wide map in appendix E1, and on individual building drawings in appendix E2. The current status of all SWMUs and AOCs are addressed in Section E (Releases from Solid Waste Management Units).

B1.2 DANGEROUS WASTE MANAGEMENT OPERATIONS AND PROCESSES

B1.2.1 HOW AND WHERE DANGEROUS WASTE IS GENERATED AT THE FACILITY

The TSD Facility generates very little dangerous waste, mostly from the consolidation process. However, dangerous waste generation occurs at designated shops and laboratories throughout the installation. Wastes are accumulated in marked compatible containers while located in the accumulation sites. These satellite wastes may be further accumulated in CAAs or they may be transferred directly to the TSD Facility. Wastes held in CAAs are transferred to the TSD Facility within 90 days from the accumulation start date.

B1.2.1.1 Dangerous Waste Generation Sites on Installation

The following is a general description of the processes that constitute the majority of the dangerous wastes generated at the installation:

1). MACHINING

A wide range of materials are machined for use in systems and subsystems, as well as support and maintenance equipment. A laser cladding operation and several large multi-axis machining centers, as well as grinding equipment are located in building 233. Metal forming and welding processes are located in building 38. Machining operations such as milling, drilling and turning are located in building 84. Welding operations also take place in building 824.

2). PAINTING

The majority of painting, of almost every type, is performed (e.g., epoxy, powder, enamel, latex) in building 84. This category includes the painting of components and various subsystem components that are refurbished or manufactured, as well as the painting of base equipment and facilities. Spray cans are used in various buildings for small jobs such as stenciling or touch up.

3. PLATING

System components are plated in building 1058 to resist corrosion or to improve properties. Keyport has type I, type II, and type III anodize capabilities for aluminum, and performs general and precious metal electroplating (including cadmium, nickel, gold, silver, and others) and a variety of cleaning, stripping, and surface finish operations. An anodize touch-up process known as Alodine treatment takes place in buildings 81a, 84, 98, 489, 514 and 1058.

4. ASSEMBLY AND DISASSEMBLY

Various system components are disassembled and reassembled during repair and/or testing in buildings 81, 82, 98, 489, 514, 894, and 1050. These operations comprise a wide range of assembly-type functions including electronic potting, mechanical and circuit board assembly, small part casting and plastics processing.

5. FUELING AND DEFUELING

Otto Fuel II, a monopropellant, requires unique handling, storage, and waste procedures. System components using Otto Fuel II must be defueled and the unused fuel is processed for re-use. These processes take place in building 514 and 1049.

6. CLEANING AND METAL PREPARATION

Cleaning operations are performed prior to assembly, painting, or plating. Nearly every type of commercially available cleaning system is employed, including sandblasting, plastic media blasting, acid baths, caustic baths, chemical solvents of all types, steam cleaning, and pressurized water cleaning. These processes take place in buildings 84 and 1058. There is also a blasting booth in building 84 that uses sodium bicarbonate instead of plastic or glass media. Alcohol and spray cans of electrical cleaner are used in various buildings for spot cleaning of solder flux or electrical connectors.

7. WASTEWATER TREATMENT

Liquid wastes that are treatable are piped or trucked to building 825, the Industrial Waste Treatment Plant (IWTP), where they are treated and discharged into the municipal sewer under Washington State Waste Water Discharge Permit #7353. The industrial operations on the installation produce heavy metal containing wastewaters. The treatment process produces an effluent that meets regulatory discharge limitations with a reduction in the sludge volume and chemical usage. The precipitated heavy metal sludge that are by-products of the process are dewatered and are deposed as a dangerous waste through the TSD Facility. Types of treatment processes at the IWTP are: metal precipitation, neutralization, clarification, flocculation, filtration, and dewatering.

8. PROCESS SUPPORT

This category covers areas which are not directly tied to a major function, but which exist by offering services to other processes as required. Examples of this support are the chemistry laboratory, the failure analysis laboratory, etc.

Table B1-2 Waste Processes by Building Number

Building Number	Processes
38	Machining and Welding
81	Alodine Treatment, Assembly and Disassembly
82	Assembly and Disassembly, Process Support
84	Machining, Alodine Treatment, Painting, Cleaning and Metal Preparation
98	Alodine Treatment, Assembly and Disassembly
206	Process Support (Laboratory)
233	Machining
489	Alodine Treatment, Assembly and Disassembly
514	Alodine Treatment, Assembly and Disassembly, Fueling and Defueling
824	Welding
825	Wastewater Treatment
894	Assembly and Disassembly
1049	Fueling and Defueling
1050	Assembly and Disassembly
1058	Plating, Cleaning and Metal Preparation

B1.2.2 HOW AND WHERE DANGEROUS WASTE GENERATED OFF-SITE ENTERS THE FACILITY

Trucks transporting dangerous wastes from locations other than the installation enter at the Main Gate located off State Route 308, from which they are directed to building 1051, the TSD Facility. The Dangerous Waste Program Manager will confirm that the waste received matches the identity of the waste on the accompanying manifest. The manifest and the load on the truck are inspected to verify:

1. The correct number of containers of each type of waste or the correct volume if transported in bulk.
2. The information on the manifest is correct.
3. The containers are not leaking, are properly labeled, and are in approved storage containers.
4. The waste listed on the manifest is also checked to ensure that there is an approved profile on file for the generator.

The Dangerous Waste Program Manager or Designator signs the manifest and the truck is then directed to unload at the TSD Facility. The waste is then entered into the tracking system as set forth in Section C (Waste Analyses) and stored onsite as set forth in Section D (Process Information). Additionally, the TSD Facility submits an electronic manifest (e-manifest) in accordance to the Hazardous Waste Electronic Manifest Establishment Act.

Sampling of containers for waste verification is conducted at the TSD Facility following waste acceptance pursuant to the procedures identified in Section C (Waste Analyses).

Discrepancies are managed according to the procedures identified in Section C (Waste Analyses).

Currently, the TSD Facility is only accepting waste from other Navy government facilities.

B1.2.3 HOW WASTE IS TRACKED

Internal waste transfers from NUWC Division, Keyport waste accumulation stations are transferred to the TSD Facility by use of a Waste Disposal Request Form. The labels on the waste material are checked against the information provided on the Waste Disposal Request Form by the TSD Facility personnel. Refer to appendix C2, Example Waste Management Forms, for an example form. The Waste Disposal Request Form follows the waste to the TSD Facility, where the information is logged into the computer tracking system.

A more detailed description of the computer-based tracking system is provided in Section C (Waste Analyses).

B1.2.4 WHERE THE WASTE IS TREATED AND/OR STORED

The TSD Facility, Building 1051, is a 44,000 square foot one-story enclosed structure with approximately 18,000 square feet of attached exterior covered area. A diagram of the TSD Facility floor plan is shown in attachment B to the Part A form. Treatment, Storage and Disposal Facility Drawings. The enclosed structure consists of three basic functional areas: (1) the warehouse which consists of the tank area, container handling and storage areas, and waste process/treatment areas; (2) personnel areas comprised of office spaces, laboratory, lunch room, and toilet/shower facilities; and (3) mechanical/storage areas comprised of a mezzanine level for heating, ventilation and air conditioning equipment, boiler rooms, electrical room, fire protection, and spill response storage. The exterior covered area consists of the truck loading/unloading dock, empty (new) drum storage, drum shredder, asbestos storage bin, battery charging station, and the soil dewatering areas.

The receiving area, room 123, is located in the center of the north end of the TSD Facility adjacent to the truck loading/unloading bay. The area includes scales; Dangerous Waste accumulation, drums for consolidating incoming partially filled drums, and a drum compactor. The area also includes several three-shelf pallet storage racks. Waste Awaiting Designation (WAD) is stored between the receiving area and the Class 9 (ORM) area in individual secondary containments until the waste has been designated and can be assigned to a compatible storage area.

The staging/shipping area, room 140, is located at the south end of the TSD Facility. This area is for organizing, inspecting, and preparing shipments of containers. The shipping area provides direct access to the covered shipping dock and truck loading facility. The area has secondary containment and fire flow containment which is shared with the tank and treatment areas.

The tank area, room 124, is located in the northeast corner of the TSD Facility and is adjacent to the truck load/unload area. The tank area houses a total of nine 5,000-gallon steel tanks for a total storage capacity of 45,000 gallons. Six vertical tanks are currently in use and described in detail in Section D (Process Information). The remaining three vertical tanks may eventually be brought on-line depending on usage and monetary constraints. All tanks are coated with chemical resistant epoxy. Air emission control is provided as discussed in Section D (Process Information). The tank area has 7,000 gallons of secondary containment in addition to fire flow containment.

The treatment process of separating two-phase systems from their natural and equilibrium states is performed in tanks 104/105 and tanks 101/102. This decanting process allows us to separate out the water layer from the rest of the waste stream in order to reduce the waste stream volume.

The enclosed container storage area has capacity for a total of 67,925 gallons of storage, and each area is separated by a minimum of 4-hour firewalls between the storage compartments. The storage compartments were determined based upon segregation of wastes according to Military/Handbook 1005/13 and 49 CFR 173. A new outside bulk storage area under the roofline within the East Storage location has been configured to store hazardous construction debris in roll-offs on a case by case basis as well as portable containers with secondary containment. We also established an isolated accumulation area for contingency purposes. This new area will increase the overall storage by less than 25% to 85,180 gallons. The total storage capacity for this new area will be 17,255 gallons.

Other major equipment items are located in room 126, which houses the chromic acid wastewater pretreatment unit and room 128, which houses the drum washer, drum de-header, and paint consolidation units. Several dumpsters are located outside, under the canopy on the east side of the TSD Facility. The drum treatment equipment in room 128 and the dumpsters are used exclusively for non-contaminated drums and metals. The dumpster contents are shipped to a recycler.

Batteries are stored in room 130 (acids), room 131 (reactive when wet), and room 138 (caustics). They are shipped out as universal waste. Due to the limited space in room 138, silver-zinc batteries may also be stored in room 140 (shipping).

Fluorescent tubes received from onsite dangerous waste accumulation sites and from offsite are stored in room 137 (Universal Waste). Tubes are stored in their original shipping containers or equivalent to protect them from breakage and are shipped off as universal waste.

The mechanical areas are located in room 117, on the west side of the building, and room 127 on the east side of the building. The TSD Facility is heated with boilers and a hydronic heating water system. Two boilers for this system are located in the boiler room, room 118, which has outside access through double doors to facilitate service and maintenance. The boiler room opens directly into the mechanical room which houses additional equipment for the heating system such as pumps, tanks, and fuel tanks. A breathing air compressor is also located in the mechanical room. Other mechanical rooms include an electrical controls room, fire protection room containing sprinkler system risers, and a 3,300 square foot mechanical mezzanine housing the heating, ventilation, and air conditioning equipment.

Room 121, the spill response storage room, is accessed off the receiving area. This storage room is approximately 1,000 square feet and is equipped with shelving and lockers for supplies and equipment for the TSD Facility and the spill responders.

B1.2.5 EQUIPMENT AND STRUCTURES USED TO TREAT AND/OR STORE DIFFERENT CATEGORIES OF DANGEROUS WASTES

The waste stream categories listed in the Part A are either stored in containers (S01), stored in tanks (S02), or treated (T01). Table B1-1 lists the waste stream categories and the waste processes of each category.

The dangerous waste process activities subject to the dangerous waste permit at the TSD Facility include:

1. Container Storage
2. Tank Storage
3. Loose Packing
4. Consolidation/Volume Reduction/Compaction
5. Separation

Containers are processed at the main receiving dock at the north end of the TSD Facility. The containers are then moved to the covered receiving area where they are inspected and sampled as set forth in Section C (Waste Analyses). Containers are logged in and placed in storage within two working days. The receiving area is capable of holding a maximum of 144 drums at one time. Drums are palletized and stored on pallet racks within the various storage compartments. The storage capacity for containerized dangerous waste inside the facility is 67,925 gallons. Containers are stored in segregated and enclosed storage areas in the TSD Facility. Each storage area has spill containment, fire flow containment, ventilation, and fire rated construction.

In the receiving area, compatible wastes may be consolidated into loose packs that contain a variety of wastes including discarded laboratory chemicals, adhesives, and paints. Items for loose packing are received at the TSD Facility in drums and bags, and metal, glass, plastic and carton containers. Loose packs are packaged according to the requirements of the Department of Transportation (DOT) in 49 CFR 173.2 and WAC 173-303-161. Items are identified to assess the hazardous characteristics and to determine proper disposal arrangements and manifesting requirements. Only trained Keyport Waste Handlers construct the loose packs.

There are nine 5,000-gallon vertical waste storage tanks in room 124. These tanks are each supported on steel legs, coated with chemical resistant epoxy and equipped with level sensors and alarms. Only six of the tanks are certified for storage of dangerous wastes at this time. Bulk dangerous waste is transported to the TSD Facility from the site of waste generation on base by tank truck. Occasionally, bulk waste will be transported in portable containers. There are two hose stations for the transfer of bulk waste into and out of tanks; the truck-load hose station and truck unload hose station. The truck arrives at the main truck load/unload bay on the north side of the TSD Facility. A transfer flex hose is connected to the manifold at the truck unload hose station. The transfer flex hoses have quick connect, no drip couplings, and are chemical resistant. If wastes are transported in a portable tank, an air-operated diaphragm pump made of chemical resistant construction is attached. The pumps are portable, skid-mounted, self-contained, and located within the secondary containment basin during operations. There are two of these portable pump units available at the TSD Facility. For off-site disposal, the contractor tank truck arrives at the loading dock on the north end of the TSD Facility. A transfer flex hose is attached to the truck tank and to the discharge manifold at the truckload hose station. The bulk waste is pumped from the storage tank to the truck tank.

Paint consolidation takes place in room 128. The process takes place under vacuum and is designed to remove all liquids and volatiles from the containers (including aerosol cans). Volatiles are filtered through a pair of carbon filters in series prior to venting to the atmosphere. The carbon filters are changed as set forth in section D (Process Information).

Drums are prepared for shredding in room 128. Residues from waste containers are consolidated in an appropriate consolidation container. The consolidation container is sealed and transferred to the appropriate storage location after the transfer process is complete. Next the top is removed from bung drums on the drum de-header. Bung drums, with the top removed, and open-top drums are washed in an enclosed industrial drum washer. Wastewater from the drum washer is piped to the oily wastewater tanks in room 124. Decontaminated drums are shredded in the drum shredder under the east canopy adjacent to room 128.

Miscellaneous minor consolidation also takes place in each of the storage areas. These wastes are received from waste accumulation sites prepackaged for safe handling. The containers are not opened at the TSD Facility unless required for verification testing per Section C (Waste Analyses), but are placed directly in the consolidation drum in the appropriate storage area immediately after inspection and logging in at the receiving area. Other consolidation/volume reduction takes place on the east storage area utilizing debris compactors. A fume hood has been installed in the room 130 (acids storage) for emergency response. If a damaged container or a container incompatible with its contents, is received at the TSD Facility; it is immediately transferred to this location, and the contents are transferred to an appropriate container under vacuum.

Because of the unique storage and handling requirements for lithium batteries (no contact with water, highly specialized fire-fighting equipment), the 'reactive when wet' storage area, room 131, is occasionally used to store and process 'A' condition lithium batteries (i.e. usable batteries). These batteries are used to power Unmanned Undersea Vehicles. When a portion of this room is used for lithium material storage and handling operations, these operations take place in a separated, marked off, specifically designated area, well away from the lithium waste storage area.

B1.3 "TREATMENT BY GENERATOR" AND "PERMIT BY RULE" PROCESSES

B1.3.1 TREATMENT BY GENERATOR

Treatment by Generator is currently not being performed at the TSD Facility. However, Treatment by Generator is performed at NUWC Keyport Bldg. 73. A 3D metal printing machine creates metal fines that are highly flammable. In order to reduce risk of ignition, the equipment Operations and Maintenance Manual directs operators to passivate the metal fines with dry quartz sand and silicone oil. This reduces flammability and makes the waste safer to handle. Waste is stored in the same Central Accumulation Area where treatment occurs (CAA K0073-15). A waste treatment log is kept on-site to document treatment dates and quantities.

B1.3.2 PERMIT BY RULE

Industrial wastewater pretreatment takes place at the Industrial Waste Treatment Plant (IWTP), Building 825. The IWTP is regulated by the WA Department of Ecology State Wastewater Discharge Permit #7353 and qualifies as a Wastewater Treatment Unit (WWTU) in accordance to the PBR provisions. The following generated wastes are treated at the IWTP and are also documented in the discharge permit.

1. Building 38 deburring machines
2. Building 514 Fuel recovery system
3. Building 1058 metal cleaning and preparation facility
4. Building 82 Battery Shop -Potassium Hydroxide Tank
5. Building 206 Laboratory – Acids
6. Other treatable waste streams – compatible wastes are processed through the IWTP on an as needed basis.

B1.4 PROCESSES INVOLVING WASTES THAT DO NOT DESIGNATE

Sludge removed from storm water catch basins throughout the installation is de-watered in a sloped area under the east canopy. These sludges have been analyzed in the past, and they have never designated as dangerous waste. Only installation-generated sludge is dewatered. The area is divided into two sections, one is in the process of drying, and the second is for new sludge. The down slope portions of the dewatering areas are surrounded by and divided by straw bales. The area is drained to a blind sump from which the wastewater is pumped to the oily wastewater tanks. Dried sludge is tested for contaminants to ensure it does not designate and disposed of at the local landfill. Sludge from catch basins in the vicinity of any documented spills is tested prior to depositing in the dewatering area and disposed of through the TSD Facility without dewatering if it designates as a dangerous waste.

Drums that have been tripled rinsed at the TSD Facility (see B1.b (5) above) are shredded at the TSD Facility under the east canopy. Rinse-water is reused to minimize waste generation and the shredded metal is recycled through the Defense Reutilization and Marketing Office (DRMO).

Used oil and oily rags are consolidated in room 139. Only wastes from known sources (Waste Disposal Request approved) are consolidated in this process. This process takes place in compliance with the requirements of WAC 173-303-515.

B1.5 SUMMARY OF ALL OTHER ENVIRONMENTAL PERMITS AT FACILITY

The installation includes the tenant command of NUWC Division, Keyport and is subject to the following permits:

1. WA State Waste Water Discharge Permit #7353
2. PSCAA Registered Facility (Synthetic Minor) GRO 8258
3. NPDES Multisector Industrial Storm water Discharge Permit #WAR05A64F

B2. SEISMIC RISK CONSIDERATIONS

WAC 173-303-806(4)(a)(xi)

The installation is classified as a Seismic Zone D2. A Seismic map of Washington State is included in appendix B1. There are no faults which have had displacement in the Holocene time, and no lineations which suggest the presence of a fault, with displacement in the Holocene time, within 3,000 feet of the TSD Facility. This seismic evaluation is based on:

1. Review of published geologic and seismicity data which included reconnaissance and local studies, interpretation of subsurface well data, and analysis of geophysical data consisting of aeromagnetic and gravity anomalies and marine seismic reflection profiles.

2. Examination of aerial photographs and Seismotectonic Maps of the Puget Sound.

The TSD Facility has been designed to seismic zone 3 requirements, which were in effect at the time the TSD Facility was designed and built.

B3. TRAFFIC INFORMATION

WAC 173-303-806(4)(a)(x)

This section provides information on traffic volumes, patterns, and vehicle type associated with access to the Naval Undersea Warfare Center (NUWC) Division, Keyport TSD Facility. Traffic control measures and transportation routes are also discussed.

The Installation is located on the Kitsap Peninsula and is in Kitsap County on Puget Sound approximately 15 miles west of Seattle. The installation shares a small peninsula with the town of Keyport, which is bordered on the north and east by Liberty Bay and by Port Orchard Reach on the southeast. State Route 308 provides vehicle access and terminates on this peninsula. State Route 308 connects with State Route 3 approximately 3 miles west of Keyport and with NBK Bangor an additional ½ mile west. State Route 3 serves as the main vehicle access to all routes leading out of Kitsap County from the installation.

The TSD Facility site is located on the installation. The site is bordered by Gadberry Street on the south, Bradley Road on the west, Buildings 951 and 820 to the north, and a large parking area to the east.

B3.1 TRAFFIC VOLUMES, PATTERNS, AND VEHICLE TYPE

The following vehicles are utilized for dangerous waste handling operations at the TSD Facility:

1. Forklifts (3)
2. Vacuum Trucks (3)
3. Flat Bed Truck (1)

These vehicles are used to transport dangerous waste from the generators and CAAs to the TSD Facility and to deliver containers to these sites. Waste collection and transfer to the TSD Facility is performed daily, based on a schedule that provides for pickup at every site within a 90-day period. Unscheduled pickups are made when requested. Delivery of containers to the generators is also made on a scheduled basis. Additional traffic volume results from commercial and contractor truck deliveries of supplies and waste shipments off site for disposal or treatment, and employee commuter traffic. An estimated fifteen loads of containers and twelve loads of bulk liquid waste are shipped off site every year for treatment and disposal.

Dangerous waste is transported off site in tanker trucks with an average capacity of 4,300 gallons or in containers on flat bed or semi-trucks with a capacity of 80 to 100 drums. Waste handling traffic on the installation from CAAs to the TSD Facility is limited to forklifts transporting portable containers of various sizes, vacuum tank trucks with capacities of up to 1,500 gallons, and flatbed trucks transporting containers.

Access to the installation is from State Route 308 through the main gate on the west boundary of the installation. All truck traffic enters and exits through the main gate. Truck access to the TSD Facility site comes through the main gate, travels east on McKittrick Road, south on "A" Street to Prichard Street, south on Prichard to Gadberry Street, and west on Gadberry to the site. Truck traffic routes are shown in appendix B2. NUWC Division, Keyport dangerous waste transport vehicles utilize various routes to and from the many pickup sites and shops on the installation.

Two main north/south arterials provide access to the TSD Facility site from other locations on the installation. Bradley Road is located along the west side of the site and serves as a major link between the main gate area and the Public Works Support Area and industrial activities located in the southern portion of the installation. A major parking area located directly west of the TSD Facility is also accessed via Bradley Road. Prichard Street is located east of the TSD Facility and runs from its intersection to the north with "A" Street and Hunnicutt road south to its terminus at Westfall Road. Prichard Street serves as the main arterial for traffic between all points within the installation. Gadberry Street runs east/west connecting Bradley Road and Prichard Street and is located along the south side of the TSD Facility. All roads consist of asphalt pavement surfaces.

A truck maneuvering area at the TSD Facility is provided along the east side of the building. The truck maneuvering area, the north truck bay, and the south truck dock are fenced and access is provided through a gate on Gadberry Street and at gates at the north end of the TSD Facility off Bradley Road. The traffic pattern within the fenced truck maneuvering area is a one-way pattern with vehicles entering through the gate at Gadberry Street, traveling north, and exiting through the north gate or through the covered truck bay at the north end of the building. Departing trucks will travel north on Bradley Road to Torpedo Road and continue on to the main gate. Refer to appendix B2.

Vacuum tank trucks transferring bulk liquid waste to the storage tanks inside the TSD Facility unload through the Truck Unload Hose Station located in the covered truck bay at the north end of the TSD Facility. Tanker trucks loading bulk liquid waste for shipment off site load at the Truck Loading Hose Station also located in the covered truck bay at the north end of the TSD Facility. Trucks enter the truck bay from the truck maneuvering area and exit through the truck bay gate to Bradley Road. Flatbed trucks transporting waste-filled containers to the TSD Facility from the CAAs arrive at the covered truck bay at the north end of the TSD Facility. Forklifts transport the portable containers into the tank storage area where their contents are transferred into the bulk storage tanks. All forklift and service vehicle traffic into and out of the building is through the covered truck bay at the north end of the TSD Facility.

Forklift and/or lift truck traffic patterns within the TSD Facility are predominantly a north-south flow between the general open warehouse areas and the segregated waste storage compartments.

Waste-filled containers delivered to the receiving area at the north end of the building are transferred by forklift to one of the enclosed waste storage compartments at the southwest side of the building through 14-foot wide corridors. Palletized containers are transferred from the storage compartments to the open staging area at the south end of the building and from there to the covered loading docks on the south and east side of the building.

Incoming supplies of clean containers are off-loaded at the east dock and transferred to the new drum storage area also located on the east side of the building. When needed, the new drums are transferred by forklift from the storage area to the receiving area via a forklift corridor on the east side of the building.

Two truck loading/unloading platforms with adjustable dock levelers are located at the south and southeast end of the TSD Facility at the shipping dock. Trucks delivering supplies or loading out waste-filled containers can utilize these docks. One of the docks is accessed by backing in from Gadberry Street. Trucks leaving this dock enter Gadberry Street and turn north on Bradley Road to return to the main gate. The second dock is accessed from within the truck maneuvering area. Trucks leaving this dock follow the one-way traffic pattern established for this area.

B3.2 TRAFFIC CONTROL

NBK Keyport is a secure military installation not accessible by the general public. All traffic enters the installation through manned security gates. No individual or vehicle is allowed to enter without first obtaining a clearance pass. Prior to obtaining a pass, all vehicles are inspected to ensure that they are in proper mechanical working order. Maximum speed limits on the installation is 20 mph or less.

Traffic on the TSD Facility site not directly related to dangerous waste activities is limited to the paved visitor parking area at the northwest corner of the site off Bradley Road. Traffic on the site is controlled by means of three gates into the fenced truck area. Each gate has a posted sign specifying that access is limited to 'authorized personnel' only. Trucks and vehicles are not operated inside the building. All container and pallet handling inside the building is performed by forklifts.

Outgoing dangerous waste shipments are pre-scheduled and contracted through the Defense Logistics Agency (DLA). All outgoing waste shipments are inspected, recorded through the waste tracking system, and manifested per Washington Department of Ecology, US Environmental Protection Agency and the Federal Department of Transportation regulations.

B3.3 ROADWAYS AND ASPHALT SURFACES

State Route 308, which provides access to the installation, is constructed of asphalt and is under the jurisdiction of the State of Washington. The roadways within the installation are asphalt or asphalt concrete and controlled by the Navy. The maximum gross vehicle weight is 80,000 pounds as established by the Washington State Department of Transportation.

There is a large volume of commercial and government operated truck traffic entering and exiting the installation on a daily basis, and all roadways within the installation are constructed to handle the maximum load limits of these trucks. The paved roadways and truck operating areas of the TSD Facility are paved with asphalt and constructed to comply with the 1991 State of Washington Department of Transportation Standard Specifications for Roads, Bridges, and Municipal Construction.

B4. TOPOGRAPHIC MAPS

WAC 173-303-806(4)(a)(xviii)

The figures referenced in this section contain information required to describe topographic data and other site features at the installation.

Please see Part A Form Attachment A for the Installation Topographic map. It shows the following details:

1. Map scale & date, a wind rose and map orientation
2. Major buildings and contour intervals sufficient to show surface water flow
3. 100-year flood plain area and surface waters
4. Legal boundaries, access control and surrounding land uses

5. Withdrawal wells (there are no injection wells at the installation)
6. Runoff control systems and CAAs

The locations of SWMUs and AOCs are shown in Section E.

SECTION B

APPENDIX B1

Seismic Map

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Seismic Design Category Maps for Residential Construction in Washington

by James L. Poelstra and Stephen P. Palmer

July 2004

Plate 1: Site Class D Assumed Statewide

SECTION B

APPENDIX B2

TRAFFIC ACCESS ROUTES

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TRAFFIC ACCESS ROUTES

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SECTION B

APPENDIX B3

NBK KEYPORT INSTALLATION CENTRAL ACCUMULATION AREAS

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NBK Keyport Installation Central Accumulation Areas

BLDG #	SITE #	SITE LOCATION	DOT ID	ERG Guide No.	ERG ID Name	PROCESSES
6	K0006-01	Outside Bldg. 6, East Side (Along Quayewall)	UN1993	128	Flammable liquid, n.o.s.	Process Support: Drained fluids and painting in performing vessel/equipment maintenance.
			UN1263	128	Paint (flammable)	
73	K0073-02	Outside Bldg. 73, NW Corner	NA3082	171	Environmentally hazardous substance, liquid, n.o.s.	Machining Operations: Oil and oily water wastes, Treatment by Generator for Metal 3D Printer metal fines.
			UN1993	128	Flammable liquid, n.o.s.	
	K0073-08	Outside Bldg. 73, NW Corner	UN1993	128	Flammable liquid, n.o.s.	
			UN3082	171	Environmentally hazardous substance, liquid, n.o.s.	
			UN3175	133	Solids containing flammable liquid, n.o.s.	
	K0073-09	Bldg. 73 SW Corner	N/A	N/A	Oily Debris	
	K0073-15	Bldg. 73 Inside, 3D printing room	UN3189	135	Metal Powder, Self-Heating, n.o.s (Chromium, Nickel)	
81	K0081-01	Outside Bldg. 81A, NW Corner	NA3082	171	Environmentally hazardous substance, liquid, n.o.s.	Assembly/Disassembly and Alodine Treatments Operations: Alodine contaminated rags and wastewater; greasy rags and gloves, alcohol saturated rags, and bonding agents
			UN1950	126	Aerosols	
			UN1993	128	Flammable liquid, n.o.s.	
			UN2735	153	Amines, liquid, corrosive, n.o.s.	
			UN2810	153	Toxic liquid, organic, n.o.s.	
			UN2922	154	Corrosive liquid, toxic, n.o.s.	
			UN3175	133	Solids containing flammable liquid, n.o.s.	
			UN3264	154	Corrosive liquid, acidic, inorganic, n.o.s.	
	K0081-13	Inside, middle of room (Designated Storage Area)	UN3175	133	Solids containing flammable liquid, n.o.s.	
			UN3264	154	Corrosive liquid, acidic, inorganic, n.o.s.	
82	K0082-01	Outside Bldg. 82, East Side	UN1993	128	Flammable liquid, n.o.s.	Assembly/Disassembly and Process Support Operations: Greasy rags and gloves, alcohol saturated rags, and oily wastewater from parts washer.
			UN2735	153	Amines, liquid, corrosive, n.o.s.	
	K0082-104	Outside Bldg. 82, East End	NA	NA	Oily Water	
	K0082-105	Outside Bldg. 82, NE Corner	NA	NA	Corrosive liquids (acids and bases) and metal salts treated at Bldg. 825	
84	K0084-13	Outside Bldg. 84, East Side	NA3077	171	Environmentally hazardous substance, solid, n.o.s.	Cleaning and Metal Preparation: Greasy rags and gloves, alcohol saturated rags, washwater from parts cleaner, paints and blast media.
			UN1263	128	Paint related material (flammable)	
			UN1950	126	Aerosols	
			UN3175	133	Solids containing flammable liquid, n.o.s.	
			UN1950	126	Aerosols	
			NA3077	171	Environmentally hazardous substance, solid, n.o.s.	
			NA3077	171	Environmentally hazardous substance, solid, n.o.s.	
			NA3077	171	Environmentally hazardous substance, solid, n.o.s.	
98	K0098-01	Outside Bldg. 98, NW Corner	NA3077	171	Environmentally hazardous substance, solid, n.o.s.	Assembly/Disassembly and Alodine Treatment Operations: Greasy rags and gloves, alcohol saturated rags, oily wastewater from parts washer and alodine contaminated rags and wastewater
			UN1935	157	Cyanide solution, n.o.s.	
			UN1993	128	Flammable liquid, n.o.s.	
			UN2735	153	Amines, liquid, corrosive, n.o.s.	
			UN2810	153	Toxic liquid, organic, n.o.s.	
			UN3028	154	Batteries, dry, containing Potassium hydroxide solid	
			UN3077	171	Environmentally hazardous substance, solid, n.o.s.	
			UN3175	133	Solids containing flammable liquid, n.o.s.	
	K0098-20	Supply Cage NE Side of Bldg.	NA3077	171	Environmentally hazardous substance, solid, n.o.s.	
			NA3082	171	Environmentally hazardous substance, liquid, n.o.s.	
			UN1090	127	Acetone	
			UN1263	128	Paint (flammable)	
			UN1935	157	Cyanide solution, n.o.s.	
			UN1950	126	Aerosols	

NBK Keyport Installation Central Accumulation Areas

BLDG #	SITE #	SITE LOCATION	DOT ID	ERG Guide No.	ERG ID Name	PROCESSES
98	K0098-20	Continuation	UN1956	126	Compressed gas, n.o.s.	Assembly/Disassembly and Alodine Treatment Operations: Greasy rags and gloves, alcohol and fuel saturated rags, oily wastewater from parts washer and alodine contaminated rags and wastewater
			UN1993	128	Flammable liquid, n.o.s.	
			UN2735	153	Amines, liquid, corrosive, n.o.s.	
			UN2922	154	Corrosive liquid, toxic, n.o.s.	
			UN3077	171	Environmentally hazardous substance, solid, n.o.s.	
			UN3148	138	Water-reactive liquid, n.o.s.	
			UN3175	133	Solids containing flammable liquid, n.o.s.	
			UN3260	154	Corrosive solid, acidic, inorganic, n.o.s.	
			UN3264	154	Corrosive liquid, acidic, inorganic, n.o.s.	
			UN3265	153	Corrosive liquid, acidic, organic, n.o.s.	
			UN3267	153	Corrosive liquid, basic, organic, n.o.s.	
			UN3480	147	Lithium ion batteries (including lithium ion polymer batteries)	
	K0098-22	SW Corner Inside Combat Area	NA3077	171	Environmentally hazardous substance, solid, n.o.s.	
	K0098-27	Inside Bldg., Near Column E8 South Side	UN3175	133	Solids containing flammable liquid, n.o.s.	
233	K0233-02	Inside Bldg. 233, South End, Outside Men's Rm, North Wall	N/A	N/A	Oily Debris	Machining Operations: Oil and oily water wastes
489	K0489-04	Inside Bldg. 489, by Door #9	NA3077	171	Environmentally hazardous substance, solid, n.o.s.	Assembly/Disassembly and Alodine Treatment Operations: Greasy rags and gloves, shelf life expired material, alcohol and fuel saturated rags, oily wastewater from parts washer and alodine contaminated rags and wastewater.
			UN3175	133	Solids containing flammable liquid, n.o.s.	
	K0489-06	Inside Bldg. 489, Cleaning Rm	UN1993	128	Flammable liquid, n.o.s.	
	K0489-07	Inside Bldg., Between Columns C6 and D6	NA3077	171	Environmentally hazardous substance, solid, n.o.s.	
			NA3082	171	Environmentally hazardous substance, liquid, n.o.s.	
			UN1263	128	Paint (flammable)	
			UN1950	126	Aerosols	
			UN1987	127	Alcohols, n.o.s.	
			UN1993	128	Flammable liquid, n.o.s.	
			UN2735	153	Amines, liquid, corrosive, n.o.s.	
			UN2922	154	Corrosive liquid, toxic, n.o.s.	
			UN3028	154	Batteries, dry, containing Potassium hydroxide solid	
			UN3077	171	Environmentally hazardous substance, solid, n.o.s.	
			UN3090	138	Lithium metal batteries (including lithium alloy batteries)	
			UN3148	138	Water-reactive liquid, n.o.s.	
			UN3175	133	Solids containing flammable liquid, n.o.s.	
			UN3260	154	Corrosive solid, acidic, inorganic, n.o.s.	
			UN3288	151	Toxic solid, inorganic, n.o.s.	
			UN3480	147	Lithium ion batteries (including lithium ion polymer batteries)	
	K0489-08	Outside Bldg. 489, SW Corner near Door #3	NA3077	171	Environmentally hazardous substance, solid, n.o.s.	
			NA3082	171	Environmentally hazardous substance, liquid, n.o.s.	
			UN1950	126	Aerosols	

NBK Keyport Installation Central Accumulation Areas

BLDG #	SITE #	SITE LOCATION	DOT ID	ERG Guide No.	ERG ID Name	PROCESSES
489	K0489-12	Inside Bldg. 489, Env. Coordinator's Office	NA3082	171	Environmentally hazardous substance, liquid, n.o.s.	Assembly/Disassembly and Alodine Treatment Operations: Greasy rags and gloves, shelf life expired material, alcohol and fuel saturated rags, oily wastewater from parts washer and alodine contaminated rags and wastewater.
			UN1950	126	Aerosols	
			UN1993	128	Flammable liquid, n.o.s.	
			UN2735	153	Amines, liquid, corrosive, n.o.s.	
			UN3028	154	Batteries, dry, containing Potassium hydroxide solid	
			UN3175	133	Solids containing flammable liquid, n.o.s.	
			UN3259	154	Amines, solid, corrosive, n.o.s.	
			UN3480	147	Lithium ion batteries (including lithium ion polymer batteries)	
	K0489-14	Inside Bldg. 489, WT Accessories Rm	UN1993	128	Flammable liquid, n.o.s.	
514	K0514-01	Outside Bldg. 514, NW Corner	NA1993	128	Combustible liquid, n.o.s.	Assembly/Disassembly and Alodine Treatment Operations: Greasy rags and gloves, shelf life expired material, alcohol saturated rags, fuel saturated rags, aprons, and gloves, oily wastewater from parts washer and alodine contaminated rags and wastewater. Sites K0514-105 and 108 are sent to the TSD Facility and placed into tanks 103/106 and 104/105 for disposal.
			UN1950	126	Aerosols	
			UN3028	154	Batteries, dry, containing Potassium hydroxide solid	
			UN3082	171	Environmentally hazardous substance, liquid, n.o.s.	
			UN3090	138	Lithium metal batteries (including lithium alloy batteries)	
			UN3175	133	Solids containing flammable liquid, n.o.s.	
	K0514-105	Outside Bldg. 514, North End (Inside Fuel Tank Farm)	UN1993	128	Combustible liquid, n.o.s.	
	K0514-108	Outside Bldg. 514, NW Corner	UN1993	128	Flammable liquid, n.o.s.	
824	K0824-01	Outside Bldg. 824, West Side	UN1993	128	Flammable liquid, n.o.s.	Machining: Welding Operations
825	K0825-01	Inside Bldg. 825, South End	N/A	N/A	Non-Regulated Liquid/Solid	Industrial Wastewater Treatment (Permit #ST0007353)
894	K0894-01	Inside Bldg. 894, NW End	NA3077	171	Environmentally hazardous substance, solid, n.o.s.	Assembly/Disassembly Operations: Greasy rags and gloves, alcohol saturated rags, and oily wastewater from parts washer
			UN1950	126	Aerosols	
			UN1987	127	Alcohols, n.o.s.	
			UN1993	128	Flammable liquid, n.o.s.	
			UN2735	153	Amines, liquid, corrosive, n.o.s.	
			UN2922	154	Corrosive liquid, toxic, n.o.s.	
			UN3028	154	Batteries, dry, containing Potassium hydroxide solid	
			UN3090	138	Lithium metal batteries (including lithium alloy batteries)	
			UN3175	133	Solids containing flammable liquid, n.o.s.	
			UN3260	154	Corrosive solid, acidic, inorganic, n.o.s.	
			UN3267	153	Corrosive liquid, basic, organic, n.o.s.	
			UN3480	147	Lithium ion batteries (including lithium ion polymer batteries)	
1006	K1006-01	SW Inside Bay Area	NA3082	171	Environmentally hazardous substance, liquid, n.o.s.	Process Support: Material storage with expired shelf life material
			UN1090	127	Acetone	
			UN1263	128	Paint (flammable)	
			UN1950	126	Aerosols	
			UN1993	128	Flammable liquid, n.o.s.	

NBK Keyport Installation Central Accumulation Areas

BLDG #	SITE #	SITE LOCATION	DOT ID	ERG Guide No.	ERG ID Name	PROCESSES
1006	K1006-01		UN2735	153	Amines, liquid, corrosive, n.o.s.	Process Support: Material storage with expired shelf life material
		Continuation	UN2810	153	Toxic liquid, organic, n.o.s.	
			UN3028	154	Batteries, dry, containing Potassium hydroxide solid	
			UN3090	138	Lithium metal batteries (including lithium alloy batteries)	
	K1006-02	SW Inside Bay Area	UN1993	128	Flammable liquid, n.o.s.	
1050	K1050-02	Outside Bldg. 1050, SE Corner	UN1993	128	Flammable liquid, n.o.s.	Assembly/Disassembly Operations: Greasy rags and gloves, alcohol and fuel saturated rags, oily wastewater from parts washer
			UN3028	154	Batteries, dry, containing Potassium hydroxide solid	
			UN3090	138	Lithium metal batteries (including lithium alloy batteries)	
			UN3480	147	Lithium ion batteries (including lithium ion polymer batteries)	
1058	K1058-05	Outside Bldg. 1058UTSIDE BLDG. 1058, NW CORNER	NA3082	171	Environmentally hazardous substance, liquid, n.o.s.	Plating, Cleaning and Metal Preparation: Expired shelf life material.
			UN1263	128	Paint related material (flammable)	
			UN3087	141	Oxidizing solid, toxic, n.o.s.	
			UN3260	154	Corrosive solid, acidic, inorganic, n.o.s.	

SECTION C

WASTE ANALYSES

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Appendix

C. WASTE ANALYSES

(WAC 173-303-110; -140; -300; -350(3)(b); -370; -395; -630(7)(c) and (9); -640(1)(b), (2)(c), (3)(a), and (10); -690; -691; -692; -806(4)(a)(ii) and (iii), (4)(b)(ii) and (v), and (4)(c)(x); [40 CFR Part 264 Subparts AA, BB, and CC]

C1. INTRODUCTION TO THE WASTE ANALYSIS PLAN

The Waste Analysis Plan (WAP) describes sampling methods, analytical techniques, waste acceptance procedures, problem manifest (off-installation),Waste Pick-up Request (installation) procedures, and waste tracking systems used for safe waste management and recordkeeping. The TSD Facility also uses Waste Generation Record (WGR), Waste Disposal Request (WDR) and Waste Identification Tracking (WIT) forms for waste generated within the NBK Keyport fence line that does not travel over a public roadway, as internal waste tracking system documentation; these terms are defined in Section C2 below. The forms presented in this WAP are internally developed and used by the facility. They may be revised as needed to address the permit, regulatory changes, facility operations and customer needs. All records required by this WAP are kept in either paper or electronic format as part of the TSD Facility operating record and will be made available for inspection at the request of the department.

The purpose of this plan is to describe how dangerous wastes accepted at the Naval Undersea Warfare Center (NUWC) Division Keyport Treatment Storage and Disposal (TSD) Facility (building 1051) are identified to ensure NUWC safely manages them while on site as well as to arrange for proper final disposition off-site. The TSD Facility manages all dangerous wastes generated on the NBK Keyport Installation. In addition, wastes generated at other regional U.S. Navy facilities may be accepted for treatment and storage.

Waste managed at the TSD Facility is identified through designation (testing and knowledge), bulked and/or packaged, segregated by hazard class while stored up to one year, and finally treated or shipped to off-site facilities for final disposition. Treatment processes authorized at the TSD Facility are listed in Part A.

The TSD Facility can receive, process, store, and ship off-site dangerous wastes. Details regarding tank systems, container storage areas and process equipment are provided in Section D, Process Information.

See Appendix C1 (Quality Manual) for specific decision-making responsibilities of TSD Facility personnel.

C2. DEFINITIONS

For the purposes of this WAP, the following terms are defined:

1. Compatibility - Combining of wastes without chemical or physical reaction; i.e., there is no fire, explosion, excessive heat generation or other unexpected and adverse reactions that would affect safe handling and storage.
2. Dangerous waste - Solid wastes designated in WAC 173-303-070 through 173-303-100 as dangerous, or extremely hazardous waste.

3. Designation – is the process of determining whether a waste is regulated under the dangerous waste lists, WAC 173-303-080 through 173-303-082; or characteristics, WAC 173-303-090; or criteria, WAC 173-303-100. The procedures for designating wastes are in WAC 173-303-070. A waste that has been designated as a dangerous waste may be either DW or EHW.
4. Facility Maintained Database - On-line database used to track dangerous wastes from generation to final disposal and is part of the TSD Facility operating record.
5. Generator - Any person, by site, whose act or process produces dangerous waste or whose act first causes a dangerous waste to become subject to regulation.
6. Installation Waste – Dangerous Waste generated within the Naval Base Kitsap (NBK) Keyport fence line, which does not travel over a public roadway during the course of transportation to the TSD Facility.
7. Off-Installation Waste – Dangerous Waste generated outside the NBK Keyport fence line, which requires travel over a public roadway during the course of transportation to the TSD Facility.
7. Knowledge - Sufficient information about a waste to reliably substitute for direct testing of the waste. To be sufficient and reliable, the "knowledge" used must provide information necessary to manage the waste in accordance with the requirements of WAC173-303.
8. Pick-up Request – a document used to transport waste from within the NBK Keyport installation generator Satellite Accumulation Areas (SAAs) and Central Accumulation Areas (CAAs) to the TSD Facility.
9. Process limitations - Consists of two components; physical (e.g. storage capacity of containers) and treatment limits (chemical and regulatory).
10. Profile - Details the waste stream's physical and chemical properties as well as its regulated status to assist the TSD Facility in determining how to safely manage the waste in compliance with the dangerous waste management permit requirements. The profile is based on the WGR and additional information developed to designate the waste. The completed profile is attached to the WIT in the facility maintained database. Waste profile information is documented within WGR, WIT and WDR forms, which are maintained for active waste streams.
11. Re-profiling – On a biennial basis, Keyport will review and re-evaluate an industrial waste stream's profile for changes in its chemical, physical, or biological composition, which may affect its regulatory status or the ability for the TSDF to safety accept and store it in compliance with this permit and the Dangerous Waste Regulations. . Documentation of this review will be maintained in the operating record.
12. Verification Analysis - Process used to determine that the waste stream received is the same as the waste stream described in the profile documentation or manifest, and that the waste stream matches the profile, using procedures in Section C4.2 and the Initial Waste Analysis form in Appendix C2 Waste Management Forms – Examples.
13. Waste Disposal Request (WDR) - After the TSD Facility accepts responsibility for management of a waste stream by approving a WGR, assigning a WIT number, and generating a profile, a WDR is provided to the generator. This document is signed and dated by the generator to certify composition of the waste every time the waste is picked up, accompanies the waste container to the TSD Facility and is maintained in the TSD Facility operating record.
14. Waste Generation Record (WGR) - A document filled out and submitted by the generator, providing detailed information to the TSD Facility about a new/potential waste stream. This document includes waste codes and final disposal actions. A unique WGR number is assigned in the facility maintained database for each documented waste stream accepted. This document is completed for all on and off-site waste streams. WGRs are maintained in the TSD Facility operating record.
15. Waste Identification Tracking (WIT) - All dangerous wastes managed by the TSD Facility are tracked by their WIT number in addition to the WGR number. The WIT number addresses the following:

a. The same waste may be generated in more than one location or by more than one generator. These compatible wastes are consolidated at the TSD Facility. Each generator contributing to the WIT completes and submits a WGR. The profile for each individual generator's waste stream must be consistent with the WIT's profile and final disposition options.
b. Because the same procedures are used in some of the processes generating wastes, waste streams don't necessarily change with a change in location or with a change in generator. Using historically consistent tracking numbers reduces likelihood of errors and is more efficient.

16. Waste profiling - Process of evaluating a waste stream for acceptance at the TSD Facility. Profiling includes gathering and compiling information from the generator and/or laboratory testing to determine whether the waste stream can be safely managed as well as accepted under permit conditions. Waste management alternatives, such as onsite treatment, are considered during this step. Supporting documentation and completed profiles are maintained in the TSD Facility operating record.
17. Waste Profile Questionnaire (WPQ) – Form used to submit profile details to the offsite disposal contractor.
18. Waste stream is dangerous waste from a single generator unique to a particular waste generation process. Each process waste stream is assigned a unique WGR number.
19. Waste shipment is a dangerous waste transfer from generator point A to point B by a uniform hazardous Waste Manifest, Bill of Lading, or Pick-up Request. Installation shipments that occur within the NBK Keyport fence line and do not travel over a public roadway are documented by a Pick-up Request. Incoming shipments generated from other DoD locations, and outgoing shipments are manifested according to RCRA and DOT requirements.

C3. CHEMICAL, BIOLOGICAL, AND PHYSICAL CHARACTERISTICS OF WASTE STREAMS

The majority of wastes accepted at the Building 1051 TSD Facility are generated within the NBK Keyport installation fence line. NBK Keyport, located in Keyport, Washington, houses testing and evaluation, engineering assembly, maintenance and repair, and fleet and industrial base support operations for undersea warfare systems. General industrial activities include painting, metal finishing, metal working, machining, electrical assembly, maintenance and repair, component teardown and refurbishment, component testing, and naval vessel operation and maintenance. Wastes generated within the NBK Keyport installation fence line are designated at the point of generation and are temporarily accumulated and managed within Accumulation Areas located throughout NBK Keyport in accordance with the requirements of WAC 173-303.

Industrial processes taking place at NBK Keyport that generate regulated wastes accepted at the TSD Facility includes but is not limited to the process waste streams listed in Table C3-1:

TABLE C3-1 PROCESS WASTE STREAMS

100-199 CLEANING AND DEGREASING 110 ABRASIVE BLAST WASTES 120 CLEANING AGENTS, ACIDIC 130 CLEANING AGENTS, ALKALINE 140 CHEMICAL PAINT STRIPPING WASTES 150 VAPOR DEGREASER WASTE 160 SOLVENTS/SOLVENT CLEANING 170 MECHANICAL REMOVAL 180 GENERAL CLEANING N.O.S. **200-299 SURFACE PREP AND FINISHING** 210 ELECTROPLATING WASTES 211 ETCHING WASTE 220 PAINT WASTES & THINNERS 230 DYES 240 CORROSION PREVENTATIVES 260 VARNISHES 270 WOOD PRESERVATIVES 280 HEAT TREATING WASTE **300-399 FORMING AND PRODUCTION PROCESSES** 315 RESINS/ADHESIVES/SEALANTS 320 METAL FORMING 350 WELDING FLUX 360 INSULATING MATERIALS 370 FLOORING MATERIALS 380 PLASTICS & RUBBER FORMING **400-420 LAB/MEDICAL/BIOLOGICAL WASTES** 410 LABORATORY WASTE **430-499 MISCELLANEOUS PROCESS WASTES** 440 PUMPWELL/SUMP MAINTENANCE 460 TESTING & INSPECTION WASTES 480 INSECTICIDES/HERBICIDES	**500-599 FLUID AND COMPONENT CHANGE-OUT** 510 COOLANTS 520 CUTTING FLUID WASTES 530 GREASES 540 HYDRAULIC FLUIDS 550 LUBRICANTS 560 BATTERIES 570 REFRIGERANT WASTES 580 RESIN, ION EXCHANGE 590 FILTERS, N.O.S. **600-699 MISCELLANEOUS WASTES** 610 TREATMENT PLANT WASTE 620 AIR POLLUTION CONTROL DEVICE WASTE 635 MISCELLANEOUS CONSTRUCTION/ CONTRACTOR WASTE 640 SPILL CLEAN UP WASTE 650 RECYCLING OF USED PRODUCT 660 WATER COLLECTION/RUNOFF WASTE **700-799 INORGANIC CONTAMINANTS** 710 ACID WASTES 720 ALKALINE WASTES 730 CADMIUM WASTES 740 CHROMIUM WASTES 750 LEAD WASTES 760 MERCURY WASTES 770 NICKEL WASTES 780 CYANIDE WASTES 790 OTHER INORGANIC WASTES **800-899 ORGANIC CONTAMINANTS** 820 PCB WASTES 830 ALCOHOL WASTES 840 OIL 850 DIESEL WASTES 870 OTHER NON-CHLORINATED HYDROCARBONS **900-999 MISC CHEMICAL PRODUCTS** 910 MISC CHEMICALS, N.O.S. 920 MISC OFFICE MATERIALS 940 UNUSABLE AEROSOL CANS (NON-PAINT) 950 EMPTY HM CONTAINERS (NON-AEROSOL) 985 COMMON TRASH 990 REUTILIZATION

A list of accepted waste codes at the Building 1051 TSD Facility is included in Part A. The TSD Facility does not accept radioactive, infectious or explosive wastes. Common waste streams managed at the TSD Facility includes but not limited to:

Ignitables
Corrosives (Acids and Caustics)
Reactives as defined by 40CFR261.23
Toxics
Oil, Oily Debris and Oily Wastewater
Solids and Sludge
Fuel Wastes
Industrial Wastewaters
PCB Wastes
Contaminated Debris
Universal Waste

Wastes are sampled and analyzed as described in Section C4, Waste Analysis Plan. Wastes are designated in accordance with WAC 173-303-070. Analytical requirements are summarized in Table C3-2, Waste Analysis Summary. Waste management options are described in Section B, Facility Description and General Provisions. Dangerous wastes received are treated, if possible, in accordance with this permit or in accordance with SWDP ST0007353. The majority of wastes received at the TSD Facility are shipped and disposed of off-site.

Table C3-2 Waste Analysis Summary

WASTE ANALYSIS[1]	TEST METHOD(S)[2]	STORAGE/ SHIPPING	SIMPLE CONSOLIDATION
Physical Description	ASTM D4979	✓	✓
Flash Point	ASTM D93, ASTM D56	✓	✓
pH	SW-846 9040,9041 or 9045	✓	✓
Water Content	ASTM D890	✓	✓
Specific Gravity	ASTM D1298	✓	✓
Total Cyanide	SW-846 9010	✓	✓
Total Sulfide	SW-846 9030	✓	✓
Total Metals	SW-846 6010	✓	✓
TCLP Metals	SW-846 1311/6010		
PCB	SW-846 8082/9079 EPA 600/4-81-045	✓	✓
Halogens	SW-846 8021/8260/8270/9077	✓	✓
Volatiles	SW-846 8260	✓	✓
Semi-volatiles	SW-846 8270	✓	✓
Hexane Extractable Materials (HEM)	SW-846 9071/ EPA 1664	✓	✓
Compatibility Testing	ASTM D 5058 EPA 600/2-80-076	✓	✓

[1] These are common analyses, but others may be required to completely characterize a waste per regulations (WAC 173-303).

[2] Additional methods approved per WAC 173-303-110(2) other than those listed above may be used.

✓ Generator knowledge is used to determine waste analysis selected for designation.

C4. WASTE ANALYSIS PLAN

WAC 173-303-110; -140; -300; -395; -630(7)(c) and (9); -640(1)(b), (2)(c), (3)(a), and (10); -690; -691; -692; -806(4)(a)(ii), (4)(b)(ii) and (v), and (4)(c)(x); [40 CFR Part 264 Subparts AA, BB, and CC]

C4.1 WASTE PRE-ACCEPTANCE PROCEDURES – WASTE STREAM CHARACTERIZATION AND PROFILING

The TSD Facility has developed a series of control procedures to determine the acceptability of specific wastes for management at the facility. Pre-acceptance procedures dictate what information the TSD Facility must obtain to determine the acceptability of the waste for management. At a minimum, the TSD Facility must obtain all the information required by WAC 173-303-300(2). necessary to manage waste. Pre-acceptance procedures allow TSD Facility personnel to determine the acceptability of a given waste based on permit limitations, regulatory requirements and whether the facility can safely manage the waste. See Figures C4-1 and C4-2 for a summary of these procedures.

1. To complete pre-acceptance procedures each waste stream must be designated and

    a. have a completed WGR,
    b. be acceptable, based on permit and operational constraints,
    c. be assigned a WIT number,
    d. have a valid profile (i.e., accurate and current), and
    e. have all documentation of the waste available in the operating record.

2. The decision on whether to accept or reject the waste is made based on:

    a. A review of the profile results as described in Section C4.1.2;
    b. Personnel's technical experience and judgment;
    c. Management methods available;
    d. Descriptions of wastes listed on the Part A;
    e. Determination if the waste is a restricted waste;
    f. Conditions or limitations of existing permits and regulations;
    g. Capability to manage the waste in a safe and environmentally sound manner;
    h. Profile description of the process generating the waste;
    i. Profile description of the chemical and physical properties of the waste;
    j. Results of laboratory analyses; and

k. Any additional documentation, including information that the waste is subject to the Land Disposal Restrictions (LDR) of 40 CFR Part 268, if appropriate.

3. A waste will be rejected during the pre-acceptance process for one of the following reasons:

   a. Incomplete or outdated profile provided by the waste generator;
   b. The waste cannot be treated, processed, stored or discharged at the TSD Facility because of permit limits and/or safety concerns; or
   c. The material is any of the following restricted wastes:
      1) Radioactive waste per WAC 402-12-050(49) and (50)
      2) Explosive waste per WAC 173-303-090 and 49 CFR 173.54
      3) Infectious waste per 49 CFR 240.101(p)

C4.1.1 PROFILE SYSTEM

The TSD Facility obtains profile information (as defined in Section C2) regarding each regulated waste stream before it is stored, treated or disposed. This information must contain the details necessary to manage the waste in accordance with WAC 173-303. The profile may be based on: 1) existing published or documented data on the dangerous waste; 2) waste generated from similar processes; 3) data obtained from analytical testing; or 4) generator knowledge.

The TSD Facility uses this information to determine if the waste can be accepted for storage or treatment operations conducted at the TSD Facility. Approval of a waste profile is dependent on existing permits and operational constraints.

The procedure for the completion of a waste profile is described below:

1. The generator of the waste completes and submits a WGR to the TSD Facility. The WGR provides space for recording information identifying the waste, the process generating the waste and waste storage site. The information is based on analytical testing or generator knowledge.

2. TSD Facility personnel review the WGR for completeness of physical and chemical information and to ensure it accounts for 100% of the waste constituents. They determine if the submitted WGR contains sufficient information to identify all applicable dangerous waste codes determined through the waste designation procedure required by WAC 173-303, and profile the waste according to section C4.1.1. Information from the WGR is entered into the facility maintained database.

3. If information is not sufficient, TSD Facility personnel will gather the information necessary to develop an adequate waste profile through research or analytical testing. This additional information is entered into the facility maintained database.

4. When the information is complete, the WGR is reviewed for acceptance. If a waste cannot be safely managed by the TSD Facility because of permit limitations or regulatory requirements, it will not be accepted. See C4.1 for details.

5. If the WGR is for an Off-Installation waste and would be acceptable per C4.1, profile sampling and analysis or generator knowledge are acceptable to ensure the accuracy of the WGR. (See Section C4.2.2) If analyses confirms the WGR, it is accepted.

6. After the WGR is accepted, a WIT number is assigned. All dangerous waste codes, compatibility group for storage, treatment and/or disposal method and amounts generated/disposed of; are linked to the waste stream via the WIT. Multiple generators may contribute to the same WIT only if the waste streams' profiles match and proper management of the waste will not change.

7. Information and analytical data from the WGR review process is used to create the profile of the waste stream.

8. The profile is then entered into the facility maintained database with start and end dates. The WGR and supporting documentation is maintained in the TSD Facility operating record.

9. The generator is supplied with the Waste Disposal Request (WDR) form and labels for the waste containers. A generator signed WDR certifying waste identification and composition is turned in with every waste container and bulk load submitted to the TSD Facility.

10. Waste streams are re-profiled every two years; and more often if conditions set forth in Section C4.1.1 apply.

C4.1.2 CONFIRMING/RECONFIRMING WASTE STREAM PROFILES

Each industrial waste stream, with the exception of unused commercial products, shall undergo re-profiling every two (2) years. Due to the unique SDS number assigned to pure products, they will not be re-profiled every two years. Re-profiling is conducted by completing a WGR and profile, including identifying dangerous waste constituents and characteristics necessary for proper profiling and management of the waste stream, along with accounting for 100% of the constituents. The WGR shall be submitted by the generator. A valid WIT number will be assigned. The WGR, completed profile and supporting documentation will be maintained in the TSD Facility operating record. All waste streams in the facility maintained database are automatically void at two (2) years. The generator must submit a newly updated WGR and a profile review must be completed before a waste can be shipped to the TSD Facility.

1. Except as specified in 2 below, re-profiling shall include or consist of either:

   a. Acceptable knowledge as defined by WAC 173-303-300(2) (a) and (b). The use of acceptable knowledge shall include confirmation by the generator that the process generating the dangerous waste has not significantly changed. Generator confirmation is documented by the WGR submitted to the TSD Facility verifying; or
   b. Laboratory analysis of the waste stream consisting of chemical and physical analyses using methods specified in WAC 173-303-110.

2. In addition to re-profiling every two years as required above, a waste stream shall undergo re-profiling under the following circumstances:

   a. The TSD Facility has been notified, or has reason to believe, that a process or operation generating the dangerous waste has significantly changed;

b. There is a discrepancy between the waste profile, and observed waste characteristics as determined by verification analysis or other waste analyses or waste evaluation;
c. Bulk tank waste that is a consolidation of compatible WITs shall be re-profiled prior to shipment for off-site treatment or disposal, to confirm final designation.

C4.2 INCOMING WASTE PROCEDURES
WAC 173-303-300(3); -370

C4.2.1 MANIFEST REVIEW AND PROCEDURES
WAC 173-303-370

All wastes must go through the Pre-acceptance procedures in Section C4.1.

A. INSTALLATION WASTE SHIPMENTS

Figure C4-3 depicts the Waste Check-in process for waste shipments arriving from the Installation.

For Installation wastes, a generator requests a pick-up by submitting a Waste Pick-up Request form in Appendix C2. Prior to pick-up, TSD Facility staff confirm that there is a valid WGR and profile for the waste stream and that verification analyses listed in table C4-1 was conducted on the waste stream as required. Verification analysis on a waste stream does not need to be conducted if the waste stream has a valid up-to-date profile and WAC-173-303-300(4) does not apply. This information is entered on the form. The wastes from NBK Keyport accumulation sites are transported to Bldg. 1051 (the TSD Facility) by the dangerous waste collectors. The generator is required to include a signed WDR with every container submitted to the TSD Facility to certify the waste identification and composition.

1. Before accepting for transport, trained dangerous waste collectors inspect the waste to verify the following:

   a. There is a WDR for each container of each type of waste,
   b. That the WDR(s) is/are correct (matches the waste being offered) and complete,
   c. That container labels match the WDR, and
   d. The containers are not leaking.

2. If a discrepancy is discovered, the generator is contacted to resolve the issue. Transport does not take place until the discrepancy is resolved.

3. Tracking Installation waste at the TSD Facility begins when the generator forwards a Waste Pick-up Request to the TSD Facility (See Appendix C1 (Quality Manual) for details of the waste tracking system).

4. Except as specified in #5 below, a minimum of 10% of the containers of each waste stream in each Installation waste pick up, and every bulk load in each Installation waste pick up, is subject to ASTM D4979, Standard Test Method for Physical Description Screening Analysis in Waste, by trained personnel at the time the waste is received at the TSD Facility. See Section H (Personnel Training), for required training and Appendix C2, Waste Management Forms – Examples), for a copy of the Verification Analysis form.

5. The following Installation waste streams do not require Verification Analysis included in the procedures of #4 above:

   a. If it's not a dangerous waste per WAC 173-303,
   b. If it's chemicals packaged in accordance with WAC 173-303-161,
   c. If it's an empty product container as defined in WAC 173-303-160
   d. If it's an unused commercial product in its original container with SDS, or
   e. Waste streams from known processes and which can be adequately identified using acceptable knowledge for proper management.

6. Upon verification that the waste in the shipment is properly represented by the approved and certified profile, it is moved to the appropriate storage or process area according to its waste stream category.

7. If waste does not pass verification analysis, it is placed in the WAD area located in room 123, and the generator is contacted to resolve the discrepancy. (See Section C4.3 for more details on Discrepancy Resolution).

B. OFF-INSTALLATION WASTE SHIPMENTS

Figure C4-4 depicts the Waste Check-in process for <u>waste shipments arriving from Off-Installation</u>:

1. Waste shipments are directed to the unloading area.

2. The manifest and physical load are inspected to verify the following:

   a. The information on the manifest is correct and complete.
   b. The correct number of containers of each type of waste is as indicated on the manifest.
   c. The containers are not leaking, are properly labeled and are approved storage and shipping containers.

3. The waste(s) listed on the manifest is checked to ensure that the waste is permitted for receipt at the TSD Facility and that a current WGR and profile is on file for the generator. This guarantees that:

   a. The correct waste codes have been assigned to the waste stream,
   b. The correct LDR notification and certification information has been provided, and
   c. Safe and effective management in conformance with the conditions of this permit is possible.

4. Verification analysis is performed on a minimum of 10% of the containers and every bulk load of each regulated waste stream in each waste shipment (see Section C4.2.2 and appendix C1, Quality Manual).

5. If a manifest discrepancy is discovered, the generator is contacted to resolve the issue. If an issue cannot be resolved in a timely manner, the shipment will be rejected. See Section C4.3 for more details on Discrepancy Resolution.

6. If no discrepancies are noted, material is off-loaded and a waste tracking number is applied to each container and the number is recorded on the WDR under "Login or Consolidation number."

7. Upon verification that the waste in the shipment is properly profiled, it is moved to the appropriate storage or process area and the transporter is given a signed copy of the manifest.

8. If waste does not pass verification analysis, the generator is contacted to resolve the discrepancy.

For On- and Off-Installation wastes, waste received remains in the receiving area until verification analysis is complete. Wastes known or suspected of being reactive when wet are immediately transferred to the Reactive When Wet and compatible materials waste storage area.

Rejected wastes are placed in a dedicated secondary containment WAD area and are labeled 'Waste Awaiting Designation' (WAD) until the waste is properly profiled or until the manifest discrepancy is resolved. Rejected wastes must maintain their original label start date.

C4.2.2 WASTE STREAM VERIFICATION ANALYSES

Waste is designated per WAC 173-303-070. Proper characterization of a waste stream may include or consist of knowledge as defined in Section C2, or in combination with testing or obtain detailed chemical, physical, and/or biological analysis of a waste as required in WAC 173-303. Representative waste samples are analyzed to:

- Characterize the chemical properties of a waste stream,
- Confirm the initial characterization of off-station waste streams, and
- Facilitate proper treatment and storage of wastes.

Waste analysis parameters are based on knowledge of the raw materials and physical/chemical properties of each waste process, as well as historical analytical results. The usage and applicability of analyses are described herein. The analytical procedures and methods described in this text and in Table C3-2, Waste Analysis Summary, are referenced in WAC 173-303-110(3) as valid for designating waste and have been chosen to identify waste and to provide the information required to properly and safely manage wastes.

A. MANDATORY VERIFICATION ANALYSES

The following mandatory verification analyses are used to screen received waste providing a "fingerprint" identification that the waste stream is as described in the waste profile and WGR. Mandatory verification is not performed on wastes that are considered a laboratory analysis exempt waste stream, see Section C4.5.

1. Physical description is used to determine the general properties of the waste (color, physical state, layering, odor, etc.). This facilitates subjective comparison of the sampled waste with prior waste descriptions or samples. It applies to all wastes and is used to identify any obvious change in the waste's physical properties.
2. Flash point is used to indicate the potential ignitability of the waste. This is necessary to determine appropriate storage conditions/containers, compatibility, treatment options, for DOT

shipping information and is used to identify variance from initial characterization. Flash point is not performed on solids or D001 liquids.

3. pH is used to determine the corrosive nature of the waste. This is required to identify appropriate storage containers, compatibility, treatment options and is used to identify variance from initial characterization.
4. Water content to determine the general properties of the waste and is used to identify variance from initial characterization.
5. Specific gravity provides information regarding the general chemical composition of a waste and is used to identify variance from initial characterization.
6. Halogen (Chloride) screen is used for Off-Installation receiving facility criteria and used oil.
7. Cyanide screen is used to evaluate if a waste will produce hydrogen cyanide when acidified, plating solutions or Otto fuel aqueous wastes).
8. Sulfide screen is used to evaluate if a waste will produce hydrogen sulfide when acidified. Only performed on waste streams with a pH > 7 or wastes suspected of containing sulfides (i.e. waste oils, or oil sludge).
9. VOC screen is used to verify VOC level of <500 ppm.

B. SUPPLEMENTAL ANALYSES

The following supplemental analyses can be performed when there are discrepancies between the mandatory verification analyses and the documentation, additional information is needed for management of the waste at the TSD Facility, if a change in the composition of the waste stream is suspected, or analysis is needed for LDR compliance.

1. Total metals analysis provides information regarding the general chemical composition of a waste and is used to identify variance from initial characterization.
2. TCLP is used for Off-Installation receiving facility criteria, and LDR compliance.
3. Total cyanide is used to identify potential reactivity and relevant health and safety precautions. It is necessary to determine compatibility, treatment options and is used to identify variance from initial characterization. In addition, this analysis is used for Off-Installation receiving facility criteria, and LDR compliance.
4. Total sulfide is used to identify potential reactivity and relevant health and safety precautions. It is necessary to determine compatibility, treatment options and is used to identify variance from initial characterization. In addition, this analysis is used for Off-Installation receiving facility criteria, and LDR compliance.
5. PCB (Aroclor) analysis is used for Off-Installation receiving facility criteria, and LDR compliance.
6. Volatiles analysis is used for Off-Installation receiving facility criteria, and LDR compliance. Results also used for emissions information.
7. Semi-volatiles analysis is used for Off-Installation receiving facility criteria, and LDR compliance. Results also used for emissions information.
8. Oil and grease analysis provides information regarding the general chemical composition of a waste and is used to identify variance from initial characterization. Also required for Off-Installation receiving facility criteria, and LDR compliance.
9. Paint filter test is done for LDR compliance.

These are common analyses, but others may be required to completely characterize a waste per regulations (WAC 173-303).

C. PROFILE CONFORMANCE

The use of "fingerprint" analyses is allowed for the purpose of verification analysis. "Fingerprint" analyses may also be helpful for a portion of a waste stream's profiling and re-profiling process. Typically, waste streams are sampled and analyzed for a few key chemical and physical parameters to determine or substantiate the waste's characteristics. This practice expedites waste designation and minimizes the time and labor involved. Generally, verification analysis parameters are selected based upon the knowledge of the waste stream. See Table C4-1 for minimum specific analyses for each waste type. See Section 4.1.2 for more detail on confirmation and verification analysis.

Verification analyses of incoming waste are compared to the waste profile information to ensure that there is not a significant variation between the received waste and its expected profile. Some variation in a waste stream is expected between containers and shipments; the intent is to identify wastes that may require different waste management practice or indicate the waste may be from a different waste generating process. Discrepancies are documented using the Verification Analysis form, see Appendix C2.

C4.3 DISCREPANCY RESOLUTION
WAC 173-303-350(3)(b); -370

A. INSTALLATION WASTE DISCREPANCY RESOLUTION

When a Discrepancy is noted regarding installation wastes, TSD Facility personnel will contact the generator by telephone and/or email to inform them of the discrepancy. If it is a minor discrepancy, that can be corrected immediately while the waste is still within the Receiving area, the generator will come to the TSD Facility and make the corrections and initial each correction. If the discrepancy cannot be immediately corrected, the waste will be rejected and either returned to the generator for resolution, or placed into WAD. Only wastes generated within the NBK Keyport fence line may be placed into WAD for administrative reasons. Placing wastes in WAD will be based on generator knowledge and personnel technical experience and judgment that the waste will be more safely managed and stored as WAD instead of returning the waste to the generator.

Rejected waste managed as WAD shall be segregated and logged in upon arrival. Designation shall be completed as soon as the waste has been sampled and laboratory analysis have been received

B. OFF-INSTALLATION WASTE DISCREPANCY RESOLUTION

For waste received from off-installation, the manifest discrepancy requirements of 40 CFR 264.72 and WAC 173-303-370 apply. This section sets criteria for manifest discrepancies, recordkeeping, unmanifested waste and rejecting a shipment.

Manifest discrepancies are significant discrepancies between the quantity or type of dangerous waste designated on the manifest or shipping paper and the quantity or type of dangerous waste a facility actually receives. Significant discrepancies in quantity are variations greater than ten percent in weight for bulk quantities (e.g. tanker trucks, portable tanks, etc.), or any variation in piece count for non-bulk quantities (i.e., any missing container or package would be a significant discrepancy). Significant discrepancies in type are obvious physical or chemical differences which can be discovered by inspection or waste analysis.

A. Steps to manage a manifest discrepancy:

1. TSD Facility personnel will contact the generator by telephone and/or email to inform of the discrepancy.
2. TSD Facility personnel will ask the generator for permission to correct the manifest to match the load. When permission is received, they will make any necessary corrections and initial each correction. Any correction made will be entered on all copies of the manifest received by the facility.
3. Immediately after the corrections are entered and initialed, the discrepancy space on the manifest (No. 18) will be completed with the following information:

   a. What the discrepancy is;
   b. A statement to the effect that "on day/month/year (name of person contacted) gave permission to correct the discrepancy stated above"; and
   c. Full signature of TSD Facility personnel correcting the discrepancy and date.

4. If the load consists of drums, and the discrepancy is a type of waste, the drum must be relabeled and marked prior to storage to match the corrected manifest and the corrected waste stream. The original accumulation start date must be carried over to the new label.
5. In the event that TSD Facility personnel cannot resolve a discrepancy within 15 days, in accordance with WAC 173-303-370(5)(c), a letter will be submitted to the Washington State Department of Ecology (Ecology) describing the discrepancy and attempts made to reconcile it, with a copy of the manifest or shipping paper at issue.

B. Steps to manage unmanifested loads:
1. If a regulated dangerous waste is received without an accompanying manifest, the Dangerous Waste Program Manager will be notified immediately.
2. The Dangerous Waste Program Manager will determine whether to accept or reject the load.
3. If the load is accepted, an unmanifested waste report meeting the requirements of WAC 173-303-390(1) must be completed and filed with Ecology within 15 days of waste receipt.

C. Steps to reject a shipment:

1. If a shipment arrives at the TSD Facility that cannot be managed properly, a determination will be made to reject it. Examples of loads that cannot be managed properly are:

   a. The waste is not listed on the TSD Facilities Part A Permit,
   b. The load does not match the manifest or WGR and the discrepancy cannot be resolved, or
   c. The waste cannot be treated, stored or disposed of at the TSD Facility.

2. The generator shall be contacted by TSD Facility personnel to:

   a. Notify them of the rejection and
   b. Obtain instruction from the generator on whether to send the shipment back to the generator or to another designated facility.
   c. If sent back to the generator, the TSD Facility is required to prepare a new manifest in accordance with WAC 173-303-370(5)(f).

D. Unmanageable, non-transportable loads:

Should a shipment arrive at the TSD Facility which cannot be properly managed due to reasons stated above, and the load cannot be safely transported back to the generator or to an alternate facility because it is damaged or would pose a risk to public health or the environment, the following steps shall be taken:

1. Examine the manifest and load to determine if the problem can be resolved with reasonable time, effort and supplies.
2. If the load cannot be rendered safe, implement the Contingency Plan.
3. Notify the generator, proper authorities and agencies as soon as possible.

See Appendix C1 (Quality Manual) for Recordkeeping details.

C4.4 PROCESS ANALYSES

Compatibility testing will be performed on all bulk waste streams being considered for consolidation. See Section D (Process Information) for details on consolidation in containers. For new liquid wastes being considered for bulk tank consolidation, ASTM D5058 will be the method of analysis. As required by this method, compatibility testing will be conducted using wastes that are in the tank at the time the new waste stream will be added, and will take place prior to discharging the new waste stream to the receiving tank to ensure these are compatible. Any new liquid waste being considered for consolidation in tanks 103 or 106 (cyanide waste tanks) will be analyzed for pH. Resulting pH must be >7 before being considered for consolidation in these tanks. In addition, for consolidation in tanks 103 or 106, compatibility testing per ASTM D5058 will include screening for hydrogen cyanide (HCN) gas generation using MSTOX 9001 gas detector or equivalent. Any HCN gas evolution exceeding the OSHA permissible exposure limit (PEL) will exclude new waste from consolidation in these tanks.

Refer to Section C4.1.1 for waste stream re-profiling details.

C4.5 WASTE GENERATED ON-SITE

The TSD Facility has a couple potential waste generating processes, which include:

- possible new waste stream developed during water decanting process while performing tank treatment, and
- rinsate generated from triple-rinse drum washing process with potentially of producing a hazardous waste designation.

C4.6 SAMPLING AND ANALYSES METHODOLOGIES
WAC 173-303-110; -300(5)(f)

Sampling methods used are as referenced in WAC 173-303-110(2). Sampling is performed by personnel who are properly trained in representative sampling methodology (refer to Section H, Personnel Training). Each bulk container is sampled.

The sampling devices are selected according to size and type of container and the specific material matrix involved. Sampling equipment is rinsed or disposed of between sampling events to avoid cross-contamination. Rinsate and/or sampling equipment is disposed with a compatible waste stream from the area where sampling occurs. Disposable sampling equipment is repackaged and disposed of appropriately in accordance with WAC 173-303.

Samples are stored in containers that are compatible with the waste. General criteria for containers are as follows:

1. The container must not distort, rupture or leak as a result of chemical interactions with constituents of waste samples.
2. The container must have adequate wall thickness to withstand handling during sample collection and transport to the laboratory.
3. The container must be of adequate size to contain the optimum sample volume.
4. Container shall be constructed from material that will not contaminate the sample with target analytes or interact with target analytes.

TSD Facility uses sampling methods presented in SW-846 (Test Methods for Evaluating Solid Waste, 3rd edition, November 1986 and subsequent updates and revisions) and ASTM Methods (American Society for Testing Materials) Standards D56, D93, D890, D1298, D4979, and D5058. Sample tracking procedures are described in Appendix C1 (Quality Manual).

The following lists waste streams that are exempt from laboratory analysis prior to pre-acceptance by the TSD Facility. The TSD Facility may perform laboratory analysis, a site visit, or request additional documentation for an acceptable profile.

1. Empty original manufacturer product containers, described in WAC-173-303-160(2).
2. Unused or expired commercial products in the original manufacturer product container with an up-to-date SDS that will allow for proper management of the waste by the TSD Facility.
3. Consumables and equipment removed from service that contain DW (including, but not limited to, ballasts, batteries, fluorescent light bulbs, and electrical equipment) that can be designated with sufficient knowledge.
4. Debris and residues from the cleanup of equipment removed from service or spills of a known substance, which an SDS can be provided.
5. Universal waste as described in WAC 173-303-573 (i.e. batteries, thermostats, mercury containing lamps and equipment).

C4.7 QUALITY ASSURANCE PROGRAM

TSD Facility personnel perform field verification analysis set forth in table C4-1. The NUWC Division Keyport Analytical Chemistry Laboratory completes all PGDN analyses and other testing required for profiling and re-profiling. When testing is not available on Installation, the TSD Facility may select other Navy or Off-Installation contract laboratories to conduct waste analyses. Laboratories employed by the TSD Facility must perform waste analysis per WAC 173-303. Additionally, labs accredited by the Washington State Department of Ecology shall be accredited for each analyte method.

C4.7.1 COMPREHENSIVE QA/QC PROGRAMS

QA/QC considerations are an integral part of laboratory analytical operations. Laboratory QA is undertaken to ensure that analytical methods generate data that are technically sound, statistically valid and can be documented. Individual QC procedures are the tools employed to measure the degree to which these QA objectives are met. Laboratories chosen must be able to address the following program elements.

A. Qualitative QA/QC Elements:

1. Documentation is a very important aspect of maintaining QA/QC procedures in the laboratory. An essential part of any QA program is the chain-of-custody protocol. This protocol allows tracking of the samples from collection through data analysis and reporting. The chain-of-custody protocol for labs begins with the immediate inspection of samples upon arrival for analysis and includes checking for documentation of adherence to the proper preservation techniques, proper accompanying paper work (e.g., chain-of-custody, shipping papers), proper sample containers and inspection of the sample itself for signs of anomalies which could jeopardize the sample integrity (i.e., evidence of tampering, broken or leaking containers).

2. The laboratory must meet the established holding times for the analytical parameters of interest. Holding times that are exceeded can result in the data being judged invalid. This can lead to the need to conduct re-sampling of the waste or to questions of TSD Facility compliance status. An acceptable lab will provide all the documentation necessary to demonstrate that the holding times for the required analyses are always met.

B. Quantitative QA/QC Elements:

Besides the qualitative measures associated with the chain-of-custody procedures, quantitative measures must also be used by the laboratory to monitor QA/QC. These measures include the analysis of method blanks, duplicates, matrix spikes and surrogate spikes. Table C4-3 presents the major QC techniques used by acceptable analytical laboratories to ensure data quality. A well-qualified lab will routinely employ these QA/QC procedures to evaluate the precision and accuracy of its analytical instrumentation to determine if inadvertent contamination has occurred or if other factors exist which could affect data quality.

C4.7.2 TECHNICAL ANALYTICAL EXPERTISE

The analytical laboratory chosen must be proficient in using established analytical methods for dangerous waste determinations. The laboratory must also be knowledgeable of any current developments in analytical methods that could affect data quality. Labs incapable of meeting the required detection limits compromise the ability to validate compliance with applicable waste management requirements. Therefore, it is recommended that laboratories employed by the TSD Facility are Washington State accredited laboratories to ensure analytical methods and data quality objectives are met and technically sound.

C4.7.3 INFORMATION MANAGEMENT

The lab must maintain effective information management systems. These systems are necessary to ensure the availability of all relevant data generated in association with a given sample set (e.g., chain-of-custody records, accuracy and precision information, and analytical results). Additionally, all analytical reports provided should present information in a clear and concise manner. A credible lab will tailor its reports to meet specific requirements. This is advantageous to assure that information is correctly used to verify regulatory compliance. The laboratory will also be able to provide the information needed to prove data validation (i.e., QA/QC documentation).

C4.8 WASTE TRACKING
WAC 173-303-300(6)

Please see Appendix C1, Quality Manual for details

C4.9 RECORDKEEPING
WAC 173-303-300(2)(b); -380(1)(c)

Please see Appendix C1, Quality Manual for details

C4.10 WASTE ANALYSIS PERSONNEL RESPONSIBILITIES
Please see Appendix C1, Quality Manual for details

Table C4-1 "Fingerprint" Parameters for Verification Analysis

TEST PARAMETER/ ANALYTICAL METHOD	LIQUID - AQUEOUS	LIQUID - ORGANIC	SLUDGE	SOLID	OIL
Physical Description/ ASTM D4979	✓	✓	✓	✓	✓
pH/ EPA SW-846 9040, 9041, 9045	✓		✓		
Flash Point/ ASTM D93, D56		✓			✓
Halogens/ EPA SW-846 9077 or field test kit					✓

Figure C4-1: Pre-Acceptance Process
(Installation Waste)

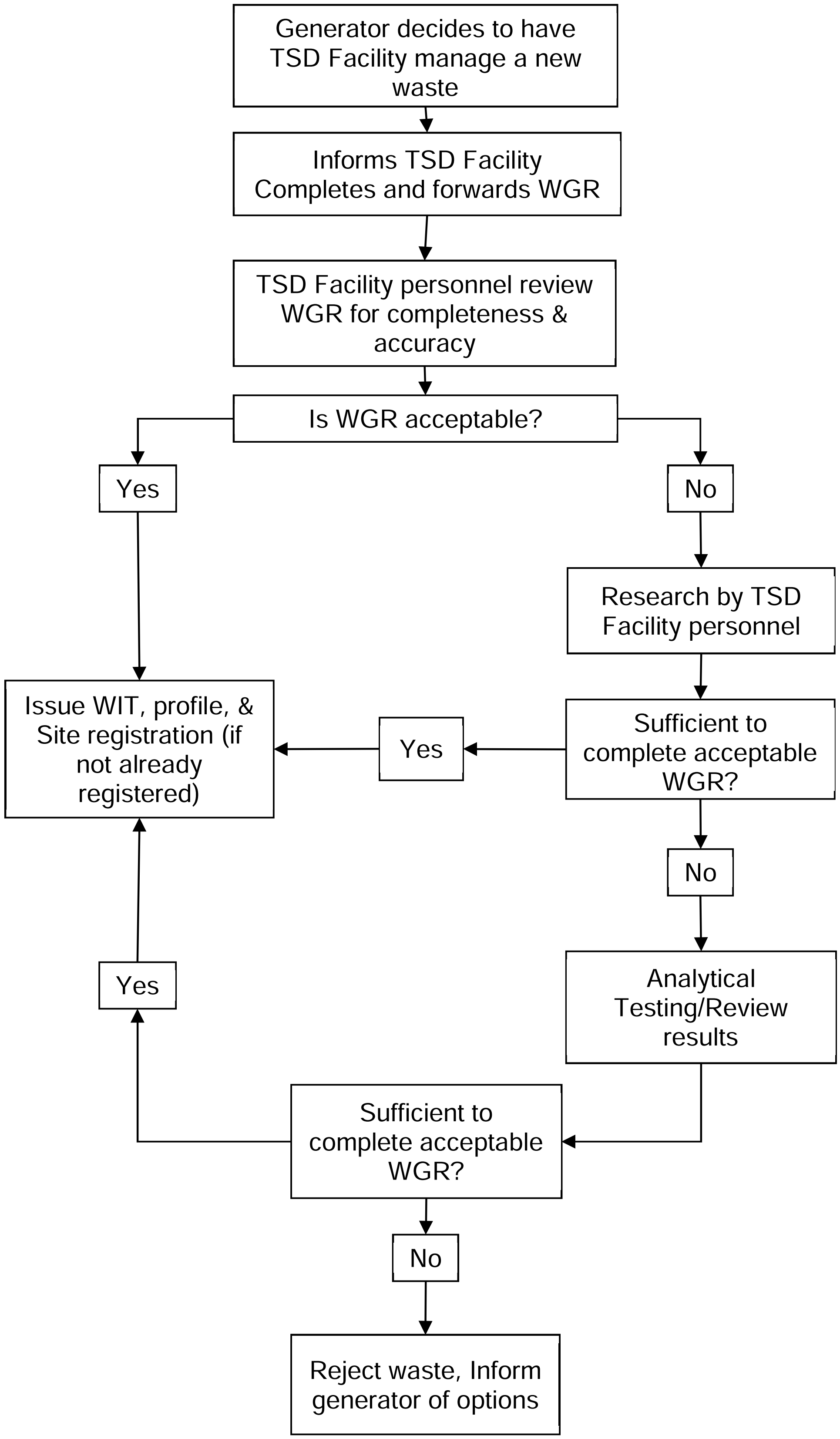
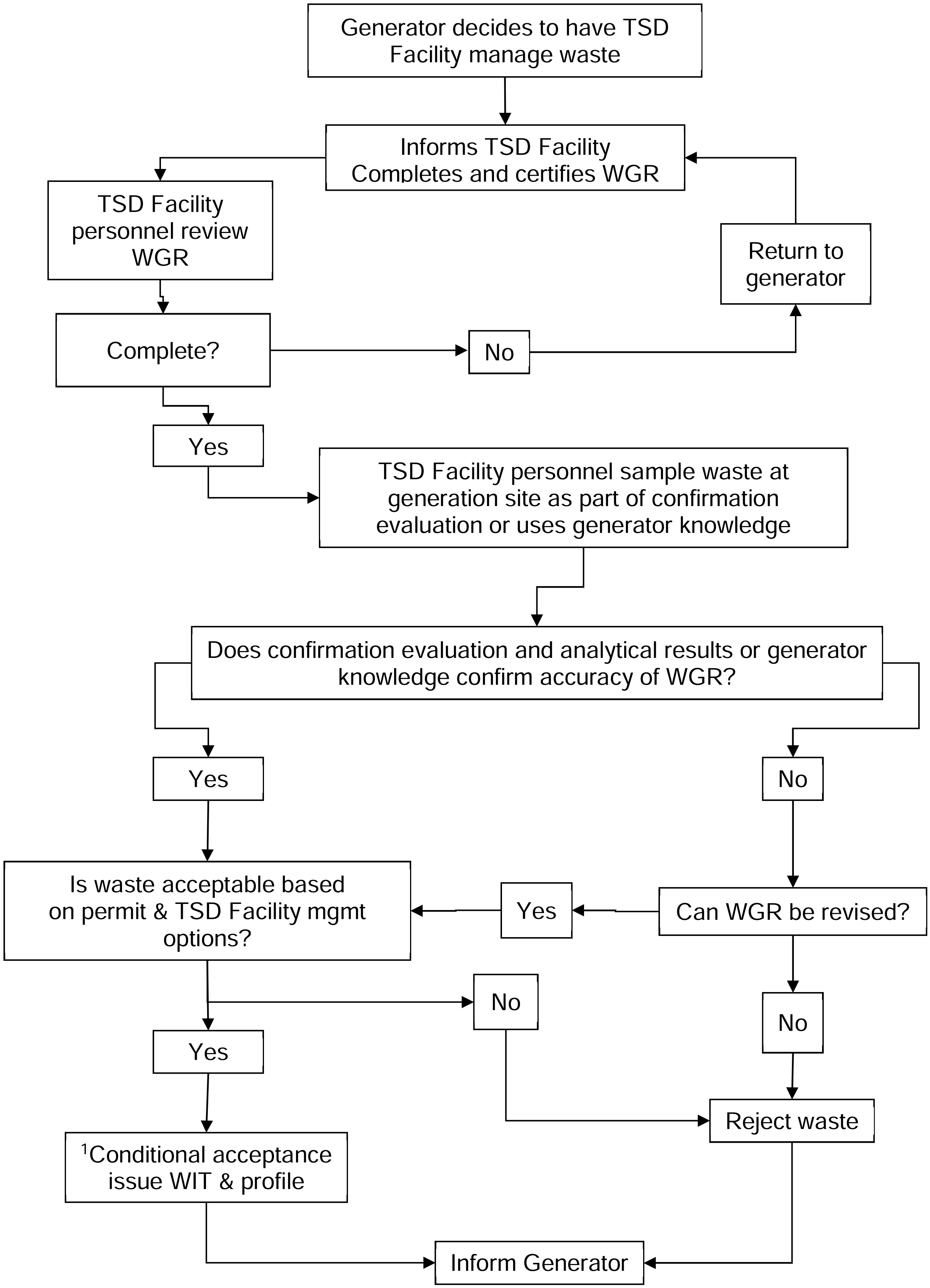


Figure C4-2: Pre-Acceptance Process
(Off-Installation Waste)



[1] Final Acceptance after waste check-in procedure

Figure C4-3: Check-In
(Installation Waste)

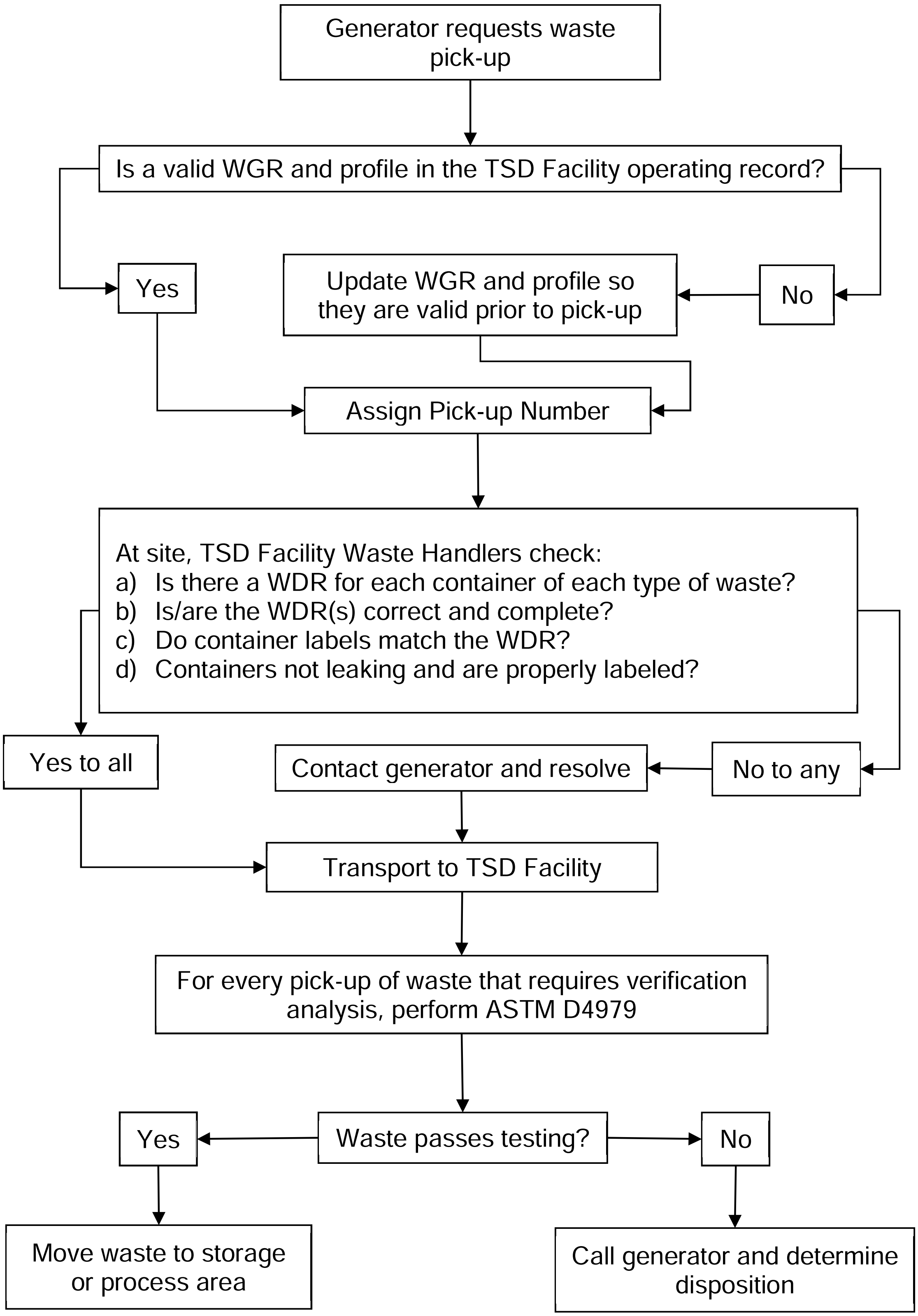
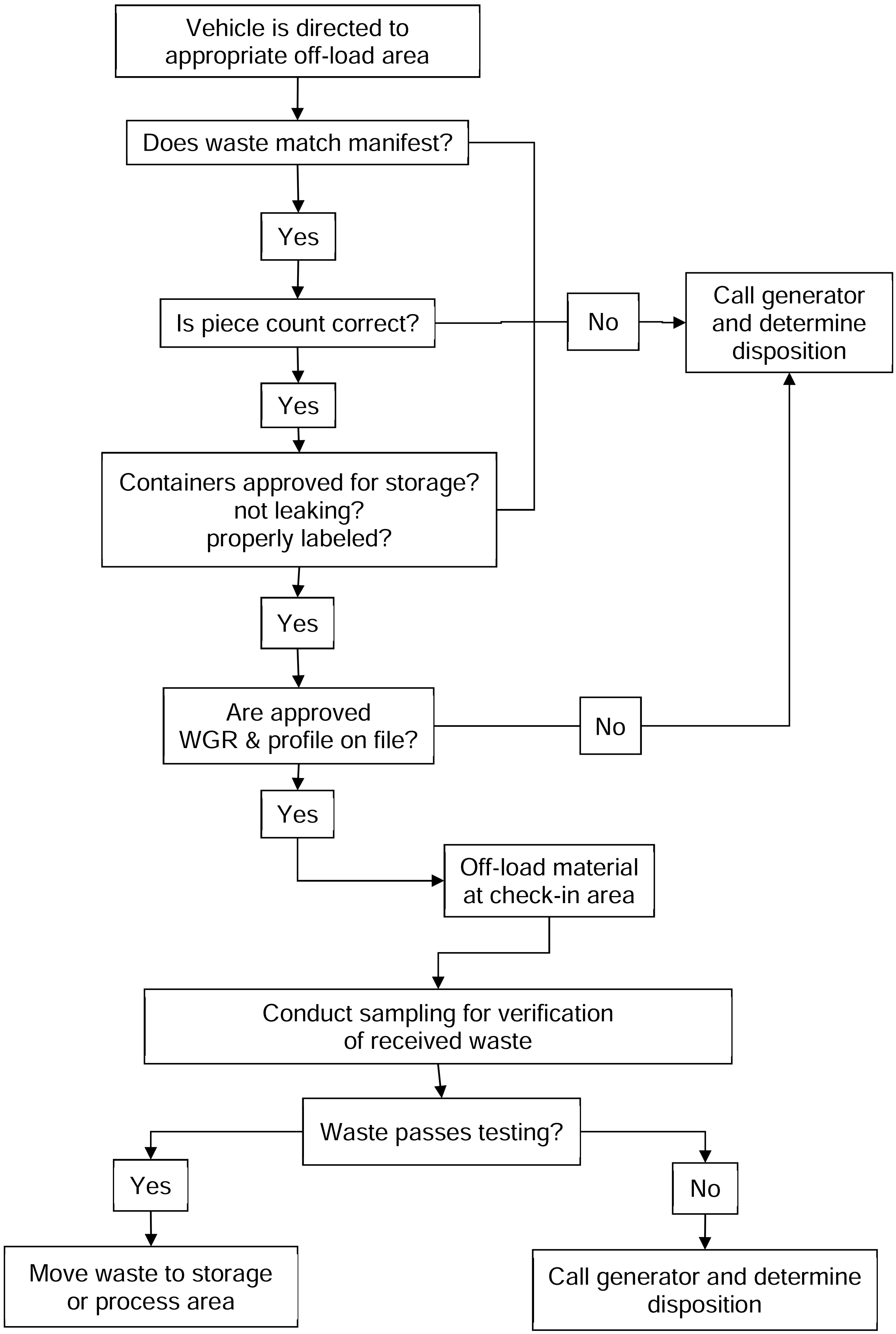


Figure C4-4: Check-In
(Off-Installation Waste)



SECTION C

APPENDIX C1

QUALITY MANUAL

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QUALITY MANUAL

NAVAL UNDERSEA WARFARE CENTER DIVISION KEYPORT
ENVIRONMENTAL BRANCH
TREATMENT, STORAGE AND DISPOSAL FACILITY (TSD Facility)
KEYPORT, WASHINGTON 98345-7610

Approved by:

____
D. HUNT
Dangerous Waste Program Manager, TSD Facility

____
T. HIATT
Environmental Branch Manager

EFFECTIVE DATE: ____________

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SECTION 1- PROGRAM DESCRIPTION

The Treatment, Storage and Disposal Facility (TSD Facility), Building 1051, as identified in Part A of Attachment A of the Permit for Storage and Treatment of Dangerous Waste is located on Naval Base Kitsap Keyport (NBK Keyport) in Keyport, Washington. The TSD Facility receives and manages dangerous wastes generated within the NBK Keyport fence-line. In addition, wastes generated at other regional Navy facilities may be accepted for treatment and storage. The TSD Facility does not accept radioactive, infectious, or explosive wastes.

The objective of the TSD Facility's Quality Assurance Program (QAP) is to guarantee compliance with local, state and federal regulations for the handling of wastes and waste records.

To accomplish this goal, TSD Facility personnel follow established policies and procedures from waste receipt to final disposition. This manual documents these measures and assures customers, regulatory agencies and other NUWC personnel of the quality of the data provided.

The program begins at the generation of a new waste stream with a waste generation request (WGR) and ends with record keeping after the final disposition of the waste. It encompasses management policies, TSD Facility Standard Operating Procedures (SOPs), sampling, testing performed by TSD Facility personnel, manifesting and record keeping.

The TSD facility uses the internal NUWC Keyport Analytical Chemistry Laboratory to perform supplemental testing for verification, confirmation, and process control purposes. Additional testing may be performed by contract laboratories accredited by the Washington State Department of Ecology.

Refer to the main body of the Waste Analysis Plan (WAP) for definitions and details of processes. See Appendix C2 for examples of documents and labels mentioned throughout this manual.

SECTION 2 - DEFINITIONS

For the purposes of this Manual, the following terms are defined:

1. Compatibility - Combining of wastes without chemical or physical reaction; i.e., there is no fire, explosion, excessive heat generation or other unexpected and adverse reactions that would affect safe handling and storage.
2. Dangerous waste - Solid wastes designated in WAC 173-303-070 through 173-303-100 as dangerous, or extremely hazardous waste.
3. Designation – is the process of determining whether a waste is regulated under the dangerous waste lists, WAC 173-303-080 through 173-303-082; or characteristics, WAC 173-303-090; or criteria, WAC 173-303-100. The procedures for designating wastes are in WAC 173-303-070. A waste that has been designated as a dangerous waste may be either DW or EHW.
4. Facility Maintained Database (FMD) - On-line database used to track dangerous wastes from generation to final disposal and is part of the TSD Facility operating record.
5. Generator - Any person, by site, whose act or process produces dangerous waste or whose act first causes a dangerous waste to become subject to regulation.

6. Installation Waste – Dangerous Waste generated within the Naval Base Kitsap (NBK) Keyport fence line that does not travel over a public roadway during the course of transportation to the TSD Facility.
7. Off-Installation Waste – Dangerous Waste generated outside the NBK Keyport fence line which requires travel over a public roadway during the course of transportation to the TSD Facility.
7. Knowledge - Sufficient information about a waste to reliably substitute for direct testing of the waste. To be sufficient and reliable, the "knowledge" used must provide information necessary to manage the waste in accordance with the requirements of WAC173-303.
8. Pick-up Request – a document used to transport waste from within the NBK Keyport installation generator Satellite Accumulation Areas (SAAs) and CAAs to the TSD Facility.
9. Process limitations - Consists of two components; physical (e.g. storage capacity of containers) and treatment limits (chemical and regulatory).
10. Profile - Details the waste stream's physical and chemical properties as well as its regulated status to assist the TSD Facility in determining how to safely manage the waste in compliance with the dangerous waste management permit requirements. The profile is based on the WGR and additional information developed to designate the waste. The completed profile is attached to the WIT in the facility maintained database. Waste profile information is documented within WGR, WIT and WDR forms, which are maintained for active waste streams.
11. Re-profiling – On a biennial basis, Keyport will review and re-evaluate an industrial waste stream's profile for changes in its chemical, physical, or biological composition, which may affect its regulatory status or the ability for the TSDF to safety accept and store it in compliance with this permit and the Dangerous Waste Regulations. Documentation of this review will be maintained in the operating record.
12. Verification - Process used to determine that the waste stream received is the same as the waste stream described in the profile documentation or manifest, and that the waste stream matches the profile, using procedures in Section C4.2 and the Initial Waste Analysis form in Appendix C2 Waste Management Forms – Examples.
13. Waste Disposal Request (WDR) - After the TSD Facility accepts responsibility for management of a waste stream by approving a WGR, assigning a WIT number, and generating a profile, a WDR is provided to the generator. This document is signed and dated by the generator to certify composition of the waste every time the waste is picked up, accompanies the waste container to the TSD Facility and is maintained in the TSD Facility operating record.
14. Waste Generation Record (WGR) - A document filled out and submitted by the generator, providing detailed information which includes waste codes and final disposal options to the TSD Facility about a new/potential waste stream. A unique WGR number is assigned in the facility maintained database for each documented waste stream accepted. This document is completed for all on and off-site waste streams. WGRs are maintained in the TSD Facility operating record.
15. Waste Identification Tracking (WIT) - All dangerous wastes managed by the TSD Facility are tracked by their WIT number in addition to the WGR number. The WIT number addresses the following:
    a. The same waste may be generated in more than one location or by more than one generator. These compatible wastes are consolidated at the TSD Facility. Each generator contributing to the WIT completes and submits a WGR. The profile for each individual generator's waste stream must be consistent with the WIT's profile and final disposition options.
    b. Because the same procedures are used in some of the processes generating wastes, waste streams don't necessarily change with a change in location or with a change in generator. Using historically consistent tracking numbers reduces likelihood of errors and is more efficient.

16. Waste profiling - Process of evaluating a waste stream for acceptance at the TSD Facility. Profiling includes gathering and compiling information from the generator and/or laboratory testing to determine whether the waste stream can be safely managed as well as accepted under permit conditions. Waste management alternatives, such as onsite treatment, are considered during this step. Supporting documentation and completed profiles are maintained in the TSD Facility operating record.
17. Waste Profile Questionnaire (WPQ) – Form used to submit profile details to the offsite disposal contractor.
18. Waste stream is dangerous waste from a single generator unique to a particular waste generation process. Each process waste stream is assigned a unique WGR number.
19. Waste shipment is a dangerous waste transfer from generator point A to point B by a uniform hazardous Waste Manifest, Bill of Lading, or Pick-up Request. Installation shipments that occur within the NBK Keyport fence line and do not travel over a public roadway are documented by a Pick-up Request. Incoming shipments generated from other DoD locations, and outgoing shipments are manifested according to RCRA and DOT requirements.

SECTION 3 - TSD FACILITY ORGANIZATION AND RESPONSIBILITIES

The TSD Facility is a part of the Naval Undersea Warfare Center (NUWC) Division, Keyport Environmental Branch. The Branch is committed to and provides an environment that encourages excellence. Everyone within the TSD Facility shares responsibility for maintaining and improving the quality of services. The position descriptions for these positions are provided in Section H, Appendix H1 (Position Descriptions). These position descriptions further detail the responsibilities, duties, and requisite qualification of current positions at the TSD Facility. Responsibilities of key positions for the TSD Facility are described below.

a) The Environmental Branch Manager is responsible for overall management of the Environmental Branch and determines quality policies and objectives for the branch. The Environmental Branch Manager is responsible for review and documentation of personnel qualifications and provides resources required to meet identified QA needs. The Environmental Branch Manager is responsible for all personnel management in the Environmental Branch, including the TSD Facility.

b) The Dangerous Waste Program Manager is responsible for ensuring that TSD Facility personnel have adequate facilities and training to perform their duties. The Program Manager:
    1) Serves as the single point of contact for all waste issues that may require federal/state agency involvement.
    2) Is responsible for keeping up with new regulatory requirements as they occur and integrating them into TSD Facility operations.
    3) Oversees training for all personnel involved in waste management and operations at the TSD Facility.
    4) Provides initial and reoccurring training to installation Waste Site managers and alternates.
    5) Is responsible for all inspections at the TSD Facility as set forth in Section F (Procedures to Prevent Hazards) of the Dangerous Waste Management Permit Application.
    6) Is part of the Change of Operations Review Panel to ensure waste stream sampling and analysis is considered for new processes.
    7) Monitors and approves treatment protocols.

8) Monitors and approves selection of final disposal option.
9) Acts as the quality manager for the TSD Facility, which includes:
    i. Oversees initial and annual training on quality requirements for the TSD Facility,
    ii. Providing oversight to ensure documentation (both paper and electronic copies) is properly filed, secured, and available upon request,
    iii. Ensuring that desk procedures or SOPs are available and up to date for the DW Handlers and DW Collectors at the TSD Facility, and
    iv. Ensures laboratories employed by the TSD Facility are certified by the Washington State Department of Ecology as an accredited laboratory following a strict Quality Assurance/Quality Control Program.
    v. Performs TSD facility performance and system audits.

c) <u>TSD Facility personnel</u> will follow the guidelines set forth in this manual. Under direction of the Dangerous Waste Program Manager, and following desk procedures and/or SOPs of (b)(10)(iii) above, they perform the following tasks:

<u>Dangerous Waste Designator:</u>
1) Is responsible for review and approval of all WGRs and profiles.
2) Provides research per WAC 173-303-300(2).
3) Requests and reviews results of analytical testing or uses generator knowledge.
4) Designates and profiles wastes.
5) Makes initial determination of acceptability of new waste streams based on permit conditions, treatability and applicable disposal regulations.
6) Ascertains the compatibility group of new wastes for storage.
7) Maintains TSD Facility waste inventory in the Facility Maintained Database (FMD).
8) Reviews and verifies test data.
9) Generates waste manifests.
10) Conducts biannual review and updating of all active process WGRs.
11) Enters all data necessary to document task completion in the FMD.
12) Assists Dangerous Waste Program Manager with Program Management duties.

<u>Dangerous Waste Handlers</u>
1) Sample waste streams for analytical testing.
2) Perform field screening and process testing.
3) Perform verification analysis per the Waste Analysis Plan (WAP).
4) Log in waste
5) Treat waste per TSD Facility Operating Manual.
6) Package and label waste.
7) Perform TSD Facility waste storage sites and equipment inspections.

<u>Dangerous Waste Collectors</u>

1) When picking up waste from approved on-station sites, verifies that the waste matches the waste description on the Hazardous Waste Pick-up Request and the Waste Disposal Request.
2) Delivers waste to the TSD Facility receiving area.

SECTION 4 – QUALITY OBJECTIVES

To be responsible environmental stewards by providing waste disposal and waste handling support and services to NBK Keyport and regional Navy activities. To maintain compliance with local, state, and Federal environmental regulations.

Quality objectives will be met by:

1) Initial and ongoing training of TSD Facility personnel.
2) Designation of waste per applicable local, state, and Federal regulations.
3) Proper documentation of waste accepted by the TSD Facility and retention of records per applicable environmental regulations.
4) Communication with customers to ensure customer needs and expectations are understood and can be fulfilled by the TSD Facility.
5) Ensuring all personnel understand the contents of the quality manual and follow requirements.
6) Ensuring resources are available to accomplish waste handling and disposal needs of the customer.

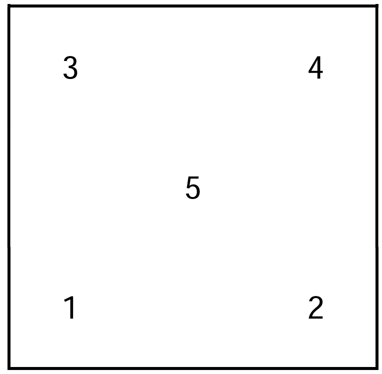
SECTION 5 – WASTE TRACKING SYSTEM

NUWC Division Keyport employs an on-line environmental management system database to track Dangerous Waste. This section describes the tracking of waste through the system and includes hard copies, logbooks, data sheets, etc. where applicable. See Table 1 for an overview of the tracking system.

1) Tracking begins with receipt of a WGR from a prospective waste generator. Each WGR is assigned a separate, unique WGR number upon entry into the NEMS..
2) If a WGR is determined to be acceptable, the profile is generated and entered into the FMD.
3) The waste is assigned a Waste Identification Tracking (WIT) number. This is entered into the FMD
4) The waste generating site and collecting site are determined and these identifiers are also entered into the FMD. Collecting site numbers follow the following format: K0514-01 (drum site) or K0514-101 (tank site), where K stands for Keyport, waste is collected at Building 514 and both are the first registered site of that type. Complete site location information is entered into the FMD.
5) The generator is sent the unique WGR number. Using this number, the generator will print WDRs containing the WGR, WIT, Generator, and collection site ID numbers that will accompany the waste to the TSD Facility at the time of pick-up. The collection container is labeled with the appropriate Non-Hazardous, Universal Waste or Dangerous Waste markers, which contain the WIT number.

6) When a waste is ready for transport to the TSD Facility, the generator submits a Hazardous Waste Pick-up Request. Upon receipt of the Request, TSD Facility staff verify that a valid and current WGR for the waste stream is on file. This information is signed off on the Request and it is posted for waste collector pick-up.
7) At the waste accumulation site, waste collectors compare the Pick-Up Request to the WDR and to the labels on the container, verify that the waste offered is the same as the waste described on the pick-up request, and verify the number of containers on the pick-up request matches the number of containers staged for pick-up. If no discrepancies are noted, the container is taken to the TSD Facility Receiving Area and the date is written on the WDR and the container. After receipt, the container must be logged-in, noting date and time, then moved from the receiving area to the proper storage site within 24 hours.
8) Waste Handlers begin log-in by assigning a pick-up number to each container that follows the format: Julian date-XX, where XX is given sequentially, starting at 11. Ex. 2019121-14 would be the fourth pick-up on May 1, 2019. This number is the unique container tracking number. It is entered into a logbook and onto the WDR and Verification Testing form. The WDR is turned in for NEMS inventory entry. The Verification Analysis form is compared to the Initial Waste Profile form and then scanned into electronic format. If any discrepancies exist, they are brought to the Dangerous Waste Program Managers attention.
9) Inventory entry includes pick-up, WGR and WIT numbers. It also includes the TSD Facility location identifier, which are given as follows:

   a. Refer to Table 2 for TSD Facility waste storage site numbering prefixes, and to Part A, Attachment A for site locations within the TSD Facility. Example: TSD-20 indicates the Dangerous When Wet storage cell. Bulk waste tanks are designated as TSD-101 through TSD-109. As they have no racks, shelves, etc. so this is their complete location designation.
   b. For cells with racks, racks are labeled A-Z from left to right. If a rack is accessed from both sides, both sides of the rack have their own designation. Example: TSD-20A denotes first rack on the left as you enter the Dangerous When Wet Storage Cell. Cells without racks have a placeholder zero in this position. Example: TSD-130 indicates that Cyanide/Sulfide Storage Cell does not have racks.
   c. For racks with shelves, shelves are numbered 1-9, with 1 being closest to the floor, 2 being next level up, etc. For cells with no shelves, a zero placeholder occupies this position.
   d. The next position A-Z is used to represent a pallet or 5-gallon container and is labeled from left to right facing the rack or row.
   e. For sites with pallets where further information is required, the last digit is 1-9 and denotes position on the pallet as required. Typical numbering of pallets is 1-5, with corners numbered left to right and middle position being 5 as below. Although the middle position is numbered, it may not be used if there is a visibility issue. Sites without pallets do not require this digit.



10) Accumulator drums at the TSD Facility are numbered as started by Julian date-0X, where X is 1 through 8 sequentially. Physical location of accumulator drums is tracked through this number.
11) In addition to FMD database entry, additions to each accumulator drum are tracked on accumulator drum sheets filed by WIT number. When the drum is full, Waste Handlers turn in the sheet and all associated WDRs to close out the drum.
12) TSD Facility tank loads are numbered by Julian date-09. Physical location of the stationary tank is tracked through this number.
13) In addition to FMD database entry, additions to bulk waste tanks are tracked in logbooks. Associated WDRs are pulled and attached to the manifest when the tank is full to close out that tank load.
14) Movements of waste within the TSD Facility and final disposition, whether treatment or shipment off-station, are tracked through the on-line FMD.

The following tables are solely for clarification of the TSD Facility waste tracking system. All wastes, whether generated on- or off-station, are tracked by this system. However, wastes received from other regional Navy facilities would not have a NUWC Division Keyport Dangerous Waste registered site number.

TABLE 1: TSD FACILITY WASTE TRACKING SYSTEM

WASTE TRACKING FOR CONTAINERS	INDENTIFIER	EXAMPLE	TRACKING
Who generated the waste?	WGR number	unique, computer-generated	tracked in FMD and on WGR, WDR in electronic or hardcopy format
What is it?	WGR number	unique, computer-generated	tracked in FMD, in logbooks and on WGR, WDR in electronic or hardcopy format
Where is waste collected?	Registered site number	K0514-01 (drum site), K0514-105 (tank site)	tracked in FMD and on WGR, WDR in electronic or hardcopy format
When was container picked up?	TSD Facility start date	MM/DD/YYYY	tracked in FMD, on container and WDR hardcopy
When was container received into TSD Facility inventory?	Inventory log-in date	MM/DD/YYYY	tracked in FMD and on WDR hardcopy
What is the unique container tracking number?	Pick-up number	K-2006121-14	tracked in FMD, logbooks, on waste container, WDR hardcopy, DD1348
What room is the container in?	TSD Facility cell site number (TSD-XX)	See Table 2	
Which rack?	Rack letter (A)		
Which shelf?	Shelf number (Y)		
Which pallet?	Pallet letter (B)		
Where on the pallet?	Position number (Z)		
Where is the container today?	Location number	TSD-XXAYBZ	tracked in FMD
How is waste to be managed?	WIT number	unique, computer-generated	tracked in FMD
When was waste shipped off-station?	Shipment date	MM/DD/YYYY	tracked in FMD and on manifest
Where was it shipped?	Receiver ID number	WAD991281767	tracked in FMD and on manifest
When did recipient facility receive shipment?	Manifest certification date	MM/DD/YYYY	tracked in FMD and on manifest
When was it finally disposed?	Disposal date	MM/DD/YYYY	tracked in FMD and on disposal certificate (if required)

TABLE 2: TSD FACILITY WASTE STORAGE SITES

SITE NAME	TSD FACILITY ROOM OR LOCATION
WAD	123 middle
OXIDIZERS DOT CLASS 5.1	129
ACID DOT CLASS 8(a)	130
CAUSTICS DOT CLASS 8 (b)	138
POISONS DOT CLASS 6.1 (or by subsidiary hazard class)	132
POISONS CLASS 6.1 (or by subsidiary hazard class)	133
FLAMMABLE/COMBUSTIBLES DOT CLASSES 3 AND 4.1	134
FLAMMABLE 1A DOT CLASS 2/COMPRESSED GASES (all hazard classes)	136
UNIVERSAL WASTE	137
USED OIL CLASS 3(a)	139
ORG PER DOT CLASS 5.2	125
DRUM DEHEADING/WASHROOM	128
ASBESTOS DUMPSTER	Outside, NE Bldg. 1051
SHIPMENT STAGING, MAIN	140
CLASS 9	140 east
REACTIVE WHEN WET AND COMPATIBLE MATERIALS DOT CLASS 4.3	131
CLASS 9	123 south
SECURED STAGING AREA FOR BULK SHIPPING CONTAINERS	Outside, East Bldg. 1051 sumped area under overhang
ACCUMULATION DRUM: PGDN CONTAMINATED DEBRIS	Outside, NE Bldg. 1051
BULK WASTE STORAGE (OILY WASTEWATER); T-101	124
BULK WASTE STORAGE (OILY WASTEWATER); T-102	124
BULK WASTE STORAGE (CYANIDE); T-103	124
BULK WASTE STORAGE (PGDN); T-104	124
BULK WASTE STORAGE (PGDN); T-105	124
BULK WASTE STORAGE (CYANIDE); T-106	124
BULK WASTE STORAGE (NOT IN USE); T-107	124
BULK WASTE STORAGE (NOT IN USE); T-108	124
BULK WASTE STORAGE (NOT IN USE); T-109	124

Exception to the Waste Tracking System:

WIT Lists and accumulator drums. In an effort to expedite waste characterization and minimize time and labor involved in database entry, WIT lists have been generated for commercial products that are in common use (example: aerosols and batteries). For each item, a virtual WGR is created with the Dangerous Waste Program Manager as generator that provides SDS information. A WIT is assigned by characteristics (example: Aerosol Flammable, Non-flammable, Adhesive, Corrosive). Generators are provided with an accumulation drum for the specific WIT. When the generator has a product to dispose, they query the FMD database, find the virtual WGR assigned and obtain the WIT number to determine the proper accumulator drum.

SECTION 6 – SAMPLING AND SAMPLE TRACKING SYSTEM

Samples obtained by TSD Facility personnel for the purpose of designation are taken in compliance with state and federal regulations as outlined in WAC173-303-110. Trained Personnel perform sampling according to the intended analytical method(s). The analytical laboratory may require different sampling containers or preservatives based on their processes or analytical method. Sampling containers and sampling devices are purchased pre-cleaned or cleaned prior to sampling. To prevent cross-contamination all sampling devices are disposed or cleaned between samples and disposed with a compatible waste. Stratified wastes are sampled to ensure a representative sample is obtained.

Samples for verification or designation analyses are tracked..

1) Sample tracking begins with the assignment of a unique sample tracking number. This number follows the format XXXX-YYYY-ZZ, where XXXX is the four digit NUWC code of the TSD Facility, YYYY is the four digit Julian date and ZZ is the sequential number of the sample taken that day, beginning with 01. This number is tracked to avoid duplicate use.
2) This number is entered on the TSD Facility Verification Analysis datasheet when tests are performed at the TSD Facility.
3) This number is also entered on the sample request form when samples are taken/sent to a laboratory. The request form contains all chain of custody information to track sampling, transport and lab receipt.
4) The sample number is also entered in the appropriate section of the online NEMS.

SECTION 7 – VERIFICATION AND SUPPLEMENTAL ANALYSES

TSD personnel perform the following tests for waste stream verification purposes to properly manage the waste received and determine compatibility for waste consolidation.

Physical Description	ASTM D4979
pH	SW 846 9041(paper)
Halogen Screen	Field test kit (oil wastes)
Flammability Screen	ASTM D4982
Specific Gravity Screen	ASTM D4979 (visual layering)
Compatibility Testing	ASTM D5058

Testing will follow methodology in Table C2-1 of the WAP. Standardized Operating Procedures (SOPs) are maintained by the Dangerous Waste Program Manager in the TSD Facility Operating Record. Verification and compatibility testing is documented on datasheets. All datasheet entries are made in ink. Amendments and/or corrections are to be made by crossing out with a single line. Write-overs are NOT ALLOWED! Each correction will be initialed and dated. Completed datasheets will be reviewed by the Dangerous Waste Program Manager or Waste Designator and will be entered into the TSD Facility operating record.

The TSD performs QC measurements in accordance with the reference method listed above. When QC measurements are not incorporated within the reference method the TSD uses alternative techniques to evaluate the accuracy of the technique, which can include, but is not limited to, periodic calibrations, verification samples (standards or blanks), and blind samples. Instrumentation is calibrated according to the reference method or manufacturer recommendations.

Supplemental analyses are performed by the NUWC Division Keyport Analytical Chemistry Laboratory or contract laboratories as needed. The NUWC Division Keyport Analytical Chemistry Laboratory maintains adherence to its internal quality control procedures according to the reference methods and the WADOE accreditation program. Contract laboratories are accredited by the Washington State Department of Ecology for the analytical method at the time of testing. A complete chain of custody accompanies samples submitted to NUWC Division Keyport Analytical Chemistry Laboratory or Contract laboratories. Preservation as required by the analytical test method is maintained during transportation of the samples to the laboratory.

The above practices are intended to ensure that the data produced and used by the TSD are precise and accurate for waste stream testing to allow for the facility to manage acceptance, rejection, treatment, storage, and consolidation.

The TSD facility verification analysis tolerances are used to ensure that the waste stream received meets the waste profile and that the constituents and characteristics of the waste are within the expected range of the waste profile and the waste has not been mixed with other wastes or materials. It is expected that there will be some variability of the waste between containers or loads. However, significant changes that may impact the handling or waste code other than that listed on the profile need to be identified. The following table includes the verification analyses and tolerance limits for which an inconsistency can indicate the waste stream is different than the intended profile.

TABLE 3: VERIFICATION ANALYSIS WITH TOLERANCE LIMITS

VERIFICATION TEST	INDENTIFIER	LIMIT	ACTION
Physical Description - Color - Turbidity - Viscosity - Physical state - Particle size - Layering	- Color variation - Clear, cloudy, opaque - Water, syrup, molasses, no flow - Liquid, solid, sludge, powder, granular - Fine, medium, coarse, chunks - Layer %, color, turbidity, viscosity, physical state	Reasonable agreement with profile	Gross differences in the physical description of a waste indicate waste stream may be from a different process – Document discrepancy and follow C4.3 in the WAP
pH	- pH range of the profile - Consolidation with TSD Tank-103/106	≤ 2 pH difference >7	Document discrepancy and follow C4.3 in the WAP
Halogen Screen (Oily waste only)	Chloride (ppm)	≥1000 ppm <1000 ppm	Ship as dangerous waste Ship as used oil.
Specific Gravity Screen	Visual Layering	Layer % or miscibility is not as expected	Document discrepancy and follow C4.3 in the WAP
Flammability Screen	Flammable or non-flammable	No tolerance of unexpected positive or negative	Document discrepancy and follow C4.3 in the WAP

Compatibility Testing	Compatible or non-compatible	No tolerance of unexpected positive or negative	Combine waste streams Do not combine waste streams

SECTION 8– RECORDKEEPING AND DOCUMENT CONTROL

Document control of required records within the TSD Facility is under the authority of the Dangerous Waste Program Manager.

There are a number of reports, forms and other types of written information that are prepared or collected at the TSD Facility. A summary of the required records is included below.

❑ Keep all Site Identification forms and related correspondence for as long as the TSD Facility is in business.

❑ Keep a copy of each Dangerous Waste Annual Report that was prepared and submitted to Ecology for a minimum of five years.

❑ Keep a copy of each WDR or manifest sent with a waste shipment and the signed manifest sent back from the dangerous waste facility for a minimum of five years.

❑ Keep a copy of each exception report sent to Ecology for a minimum of five years.

❑ Keep a copy of each Land Disposal Restriction Certification for a minimum of five years.

❑ Keep a copy of all transactions of special wastes going to municipal landfills for a minimum of five years.

❑ Keep a copy of the inspection log on the premises and available for review by Ecology staff for as long as the TSD Facility is in business.

❑ Keep the results of any laboratory analyses for as long as the TSD Facility is in business.

❑ Records (SDSs, WPQs, profile sheets, etc.) required to document designation and profiling of waste as long as the TSD Facility is in business.

SECTION 9– PERFORMANCE AND SYSTEM AUDITS

Internal audits evaluate TSD activities for compliance to the WAP and quality manual. Internal audits are intended to assess compliance with internal documented processes. The intent of internal audits is to monitor and evaluate that TSD processes are effectively implemented and functioning properly. It is the responsibility of the Dangerous Waste Program manager to perform internal audits. The manager reviews the document or process to be audited and selects valuable auditable items that can demonstrate compliance. Examples include:

- Process scope – Is the process used within its scope?
- Equipment/Materials – Does the procedure reflect the current equipment and materials being used? Do they meet technical requirements of the procedure?
- Training – Personnel performing the process are qualified?
- Procedural steps – Are specific steps of the procedure being performed? Are steps performed in the described order and frequency?
- Quality control – Are quality control elements specified in the procedure being performed and evaluated?
- Records – Are procedural records being generated? Are forms completed? Are records being retained?

If a deficiency is identified that impacts the work process, corrective actions are implemented in a timely manner to minimize recurrence.

Audits and corrective actions apply to all areas of the TSD including testing, management system, and administrative processes. The intent is to plan and implement corrective actions when departures from test procedures or quality control parameters are identified. All TSD personnel are responsible to recognize and respond to departures from the quality manual and to notify management when problems occur. Potential solutions are identified that are expected to provide the best opportunity to correct the problem and minimize recurrence. There may be many causes and solutions to a problem; the idea is to identify the best solutions to reduce the potential for recurrence considering the cost and time necessary to implement the solution(s). The Dangerous Waste Program Manager or Environmental Branch Manager authorizes resumption of work after corrective actions are taken.

SECTION C

APPENDIX C2

WASTE MANAGEMENT FORMS - Examples

The forms included in this appendix are for example only. The information contained on the forms will be included on any versions of the forms used for the same purposes, although the forms themselves may change in appearance.

Initial Waste Analysis

Date: ______________ **WGR Number:** ______________ **WIT Number:** ______________

Required Verification Testing	**Results**		
pH by EPA Method 9040 or 9045	☐ ________		
Flash Point ASTM D93, D56	☐ ________		
Paint Filter Test Method 9095	☐ ________		
Cyanide	☐ ________ **(Method 9010)**	☐ ________ **(Field Test Kit)**	
Halogens	☐ ________ **(Method 9077)**	☐ ________ **(Field Test Kit)**	
Physical Description ASTM D4979	☐ **SEE BELOW**		

Color: ____

Turbidity:
☐ clear
☐ cloudy
☐ opaque

Viscosity:
☐ like water
☐ like syrup
☐ like molasses
☐ no visible flow

Physical State:
☐ liquid
☐ solid
☐ sludge
☐ powder
☐ granular

Particle size:
☐ fine
☐ medium
☐ coarse
☐ chunks
☐ free liquid?
☐ sorbents present?

Layering? ☐ If yes, describe below:

Top layer:
% ________
Color ______________________________
Turbidity ______________________________
Viscosity ______________________________
Physical state ______________________________

Middle layer:
% ________
Color ______________________________
Turbidity ______________________________
Viscosity ______________________________
Physical state ______________________________

Bottom layer:
% ________
Color ______________________________
Turbidity ______________________________
Viscosity ______________________________
Physical state ______________________________

Obvious odor? ☐ If yes, describe: ______________________________

Analyst: ______________________________

Signature: ______________________________ **Date:** ____________________

WASTE PICK-UP REQUEST

Return completed form to TSDF Operations Bldg. 1051 by mail or e-mail form to global address: KYPT_TSDF Hazardous Waste
For assistance call ext. 6-7992 or 6-2320

Customer:	Code:	Bldg.:	Phone #:	Date:

SHADED AREAS to be filled out by the GENERATOR						Waste Collector Use only	Waste Handler Use Only
WGR#	WASTE NAME	WIT#	% Split(s) / TPM Program Code	Container Type/Size	# contr's to be picked up	# contr's picked up	# contr's received
			%/TPM# %/TPM#	/			
			%/TPM# %/TPM#	/			
			%/TPM# %/TPM#	/			
			%/TPM# %/TPM#	/			
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			%/TPM# %/TPM#	/			
			%/TPM# %/TPM#	/			

NEW DRUM DELIVERIES NEEDED

SIZE	#	TYPE
55 GAL		
30 GAL		
10 GAL		
5 GAL		
3.5 GAL		
1.5 GAL		

EMPTY DRUM PICK-UPS

SIZE	#
55 GAL	
30 GAL	
10 GAL	
5 GAL	

OFFICE WASTE

Type	#

Before accepting for transport, the waste must be inspected to verify the following:

	Verified By:
The WDR(s) is/are not connected to a WGR that is due for re-profiling and re-verification.	
There is a WDR for each container of each type of waste.	
The WDR(s) is/are correct and complete.	
Container labels match the WDR.	
Containers are not leaking, are properly labeled and are approved containers.	

WASTE RECEIVED AT TSDF BY:	DATE:

COMMENTS: ____

____

VERIFICATION ANALYSIS

Date:	______________	Test ______________		Results
Pick-up Number:	______________	ASTM D4979	☐	complete page 2
WGR Number:	______________	pH by Method SW846 9041A	☐	______________
WIT Number:	______________	Halogen Screen (oily waste)	☐	______________
		Flammability Screen		

Waste Pick-up Preview

Does WGR require update? Yes:______ No:______

If yes, enter date of update prior to pick-up: ____________

Does waste require verification analysis? Yes:______ No:______

If yes, mark required analysis on page 2.
If No, check at least one of the following:

- ☐ Is not a dangerous waste per WAC 173-303 criteria.
- ☐ Waste is chemicals packaged in accordance with WAC 173-303-161.
- ☐ Waste is an empty container as defined in WAC 173-303-160.
- ☐ Waste is unused commercial product in its original container with MSDS.

Previewer: ________________________________

Signature: ________________________________

Date: ____________________

Verification Analysis Review (Complete after verification analysis on page 2 is completed)

Do verification analysis confirm waste ID? Yes: ______ No: ______

If No: a) Describe deviation:

b) Contact generator to resolve: Contact Date: _______________
Resolution:

c) If no resolution, sample for characterization:
Sample Number: _______________
Date to Lab: __________________
Date Results Received: ____________________

New WGR Number: _________________
New WIT Number: _________________
New Profile Number: _________________
Date update to NEMS is complete: __________________

Reviewer: ________________________________

Signature: ________________________________

Date: ____________________

PHYSICAL DESCRIPTION SCREENING OF WASTE per ASTM D-4979-95 (re-approved 2003)

9.1.1 Color: ____________________

9.1.2 Turbidity:
- ☐ clear
- ☐ cloudy
- ☐ opaque

9.1.3 Viscosity:
- ☐ like water
- ☐ like syrup
- ☐ like molasses
- ☐ no visible flow

9.1.4 Physical State:
- ☐ liquid
- ☐ solid
- ☐ sludge
- ☐ powder
- ☐ granular

Particle size:
- ☐ fine
- ☐ medium
- ☐ coarse
- ☐ chunks
- ☐ free liquid?
- ☐ sorbents present?

9.1.5 Layering? ☐ If yes, describe below:

Top layer: % ______
Color ____________________
Turbidity ____________________
Viscosity ____________________
Physical state ____________________

Middle layer: % ______
Color ____________________
Turbidity ____________________
Viscosity ____________________
Physical state ____________________

Bottom layer: % ______
Color ____________________
Turbidity ____________________
Viscosity ____________________
Physical state ____________________

9.1.6 Obvious odor? ☐ If yes, describe: ____________________

Analyst: ____________________

Signature: ____________________

Date: ____________

SECTION D

PROCESS INFORMATION

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D. PROCESS INFORMATION

WAC 173-303-160(2); -190(2), (3); -340(3); -395; -630; -640; -690; -691; -692; -806(4)(a)(viii)-(x)(i), (b), (c), (j), (k), (m)

D1. INTRODUCTION

Industrial processes at NBK Keyport generate large quantities of a variety of hazardous waste. These wastes are collected at the various Central Accumulation Areas and satellite sites and transported to the Treatment, Storage and Disposal (TSD) Facility for storage, processing, and disposal. Waste categories managed at the TSD Facility are acids, caustics, cyanides/sulfides, organic, oxidizers, flammables, toxics, reactives, and non-hazardous wastes.

D2 CONTAINERS

WAC 173-303-160(2); -190(2)(3); -340(3); -395; -630; -690; -691; -692; -806(s)(viii)-(x)(i), (b), (k), (m), and 4(b)

Containers that are stored inside the TSD Facility are stored in segregated and enclosed storage areas. Each storage area has spill containment, fire flow containment, ventilation, and fire rated construction. The storage capacity for containerized dangerous waste inside the TSD Facility is 67,925 gallons.

The waste type, room number, and total liquid capacity for each inside storage area are shown in Table D1-1.

Table D1-1. Inside Container Storage Area Designations and Storage Capacity

Waste Type Designation	Room Number	Container Size (Gal)*	Drum Quantity*	Total Liquid Capacity (Gal)
Receiving	123N	Up to 550	62	3,410
DOT Class 9 (Other regulated materials)	123S	Up to 550	192	10,560
WAD	123M	Up to 550	40	2,200
Organic Peroxides DOT Class 5.2	125	Up to 55	6	330
Oxidizers DOT Class 5.1	129	Up to 55	9	495
Acids DOT Class 8 (a)	130	Up to 550	36	1,980
Reactive when wet and compatible materials DOT Class 4.3	131	Up to 55	340	18,700
Toxic DOT Class 6.1 (or by subsidiary hazard class)	132	Up to 55	6	330
Toxic DOT Class 6.1 (or by subsidiary hazard class)	133	Up to 55	4	220
Flammable/Combustibles DOT Classes 3 and 4.1	134	Up to 550	144	7,920
Flammables 1A DOT Class 2/Compressed Gases (all hazard classes)	136	Up to 55	60	3,300
Universal Waste	137	150	12	660
Caustics, DOT Class 8 (b)	138	Up to 150	24	1,320
Used Oil Class 3 (a)	139	Up to 55	30	1,650
DOT Class 9 (Other regulated materials)	140/19	Up to 55	100	5,500
Shipping	140S	Up to 55	220	9,350
Total Gallons Storage				**67,925**

* "Container Size" and "Drum Quantity" are provided to derive equivalency. Different container sizes and quantity may be placed in these container management areas, but the "Total Liquid Capacity" for the area will not be exceeded.

Containers that are stored outside in the bulk storage area under the roofline within the East Storage location will be a new storage location that will add to our overall storage capacity. This area will be able to store construction debris in 40 yd roll-offs and/or portable containers with secondary containment with a maximum storage capacity of 17,035 gallons. In addition, there is a WAD isolated accumulation area used for contingency purposes with a storage capacity of 220 gallons. Therefore, the total container storage capacity for the facility has increased to 85,180 gallons (17,255 outside + 67,925 inside). This value increases our storage capacity to less than 25% of the original capacity.

D2.1 DESCRIPTION OF CONTAINERS

WAC 173-160(2); -630(2), (4)

Containers meet the Non-bulk Performance-Oriented Packaging Standards as described in 49 CFR 178.500-600. The most common containers received at the TSD Facility are 55-gallon steel drums used for solid and liquid wastes. Both new and reconditioned drums are used at the TSD Facility. Large portable containers (between 150 and 550 gallons) are less frequently used. Examples of specification data for large portable containers are shown in Appendix D1 (Portable Tank Specifications). Additionally, roll-off dumpsters received at the TSD Facility are all DOT certified containers.

Empty 55-gallon drums are ordered when the stock-on-hand drops to 50 units. Generally, this leaves a minimum of 30 drums when replacements arrive. A minimum of eight 85-gallon and five 110-gallon salvage drums are kept in stock. A minimum of two clean spare portable containers of each type and size are kept in stock at all times.

D2.2 CONTAINER MANAGEMENT PRACTICES

WAC 173-303-340(3); -395(4); -630(5), (6), (8), (9), (11); -692(2); -806(4)(a)(viii), (b)

Container storage areas are used for storage of wastes in segregated areas compatible with other wastes as shown in Table D1-2.

A flow diagram of container storage operations is shown in Figure D1-1. Containerized waste is collected as requested from waste generation processes at various NBK Keyport accumulation areas.

D2.2.1 RECEIVING

Containers arrive at the north end of the TSD Facility (see Part A, Attachment B, TSD Facility General Layout Drawing). All drum or pallet handling/loading is typically accomplished with a forklift utilizing a drum handling attachment, or pallet jack. The containers are moved to the receiving area inside the TSD Facility. Upon arrival, containers are inspected, separated by rows a minimum of 30 inches apart according to their compatibility class as defined in Table D1-2, and perform re-verification according to Section C (Waste Analysis). Containers may remain in the receiving area for no longer than 24 hours. Once processed (weighed, inventoried, etc.) the containers are palletized and stored on pallet racks within the various enclosed storage areas.

The TSD Facility does not receive dangerous waste from off-station unless there is a current waste profile on file at the TSD Facility. The TSD Facility will submit an unmanifested waste report meeting the requirements of WAC 173-303-390(1) if the TSD Facility receives a waste shipment that is not properly manifested. The TSD Facility receives undesignated wastes on an emergency basis, such as from a spill event or the discovery of a container of unknown material on the NBK Keyport property. Each waste container of undesignated waste is placed in the 'Waste Awaiting Designation' (WAD) area located within Room 123, south of receiving area. Liquid waste in WAD is placed in a dedicated secondary containment. Storage timeframe of waste in the WAD area is typically 30 days in duration.

Unless a WAD is suspected to be 'reactive when wet', it is moved to the WAD area of the TSD Facility until the profile is complete, at which time the waste is logged in as set forth above and transferred to the appropriate segregated storage area. Wastes suspected to be 'reactive when wet' are immediately transferred to Room 131, the 'reactive when wet and compatible materials' segregated storage area upon receipt into the TSD Facility.

Containerized wastes may be received at the TSD Facility from other Department of Defense activities in the Puget Sound region such as NBK Bremerton, NBK Bangor, Puget Sound Naval Shipyard, Ft Lewis, etc. providing there is a current waste profile on file at the TSD Facility. Prior to receipt, a profile from the sending station describing the waste stream in detail will be sent to the TSD Facility. Once waste designation has been completed as required in Section C (Waste Analysis) the containers may be received at the TSD Facility. Wastes are offloaded and enter the TSD Facility in the same manner as on-station wastes described in the paragraph above.

Dangerous waste containers arriving in the receiving area of the TSD Facility are visually examined for legible and proper labeling, structural integrity, and leakage. The containers are also inspected to ensure they are sealed and closed to prevent air emissions in accordance with the requirements of 40 CFR 264.1086 (c) (4) (i). Container condition is also assessed during daily inspections and during daily operations. Additionally, containers in the receiving area, storage compartments, and shipping area are inspected daily for leaks. If a container shows signs of leakage, rusting, or structural defect, the contents are put into a replacement drum or the container is moved into a salvage drum. Emptied damaged drums are rinsed and compacted or shredded for shipment off-station. If a spill or leak of a container occurs, the incident is recorded and addressed as described in Section F (Procedures to Prevent Hazards).

The receiving area is capable of holding a maximum of 62 – 55-gallon drums at one time. Within the receiving area, wastes are segregated, consolidated and logged according to the storage method as set forth below and shown in figure D1-1. Containers in the receiving and storage areas remain closed at all times, except when sampling, adding, or removing waste. Only trained Dangerous Waste Handlers perform the segregation and consolidation tasks.

Bulk outside storage at the TSD Facility is located under the roofline in the East Storage area; see Part A, Attachment B – TSD Facility General Layout. Containers consisting of large roll-off dumpsters and large portable containers received at the TSD Facility may be stored in this area. Roll-off dumpsters are required to have no free flowing liquids and large portable containers in this area are required to have secondary containment.

D2.2.2 SEGREGATION

Items for segregation are received at the TSD Facility in drums and bags, and metal, glass, plastic and carton containers.

The following segregation processes take place at the TSD Facility:

<u>TRANSFERS</u>

This process takes place in the receiving area and is strictly reserved for containers that do not require any repackaging to move from receiving to the segregated storage areas. Containers are logged in and inspected for condition and labeling requirements. If required, labeling is corrected/updated/replaced, and the container is moved to the appropriate segregated storage area. Information, including the date the waste container was accepted into TSD Facility, the Waste Identification Tracking (WIT) Number, and any other information listed in Section D2.3 not already on the label is added.

Segregation of solid waste streams along with trash and recyclable items are separated and sent to solid waste or recycled.

<u>OVERPACKING</u>

This process takes place in the receiving area. A container that has been found to be in leaking, poor or otherwise unacceptable condition is placed in a larger container without opening the original container. The new outer container is logged in, labeled, and moved to the appropriate segregated storage area. If a container is found to be leaking in any other TSD Facility area, the overpacking process can take place in that area.

<u>LAB PACKING</u>

This process takes place in the segregated storage areas. Lab packs are packaged according to the requirements of WAC 173-303-161 and the Department of Transportation (DOT) in CFR Title 49-173(12). Lab packs contain wastes of potentially different Waste Generator Record (WGR) numbers but in the same compatibility class (see Table D1-2). When constructing the lab pack and determining which materials may be packaged in the same container, compatibility, packaging requirements, and DOT hazard classes require that only compatible materials from the same hazard class be packaged and shipped in a common shipping container. The DOT list of hazard classes is found in 49 CFR 172.101. Lab packs are constructed with a compatible absorbent material in sufficient quantity to separate the items, prevent breakage, and absorb all free liquid within the container if breakage should occur. Wastes that are combined in a single container remain in their individual intact and unopened containers.

<u>GENERAL</u>

In the receiving area, solid waste, trash and recyclables are separated and sent to solid waste or recycle for disposal.

Table D1-2. Waste Incompatibility matrix

IN compatibility Class*	Flammables (3, 4.1 & 4.2)	Oxidizers/Organic Peroxides (5.1 & 5.2)	Class 9 / Compressed Gases (all hazard classes)	Corrosives - Acids (8a)	Corrosives - Bases (8b)	Cyanides / Sulfides (8c)	Reactive When Wet and compatible materials (4.3)	Poisons* (6.1 other than PGI Zone A, and not including cyanides / sulfides listed above
Flammables (3, 4.1 & 4.2) Room 134		X		X	X		X	
Oxidizers (5.1) Room 129	X			X		X	X	
Organic Peroxides (5.2) Room 125	X			X		X	X	
Compressed Gases (all hazard classes) Room 136 **	X							
Corrosives - Acids (8a) Room 130	X	X			X	X	X	
Corrosives - Bases (8b) Room 138	X			X			X	
Reactive When Wet and Compatible Materials (4.3) Room 131	X	X		X	X	X		
Toxics Room 132 ** and Room 133								
Class 9 Room 123S; Room 140/19								

*Compatibility is based on 49 CFR 174.81 and 40 CFR, Part 264; Appendix V. Materials will be segregated by their primary hazard class. The requirements of this table do not apply to containerized materials packaged such that an outer container provides secondary containment and segregation (e.g., lab packs, overpacks, etc.)

An "X" designates that materials are **<u>IN</u>**compatible. Incompatible materials must be placed in separate container storage rooms. Incompatible materials must be staged in separate rows a minimum of 30 inches apart in the receiving area and shipping area.

** Except when there is a subsidiary hazard class, the waste will be segregated according to that class.

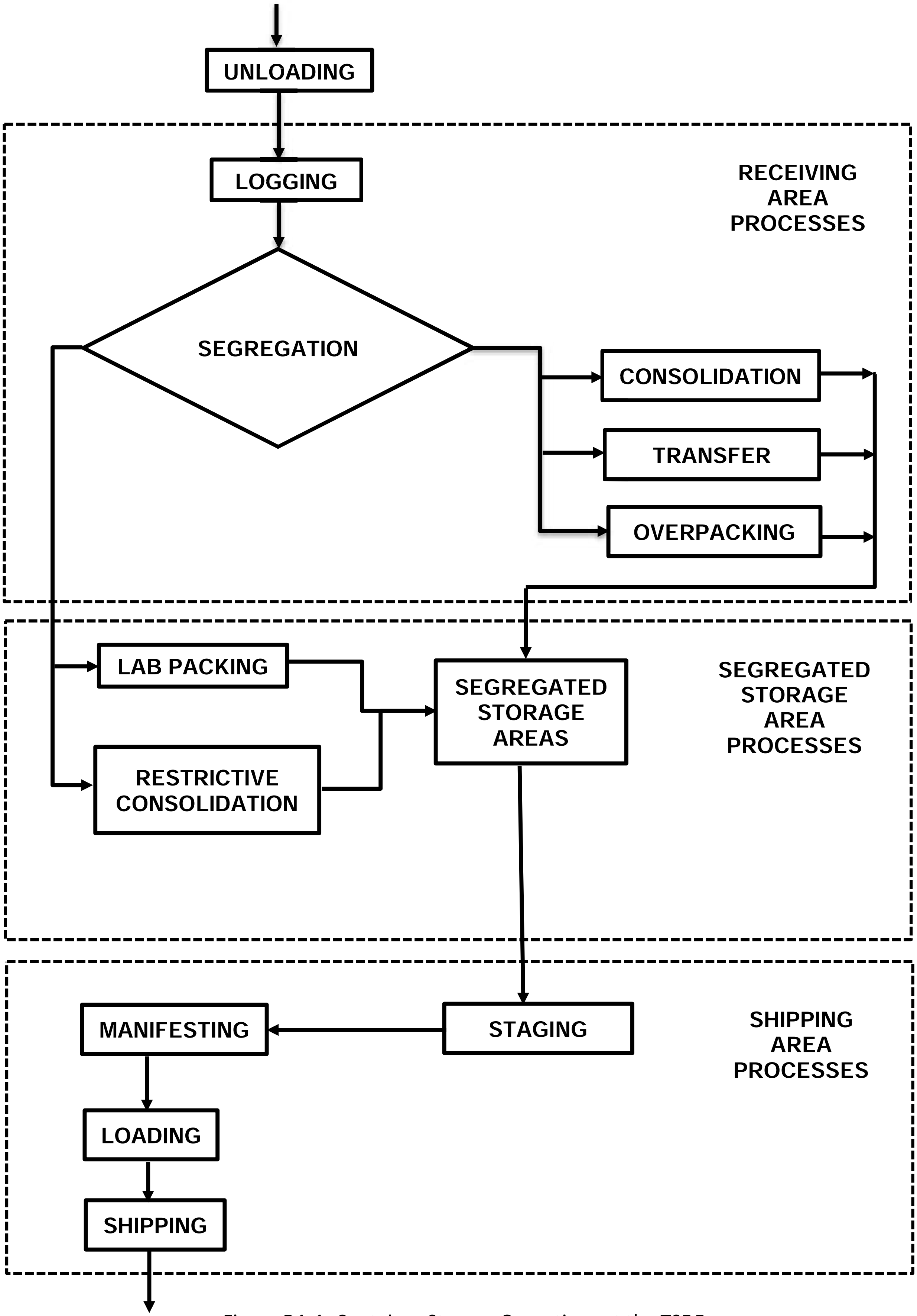

Figure D1-1, Container Storage Operations at the TSDF

D2.2.3 CONSOLIDATION

Consolidation takes place in Room 128, the drum wash area. Latex paints and associated compatible products, and oil-based paints and associated compatible products, are consolidated in dedicated drums. Aerosol cans, and pint through 5-gallon containers are punctured and drained into an open-top drum. The VOCs and propellants are captured and removed from the exhaust with a pair of carbon filters in series before venting outside the TSD Facility. See Part A, Attachment B (TSD Facility General Layout Drawing) for the exact location of this consolidation area, and Appendix D2 (Paint Consolidation Details) for details of equipment used in this consolidation process, including carbon filter breakthrough indicator calibration and filter change-out procedures. The waste paint containers are only open when placed in the paint can crusher and while it is in operation.

Drums are prepared for shredding in room 128. Residues from waste containers are consolidated in a bung drum next to a fume hood, using a 'Burpless' funnel, designed to meet the requirements of 29 CFR 1910.106(e)(2)(i). The funnel has an extension that fills the drum from the bottom, minimizing VOC generation during filling, and a lid to seal in VOCs when not in use. Waste is emptied so that the container is "empty" as defined in WAC 173-303-160(2). The consolidation container is sealed and moved to the appropriate storage location after the transfer process is complete. Fumes from the fume hood are vented outside. If the bung cannot be removed, the top of the drum will be removed using the drum de-header. Bung drums with the top removed and open-top drums are washed in an enclosed industrial drum washer. Wastewater from the drum washer is collected and shipped for disposal. Decontaminated drums are recycled or shredded in the drum shredder under the east canopy adjacent to room 128.

Consolidation also takes place within receiving and in each of the storage areas within the TSD Facility. Wastes received from accumulation areas onsite throughout the facility have been prepackaged for safe handling. Examples of such wastes received includes but is not limited to liquids sealed inside glass, metal or plastic containers placed in plastic zip-lock bags for secondary containment, and solids placed in plastic zip-lock bags prior to shipping from an accumulation site. Shipments are not received from the accumulation site unless prepared as required by the Waste Disposal Request (WDR). Pre-packaged wastes received from accumulation areas onsite meeting WDR requirements are not opened at the TSD Facility unless required for verification testing per Section C (Waste Analysis) and are then placed directly in the consolidation container in the appropriate storage area immediately after inspection and logging in at the receiving area.

Drum compaction takes place in the receiving area and on the northeast end of the facility within the East Storage area.

Drums are stored in segregated storage areas. A minimum 30-inch separation between aisles of containers is maintained at all times in the receiving, storage, and shipping areas. Rows of drums are not more than two containers wide. Drums are placed so all labels are visible from the aisle. With the exception of the Toxic and Organic Peroxides storage areas, and Class 9 room 140 - storage site 19, drums are placed on pallets, which are stored in pallet storage racks at two pallets per shelf. Pallet storage racks consist of three levels. The lower two levels are used to store palletized drums. With the exception of Class 9 room 140 - storage site19, drums or pallets are not stacked directly on top of each other. Fifty-five gallon drums are stored at up to four per pallet and 30-gallon drums are stored at up to five per pallet.

As many as four portable containers with a capacity of up to 550 gallons each may be stored on the floor in the receiving area (room 123), the acids storage area (room 130), and the flammables storage area (room 134). Portable storage containers up to 330 gallons may be stored in the used oil storage area (room 139) or the caustics storage area (room 138).

Part A, Attachment B, (TSD Facility General Layout Drawing) contains a detailed floor plan of the TSD Facility and illustrates the location, designated waste type, and room number of each storage area and the container receiving and shipping areas. The storage areas are designated according to waste compatibility as defined in Table D1-2.

In the Oxidizer storage areas, four shelf storage racks are used to store small items, and drums are placed on steel grates over the sumps. All wastes are stored in such a manner that they can be inspected from ground level.

A portion of room 140 has been set aside for the storage of a maximum of 120 – 55-gallon fuel contaminated solids and empty fuel contaminated drums (empty by RCRA definition). See Part A, Attachment B, (TSD Facility General Layout Drawing) for the exact location of this delineated area referred to elsewhere Class 9 room 140 - storage site19 or 140/19. The storage volumes of this site have been taken into account when calculating overall TSD Facility storage capacity and secondary containment requirements. Storage of Class 9 is compatible with all hazardous wastes staged in room 140S (shipping area) because it is compatible with all other storage classifications in Table D1-2. Exclusive to this storage site, drums are double-stacked, with one pallet on the floor and one pallet between the levels. Only one-size drums are stored in each double stack, for example, only 55-gallon drums are stacked with other 55-gallon drums in a double stack and only 30-gallon drums are stacked with other 30-gallon drums in a double stack. The empty drum storage area may also be utilized as a storage space for silver-zinc batteries. The batteries are managed as Universal Waste in accordance with WAC 173-303-573. The allowable quantity of all items, including batteries, will remain below Table D1-1 capacity limits at all times.

Room 131, the 'reactive when wet and compatible materials' storage area is used to store non-flammable materials compatible with 'reactive when wet' materials and wastes. These materials include, but are not limited to aluminum, cadmium, chromium, cobalt, copper, lead, lithium, magnesium, mercury, nickel, steel, tin, titanium, zinc, and alloys of these non-flammable materials.

To minimize spills that could occur during container handling, the building design features flat, level surfaces and forklift travel aisles, as well as shallow, straight ramps. In addition, there is ample maneuvering space and wide doors for safe transport of palletized drums. The storage racks are secured by anchor bolts embedded in the concrete floor and each shelf is of the appropriate size needed to accept palletized containers safely and securely. The racks are rated for 3,000 pounds per pallet and will accommodate two pallets per shelf. Two-shelf racks are designed so that drums are 1 and 6 feet above the floor.

The forklift drum handling attachment is designed to safely transport individual drums without creating unnecessary stress and strain on the drums and prevents ruptures and leaks. Drum dollies are occasionally used for the safe transport of containers.

D2.2.4 SHIPMENT

When dangerous waste is ready to be disposed offsite, the receiving TSD Facility and transporter are contacted and shipping documents prepared.

Containers are then staged in Room 140S (room 140 - shipping area) for inspection and prepared 24 hours in advance of a scheduled shipment. This area has a holding capacity for a maximum of 220 – 55-gallon containers. A minimum 30-inch separation between aisles of containers is maintained at all times in room 140S. The drums are loaded at the covered shipping dock at the south end of the TSD Facility for off-station disposal in accordance with the manifest. Incompatible materials must also be staged a minimum of 30 inches apart and in separate rows on the shipping dock.

If a shipment is delayed due to unforeseen circumstances (unexpected absence of personnel, equipment breakdown, delay of transport truck) after the shipment has already been staged in room 140S, the shipment will be held in room 140S for up to 72 hours so the shipment can take place without undue movement of the dangerous wastes. If the delay cannot be resolved within 72 hours, waste will be segregated again, as necessary, by placing containers back into their original storage areas. Any shipments held for more than 24 hours in room 140S will be recorded in the incident record.

The manifest and packing list includes the following information:

1. Drum numbers
2. Transportation manifest number
3. Name of transporter
4. DOT hazard class and identification number for the drums
5. EPA identification number
6. A description of each individual container which includes:
    a. Chemical name of all compounds and mixtures
    b. Physical state of each item
    c. Size and type of each item
    d. Amount of material in each item
    e. EPA/WDOE waste number
    f. Reportable Quantity
    g. LDR Certifications as needed

Lab packs containing material identified in 40 CFR 268 as a Land Disposal Restricted (LDR) waste must have the LDR certification accompany the load and manifest.

D2.3 CONTAINER LABELING

WAC 173-303-395(6), -630(3), -806(4)(b)(iii)

Containers are labeled with the following information:

1. Date waste container was accepted into TSD Facility
2. Waste Identification Tracking (WIT) Number
3. The words 'Hazardous Waste' or 'Dangerous Waste' and Hazard Class. Containers used to hold non-dangerous waste will be labeled as such.
4. UN/NA Number
5. Shipping Name
6. EPA/WDOE Number(s)
7. WDOE Designation
8. Generator's Name and Address
9. DOT Major Risk Label(s)
10. "Dangerous Waste" label

In addition to the above labeling required on containers in storage, the Manifest Document Number is added to the label prior to waste shipment.

Labels are legible and/or recognizable from a distance of twenty-five feet or the lettering size is a minimum of one-half inch in height. The labels are not removed unless the dangerous waste is transferred from the labeled container to another container. Labels are immediately removed and destroyed from empty containers unless the container will continue to be used for storing the same dangerous waste at the TSD Facility. If labels cannot be removed from the empty container, they are painted over. A previously used container is not used to store a different or incompatible dangerous waste. Labels are displayed in accordance with 49 CFR 172.304 and WAC 173-303-395(6) and 630(3) and are inspected for legibility during daily inspections.

Upon preparation of dangerous waste for shipping, container labels are inspected to verify labeling is correct in accordance with 40 CFR 262.31 and 262.32 and WAC 173-303-190, 395(6), and 630(3).

D2.4 SECONDARY CONTAINMENT REQUIREMENTS FOR STAGING, STORING, AND PROCESSING DANGEROUS WASTE CONTAINERS

WAC 173-303-630(7); 806(4) (b)

The loading area is covered and has a slotted drainage trench that contains any spills should they occur.

D2.4.1 SECONDARY CONTAINMENT SYSTEM DESIGN FOR CONTAINERS

This section provides design and construction information that demonstrates that the container storage areas of the building are capable of containing leakage from tanks and drums and containing major and minor spills. Operational information demonstrating that containers are kept from contact with standing liquids and are properly stored and maintained is also provided.

D2.4.2 SYSTEM DESIGN

Part A, Attachment B, (TSD Facility General Layout Drawing) contains floor plans of the container storage and handling areas. There are three types of concrete slabs used in the storage areas of the TSD Facility. A Type "D" slab is used in the following segregated storage areas: 'Reactive when wet and compatible materials', Acids, Flammables, Flammables 1A, Toxics, and Oxidizers. The Type "D" slab is 15½-inch thick reinforced concrete on 12 by 30 inch reinforced concrete grade beams on concrete pile and pile caps at 9 feet on center. A Type "B" slab is used in the Organic Peroxides,, Used Oil, Caustics, and Universal Bulbs segregated storage areas. The Type "B" slab is 14 inch thick reinforced concrete on 12 by 36 inch reinforced concrete grade beams on concrete piles and pile caps at 9 feet on center. A Type "E" slab is used in the Bulk Storage area and is 8-inch thick reinforced concrete on 12 x 28 inch reinforced concrete grade beams on concrete pile and pile caps at 9 feet on center. See Appendix D3 (TSD Facility Floor Plans and Details) for cross sections of both concrete floor slab designs. The concrete used meets the requirements for Structural Concrete for Buildings, 1989, per ACI-301 and Building Code Requirements for Reinforced Concrete, 1992, per ACI-318. The compressive strength for the floor slabs, grade beams, and piles and pile caps is 4,500 psi, 4,000 psi, and 3,000 psi, respectively. The concrete is reinforced with ASTM Grade 60 (number 5 sizes and larger) and ASTM Grade 40 (number 4 sizes and smaller) bars.

All container handling and storage areas are protected from weather. The receiving, shipping, and storage areas are protected within the enclosed TSD Facility structure. Bulk storage and empty containers within the east storage area is protected by a roof. Since there are no uncovered storage areas in the TSD Facility, additional volume of precipitation from a 25-year storm or 24-hour duration per WAC 173-303-630 (7) (a) and 173-303-806(4)(b)(i)(A) does not apply. All downspouts on the east, south, and west sides of the building are piped directly into the underground storm water drainage system. Downspouts for the north canopy drain onto the pavement outside the fenced area, away from the TSD Facility.

Construction features contain leaks and spills within each segregated storage compartment. Application of a non-shrink grout covered with a sealant provides an effective watertight seal between the segregated storage compartments. All concrete joints have built in water stops (See Appendix D3, TSD Facility Floor Plans and Details).

The floors of the segregated storage areas, the receiving area, and the shipping area are coated with special sealers. All areas are first coated with concrete sealer. Most areas are then treated with an epoxy matrix. The 'Reactive when wet and compatible materials' storage area is treated with a second coat of concrete sealer. Table D1-3 shows the specific coating for each area. The specifications and chemical resistance of each coating is found in Appendix D4 (Floor Coating Specifications). The sealers are compatible with the type of waste in each storage area.

Containment is provided in the Oxidizer, Toxic, and Organic Peroxide storage areas by segregated blind sumps. See Part A, Attachment B, (TSD Facility General Layout Drawing), for exact locations. All sumps are coated with epoxy matrix.

The condition of the coating is maintained and is reapplied as necessary per manufacturer instructions.

Table D1-3. Floor Coatings for Interior Container Storage and Handling Areas

Room Name	Room #	Floor Coating
Receiving Area	123N	Epoxy Matrix
Class 9	123S	Epoxy Matrix
WAD	123M	Epoxy Matrix
Organic Peroxides	125	Epoxy Matrix
Oxidizers	129	Epoxy Matrix
Acids	130	Epoxy Matrix
Reactive when wet and compatible materials	131	Sealer
Toxic	132	Epoxy Matrix
Toxic	133	Epoxy Matrix
Flammable/Combustible	134	Epoxy Matrix
Flammable 1A/compressed gases	136	Epoxy Matrix
Universal Waste	137	Epoxy Matrix
Caustics/cyanide/sulfide	138	Epoxy Matrix
Used Oil	139	Epoxy Matrix
Class 9	140/19	Epoxy Matrix
Shipping	140	Epoxy Matrix

D2.4.3 STRUCTURAL INTEGRITY OF BASE

The base of each storage room was designed to accept building codes in existence at the time the TSD Facility was designed and constructed as described in Section D2.4.2. The entire building was designed and constructed under the purview of licensed Professional Engineers in the employment of the architectural engineering firm SJO Consulting Engineers of Portland, OR. The

PE signature for the entire drawing package is shown on the legend and notes sheet included in Appendix D3 (TSD Facility Floor Plans and Details).

D2.4.4 CONTAINMENT SYSTEM CAPACITY

Each interior storage compartment is designed to contain at least 10 percent of the total volume of all containers or the volume of the largest container, whichever is greater (WAC 173-303-630 (7) (a) (iii)). The capacity of the containment for each segregated storage area is summarized in Table D1-4 with supporting calculations provided in Appendix D5 (Containment Calculations). See Part A, Attachment B, (TSD Facility General Layout Drawing) for dimensioned drawings of all rooms in the TSD Facility. Room 126 and the area under the canopy east of the building will not be used to store dangerous wastes.

Table D1-4. Containment for Interior Container Storage

Room Name	Room #	Total Liquid Storage Capacity (gallons)	Containment Capacity Required (gallons)	Containment Capacity Provided (gallons)
Receiving	123N	3,410	341	9,346
Class 9	123S	10,560	1056	9,346
WAD	123M	2,200	220	9,346
Organic Peroxides	125	330	55	1,040
Oxidizers	129	495	55	296
Acids	130	1,980	550	3,804
Reactive when wet and compatible materials	131	18,700	1870	15,222
Toxic	132	330	55	1,118
Toxic	133	220	55	1,118
Flammables/Combustibles	134	7,920	792	4,350
Flammable 1A/compressed gases	136	3,300	330	4,308
Universal Waste	137	660	150	480
Caustics	138	1,320	150	480
Used Oil	139	1,650	165	1052
Class 9	140/19	5,500	550	1,359
Room 140S (Shipping)	140S	9,350	935	7,000

The following storage areas have been designed with sloping floors:
Acids, Flammable/Combustible, Flammable 1A, Caustics, and Used Oil. Spilled liquids collect in the lowest point of the room. The liquid can then be removed using a portable pump and absorbent pads. Containment by blind sumps is provided in the Toxic and Oxidizers segregated storage areas. Locations of these sumps are shown in Part A, Attachment B, (TSD Facility General Layout Drawing), and secondary containment volume calculations are shown in Appendix D5 (Containment Calculations).

In both the receiving/Class 9 and shipping areas, containment is provided by the inclined floor design. The receiving/Class 9 area, which can hold a maximum of 254 drums, or 13,970 gallons of liquid capacity, has containment of 9,346 gallons. The shipping area, which can hold a maximum of 290 drums, or 15,950 gallons of liquid capacity, has containment of 11,941 gallons. Calculations for these secondary containment volumes are shown in Appendix D5 (Containment Calculations).

The TSD Facility is designed for 20 minutes of fire flow containment. The fire flow containment basins are uncovered and located on the west side exterior of the building. See Part A, Attachment B (TSD Facility General Layout Drawing) for locations of these sumps, and Appendix D5 (Containment Calculations) for secondary containment volume calculations. The containment basin areas have a flexible, high-density polyethylene membrane liner installed beneath the layer of drain rock, with a 2-inch layer of sand above and below the membrane liner. The liner adds an extra level of protection against possible future cracking of, and leakage through, the concrete. Performance specifications of the flexible membrane liner are found in Appendix D6 (Flexible Membrane Specifications). The basins are coated with concrete sealer and epoxy coating. The specifications and chemical resistance of each coating is found in Appendix D4 (Floor Coating Specifications). During normal operation, valves in the pipes that drain to the storm system remain open so that rainwater collected in the containment basin drains to the storm system. In the event of a fire, the valves close automatically to contain fire flow.

Additional safety design features are related to containment of spills in the segregated storage areas. The pallet racks are constructed so that the bottom of a drum on the lowest shelf is one foot above the floor level, preventing contact with liquid in the containment. The racks have wire decks to provide interior waterfall, in the event of a fire, without pooling of sprinkler water on the shelves.

The area containment surfaces and fire flow/spill containment sump surfaces are free of cracks or gaps and are inspected for cracks or damage as set forth in Section F (Procedures to Prevent Hazards).

D2.4.5 CONTROL OF RUN-ON

Most entrances into the building are elevated for truck loading/unloading. Those entrances that are level with the surrounding parking/shipping area are sloped away from the building to prevent run-on. There are no upslope areas near the building. The TSD Facility is designed to eliminate any run-on from a 25-year, 24-hour storm.

D2.4.6 REMOVAL OF LIQUIDS FROM CONTAINMENT SYSTEM

WAC 173-303-630(7)(a)(ii); -806(4)(b)(i)(E)

Containment sumps and floors are inspected daily for stains and/or spills. Spilled dangerous waste collected in the sumps is removed from the sump using a portable pump immediately following inspection. Refer to Section F (Procedures to Prevent Hazards). Procedures for spill response are dependent on the volume and type of waste spilled. Refer to Section G (Contingency Plan), for details of spill response of container spills and leakage.

D2.4.7 DEMONSTRATION THAT CONTAINMENT IS NOT REQUIRED BECAUSE CONTAINERS DO NOT CONTAIN FREE LIQUIDS, WASTES THAT EXHIBIT IGNITABILITY OR REACTIVITY, OR WASTES DESIGNATED F020–023, F026, OR F027

WAC 173-303-630(7)(c); -806(4)(b)(ii)

Containment is provided for all containers at the TSD Facility with one exception. Roll-off dumpsters that contain construction debris not containing free liquids are stored on a slope reinforced concrete floor under the East Storage roofline. Containers will not be impacted with precipitation or standing water in this area.

D2.5 PREVENTION OF REACTION OF IGNITABLE, REACTIVE, AND INCOMPATIBLE WASTES IN CONTAINERS

D2.5.1 MANAGEMENT OF REACTIVE WASTES IN CONTAINERS

WAC 173-303-630(8)(a); -806(4)(b)(iv)

Reactive wastes are stored in containers in segregated storage areas. Waste characteristics are identified and documented through the Waste Generation Record and WIT number. Section C (Waste Analysis), has additional details of these documents. Wastes received from off-station will have been profiled before transfer to the TSD Facility as set forth in Section C (Waste Analysis), and will be stored in the segregated storage areas based on table D1-2. Accidental reaction of these wastes is prevented by the following practices, including, but not limited to: protection from sources of open flames, smoking, cutting and welding, hot surfaces, frictional heat, sparks, spontaneous ignition, and radiant heat. While reactive waste is being handled, the operator confines smoking and open flame to specially designated locations. "No Smoking" signs are conspicuously placed wherever there is a hazard from reactive waste and smoking is prohibited inside the building.

Containers holding reactive wastes are a minimum of 50 feet from the property line. Explosives, as identified in WAC 173-303-090 (7) (vi), (vii), and (viii), are not managed at the TSD Facility. Therefore, the requirements for storage of these wastes are not applicable.

The Flammable 1A compartment is designed in compliance with explosion venting requirements per Military Handbook 1032/4.4.4, 3.3.4, Uniform Building Code 910, NAVFAC DM 32.03, and Table 8, NFPA 68. The explosion venting is located on the south wall of the storage compartment.

The 'Reactive when wet and compatible materials' storage area is designed so that water cannot enter from the outside or from adjacent storage areas within the building. The storage area has a leak-free roof, a recessed flat concrete floor with no floor drains, and protection at the door opening so that water will not run in. Raindrop sills on the exterior doors further prevent water from entering the area. Automatic sprinklers are not present, and no other water lines pass through the space. Fire protection is provided according to NFPA 485-A94 TCR by two copper extinguishing equipment carts located just outside the storage area.

There are two types of access doors for the 'Reactive when wet and compatible materials' storage area: three overhead doors to provide forklift access and six personnel swing type exit doors. The personnel exit doors are 3-hour fire rated and constructed of steel. Access is not possible from the exterior of the area, and the doors are equipped with panic bars for exit from the interior of the area. The overhead doors are 3-hour fire rated.

The 'Reactive when wet and compatible materials' storage room was designed to the requirements of the UFC 80.310 (a) (1) through (10) for indoor storage of water reactive materials. Detached storage is required if the amount of storage of Class 2 reactive 'Reactive when wet' material exceeds 50,000 pounds. The 'Reactive when wet and compatible materials' storage area has a capacity of 900, 30-gallon drums.

The 'Reactive when wet and compatible materials' storage room has humidity monitoring and adequate ventilation to prevent the build-up of gases. Room ventilation is designed to ensure negative pressure.

See Part A, Attachment B, (TSD Facility General Layout Drawing) for drawings of the 'Reactive when wet and compatible materials' storage area and Appendix D3 (TSD Facility Floor Plans and Details) for Professional Engineer (PE) certification of the design.

D2.5.2 MANAGEMENT OF IGNITABLE AND CERTAIN OTHER REACTIVE WASTES IN CONTAINERS

WAC 173-303-630(8)(b); -806(4)(b)(iv)

Ignitable wastes are stored in containers in segregated storage areas. Waste characteristics are identified and documented. Refer to Section C (Waste Analysis) for a more detailed description of waste identification and documentation procedures. Accidental ignition of these wastes is prevented by the following practices, including, but not limited to: protection from sources of open flames, smoking, cutting and welding, hot surfaces, frictional heat, sparks, spontaneous ignition, and radiant heat. While ignitable waste is being handled, the operator confines smoking and open flame to specially designated locations. "No Smoking" signs are conspicuously placed wherever there is a hazard from ignitable waste; additionally, smoking is prohibited inside the building.

All interior storage compartment walls are 4-hour fire rated walls and the exterior walls of the building are 2-hour fire rated walls. The roof is 2-hour fire rated. All storage compartments have two exits. The separation design criterion exceeds that of the Uniform Fire Code and the Uniform Building Code.

Fire inspections required by WAC 173-303-395 (1) (d) are performed as detailed in Section F (Procedures to Prevent Hazards).

See Part A, Attachment B (TSD Facility General Layout Drawing) for drawings of the ignitable wastes storage area and Appendix D3 (TSD Facility Floor Plans and Details) for PE certification of the design.

D2.5.3 DESIGN OF AREAS TO MANAGE INCOMPATIBLE WASTES

WAC 173-303-630(9)(c); -806(4(b)(iv)

Incompatible wastes are not placed in the same container or in unwashed containers. Incompatible wastes in containers are stored in segregated storage areas. The storage areas are based upon the DOT hazard classes per 49 CFR 173 and table D1-2. The segregated areas are separated by walls designed to prevent leakage into adjacent rooms. See Part A, Attachment B, (TSD Facility General Layout Drawing) for drawings of the storage areas and Appendix D3 (Floor Plans and Details) for PE certification of the design.

Verification procedures in Section C (Waste Analysis) conducted at the time a waste stream is accepted to the TSD Facility, verify the identity of the received waste stream. Wastes generated by new processes, permitted for storage at the TSD Facility, are stored in container storage areas after profiling as set forth in Section C (Waste Analysis) to ensure compatibility with the existing waste streams in the container storage area. Should spills occur in multiple segregated storage areas simultaneously, the secondary containment basins are designed so that overflow maintains segregation of incompatible wastes.

D3 TANK SYSTEMS
WAC 173-303-395(6); - 640; -806(4)(c)

This section provides TSD Facility tank system and secondary containment design, construction, and operational information. Tables D2-1, Storage Tanks, and D2-2, Tank Storage Waste Types by Tank, provide information on the tank capacities and types of wastes stored in the tanks. The WIT numbers listed in table D2-2, reflect the wastes that can be stored in these tanks. These existing waste streams have been consolidated in tanks in the past and are proven compatible with one another. Verification procedures in Section C (Waste Analysis) conducted at the time a waste stream is accepted to the TSD Facility will verify the identity of the waste stream. Wastes generated by new processes may be stored in these tanks after profiling, as set forth in Section C (Waste Analysis) to ensure compatibility with the existing waste streams in the receiving tank. The locations of the tank systems in the TSD Facility are shown in Part A, Attachment B (TSD Facility General Layout Drawing).

Table D2-1. Storage Tanks

TSD Facility Site Name	Name	Function	Total Capacity (Gal)
TSD -101	Bulk Storage Waste (Oily Wastewater)	Storage	5,000
TSD -102	Bulk Storage Waste (Oily Wastewater)	Storage	5,000
TSD -103	Bulk Storage Waste (Cyanide Wastewater)	Storage	5,000
TSD -104	Bulk Storage Waste (Solvent Wastewater)	Storage	5,000
TSD -105	Bulk Storage Waste (Solvent Wastewater)	Storage	5,000
TSD -106	Bulk Storage Waste (Cyanide Wastewater)	Storage	5,000
TSD -107*	Empty	Storage	5,000
TSD -108*	Empty	Storage	5,000
TSD -109*	Empty	Storage	5,000

*Tank is not certified and will not be used for dangerous waste unless authorized by Ecology through a permit modification.

D3.1 DESIGN, INSTALLATION AND ASSESSMENTS OF TANK SYSTEMS
WAC 173-303-395(4); -640(2); -806(4)(a)(viii)-(x)(i), (4)(c)(i), (ii), (v), and (vi)

D3.1.1 DESIGN REQUIREMENTS
WAC 173-303-640(2)(c), (3)(a)(b); -806(4)(c)(i), (ii), (iii), and (v)

Tank design drawings for the TSD Facility tanks are provided in Appendix D7 (Tank Drawings). Tank design assessments and calculations are provided in Appendix D8 (Tank Calculations).

Tank integrity assessments for the tanks currently in use (TSD -101 through 106), certified by an independent, qualified, registered Professional Engineer, pursuant to WAC 173-303-640 (2) and (3), are provided in Appendix D9, (Tank Integrity Assessments and Certifications). The design assessments attest that the tanks have sufficient integrity and are acceptable for storing and treating dangerous waste. The assessment is conducted to demonstrate that the foundation, structural support, seams, and connections are adequately designed and that the tanks have sufficient strength and compatibility with the wastes. The design assessments and information provided in Appendix D8 (Tank Calculations) demonstrate that the tank foundations maintain the load of full tanks and verify that ancillary equipment is supported and protected against physical damage and excessive stress due to settlement, vibration, expansion, or contractions.

Tank systems exterior and interior coating specifications ensure corrosion protection and compatibility with tank waste. Refer to Appendix D11, (Tank Systems Coating Specifications), which also includes manufacturer's data sheets and documentation showing conformance with the Military Specifications required in the design specifications. As Fuel is a large volume tank waste, information is provided from the Fuel technical manual stating compatibility with epoxy paint coatings.

Table D2-2. Tank Storage Waste Types by Tank

Tank Identification	Waste Type	Waste Name
TSD-101 and TSD-102	Oily Wastewater	Water & Oil
		Fuel Substitute
		Oil & Water (25-95% oil)
		Water & oil (>51% water)
TSD -103 and TSD -106	Cyanide Wastewater	Fuel Flush
TSD -104 and TSD -105	Solvent Wastewater	Fuel & Mineral Sprits
		Fuel & Agitene
		Fuel & Water
		Fuel & Alcohol
		Fuel & Fuel substitute
		Fuel, Detergent & Water
		Wash water, Oil, Coolant & HOCs
		Fuel, Water & Solvents
		Fuel Wash water, B.106
TSD -107**	None	Empty
TSD -108**	None	Empty
TSD -109**	None	Empty

* Waste Identification Tracking (WIT) Number

** Tank is not certified and is not in use

D3.1.2 INTEGRITY ASSESSMENTS

WAC 173-303-640(2)(a), (c), and (e), (3)(a, (b), and (g); -806(4)(c)(i), (ii), (iii), (v), and (vi)

Integrity assessments for tanks consist of both internal and external inspections. The tank shells and welds are visually inspected externally for cracks, leaks, corrosion, erosion, and general condition. Ultrasonic thickness measurements are taken, and tank support structures and welds are inspected for cracks, corrosion, and general condition. Interior and exterior tank coatings are inspected for scratches, craks, delamination and peeling. Results of the integrity assessment are reported for each individual tank. This report addresses the adequacy of the tanks system considering its use, and addresses its structural design, condition, and corrosion control. A professional engineer will certify acceptable tank systems. Should the independent assessment indicate that the tank requires modifications or repair; the tanks will be upgraded as required before a certification is issued.

If a tank fails certification, the independent engineer may conditionally certify the tank based on the operational hazard and the schedule for repair. Ancillary equipment is normally assessed for integrity by means of a leak test carried out at design pressure. Alternative testing methods include visual inspection and ultrasonic thickness testing.

Appendix D9 (Tank Integrity Assessments and Certifications), contains the most recent integrity inspection reports completed at permit issuance. Future integrity assessmemts are scheduled to take place once every five years.

D3.1.3 ADDITIONAL REQUIREMENTS FOR EXISTING TANKS

WAC 173-303-640(2)(a) and (c)(v)

As part of the integrity assessment, Ultrasonic tank shell thickness measurements will be taken, compared to minimum acceptable thicknesses, and documented to ensure the tank integrity is acceptable for ongoing use of the tank system. Actual or estimated corrosion rates wll be calculated and documented to demonstrate that the existing schedule for additional integrity assessments is adequate.

D3.2 SECONDARY CONTAINMENT AND RELEASE DETECTION FOR TANK SYSTEMS

WAC 173-303-640(4); -806(4)(c)(vii)

D3.2.1 REQUIREMENTS FOR ALL TANK SYSTEMS

This section describes the secondary containment systems for the TSD Facility tank systems. Tank secondary containment systems are designed and constructed to prevent any migrated waste or accumulated liquid from escaping the system and entering the soil, groundwater, or surface water at any time during use of the tank system. The containment system is capable of detecting and collecting releases and accumulated liquids until the collected material can be removed. Liquid sensors, compatible with the wastes stored in the tanks are installed under each tank. The sensors are connected to an audible and visual alarm in the truck loading-unloading bay, and are monitored by daily security patrols.

The tank system base and containment system is constructed and coated with materials that are compatible with the wastes to be placed in the tank system and have sufficient strength, thickness, and resistance to prevent failure owing to pressure gradients, physical contact with wastes, climatic conditions, and the stress of daily operations.

The containment slab is capable of providing support, resisting pressure gradients above and below the system, and preventing failure due to settlement, compression, and uplift. The 8-inch containment walls and the 14-inch concrete slab are structurally reinforced with #5 rebar. Key-joints between the walls and slab confer a high degree of structural strength. The slab rests upon an 8-inch layer of drain rock serving to alleviate hydrostatic pressure. All concrete cold joints and slab interfaces are constructed with water stops. See Appendix D3 (TSD Facility Floor Plans and Details) for details of all foundation and floor cross sections.

Most entrances into the building are elevated for truck loading/unloading. Those entrances that are level with the surrounding parking/shipping area are sloped away from the building to prevent run-on. There are no upslope areas near the building. The TSD Facility is designed to eliminate any run-on from a 25-year, 24-hour storm.

The tank area is equipped with continuous forced air ventilation into the secondary containment designed to prevent the formation and ignition of vapors.

The coating for the base and containment is a two-component primer/epoxy matrix finish, which is abrasion and chemical resistant. Refer to Appendix D4 (Floor Coating Specifications). Application of a non-shrink grout covered with a sealant provides an effective watertight seal for the containment system. All concrete cold joints and slab interfaces are constructed with water stops. See Appendix D3 (TSD Facility Floor Plans and Details) for details and locations of the water stops.

The TSD Facility is designed to provide secondary containment of dangerous wastes and containment of fire flow water. In accordance with WAC 173-303-640 (4) (e) (i), the tank system's secondary containment system is designed to contain 100 percent of the capacity of the largest tank within its boundary and is designed and constructed to prevent lateral and vertical migration of wastes. The secondary containment system for the tank area is composed of the floor area of the tank area. The floor in the tank area, room 124, is recessed 8 inches below the floor of the adjacent receiving area and provides containment sufficient to contain a spill of approximately 11,500 gallons. Refer to Appendix D5 (Containment Calculations). This volume is sufficient to contain 100 percent of the capacity of a 5,000-gallon storage tank or 10% of the total capacity of all certified tanks in the room (3000 gallons).

The secondary containment for the tank systems is inspected for the presence or release of dangerous waste or accumulated liquid during each working day.

A fire flow or spill in excess of 7,000 gallons results in overflow into the grated spill-drainage trench located between the two ramped entranceways of the tank area. The spill-drainage trench allows the excess volume to be transferred to the exterior fire flow containment basins. The piping that connects the spill-drainage trench to the exterior basins is 6- to 8-inch, outside-coated, cast ductile iron.

The drainage system for the containment system is designed to handle the worst-case spill plus the volume of fire flow water from the sprinkler system, over the minimum design area, for a water flow of 20 minutes duration. The containment basins have approximately 31,790 gallons of containment capacity and are sized to provide 20 minutes of segregated fire flow containment combined with excess internal spill containment. See Appendix D5 (Containment Calculations), for secondary containment volumes and calculations. The basins are designed to overflow into each other when one-half full. Drainage from the basins is controlled by automatic pneumatic valves. During normal operations, the valves remain open allowing rainwater to drain into the storm water retention pond. In the event of a fire, the valves close automatically with the activation of fire alarms in the TSD Facility.

D3.2.2 ADDITIONAL REQUIREMENTS FOR SPECIFIC TYPES OF SYSTEMS

D3.2.2.1 Vault systems

WAC 173-303-640(4)(e)(ii)

All requirements for vault systems are addressed above in D-2b (1) Requirements For All Tank Systems.

D3.2.2.2 Ancillary Equipment

WAC 173-303-640(4)(f)

All ancillary equipment is located inside the secondary containment for the tanks.

D3.2.3 VARIANCES FROM SECONDARY CONTAINMENT REQUIREMENTS

WAC 173-303-640(4)(g) and (h); -640

There are no variances from secondary containment systems in effect at the TSD Facility.

D3.3 TANK MANAGEMENT PRACTICES

WAC 173-303-395 (4); -640(5)(a) and (b); -806(4)(a)(viii), (4)(c)(iii), (iv), and (ix)

Nine tanks are located in the tank area, room 124. A description of the chemical composition of the wastes stored in the tanks is provided in Table D2-2. Liquids are transferred into the tanks with the vac-truck. The tanks and liquid waste transfer piping system are provided with swing check valves located in the truck loading-unloading bay for spill prevention controls. Currently six tanks are active (see Table D2-2). Tank liquid level transmitters for tank level sensing are installed in all active tanks. Information provided by the transmitters is displayed on high-visibility, red LED display panels located in the tank area and in the tank truck-unloading bay. Visible and audible overfill alarms are incorporated into the tank truck unloading bay display panel, and are set at 4000 gallons (80% of capacity). Active tanks are also provided with a backup mechanical tank liquid level measuring device consisting of a dropdown tube, float, and measuring tape.

Wastes stored in the tank systems enter the TSD Facility in bulk and non-bulk containers such as but not limited to drums, tanker trucks, polypropylene Tuff Tanks® and stainless steel Totes®. Tank trucks are unloaded in the tank truck-unloading bay, which is contiguous with the building's north perimeter. The tank truck-unloading bay has a 2.77 percent center-sloped, concrete slab, 23 feet 4 inches wide by 121 feet long. The slab is covered by a steel awning and equipped with a blind sump for spill-containment. The containment sump is covered by a steel grating and situated in the center of the slab. The sump is 24 inches wide, 45 inches deep and 83 feet in length. Bulk loads are transferred into the tank system via a manifold-hose-connection system with quick-connect no drip couplings located in the tank truck-unloading bay. Non-bulk loads use a stringer from the tanker truck to pull the waste into the tanker tank prior to transferring the waste into the tank system. Provisions for electrical grounding of tank trucks is provided by a truck-grounding bar and cable/clamp, which is connected to the grounding circuit and located adjacent to the manifold-hose-connection station. Electrical grounding is used whenever wastes are transferred to tanks TSD -103, 104, 105 and 106 (Fuel, solvents and alcohol waste tanks). See Appendix D7 (Tank Drawings) for grounding details.

D3.4 LABELS AND SIGNS

WAC 173-303-395(6); -640(5)(d); -806(4)(c)(xi)

Storage tanks and all ancillary tank system equipment, including piping and hose-connection manifolds, are clearly labeled with the waste contained in the tank, the major risk associated with the waste being stored, and visible from 50' to ensure proper transfer and storage of compatible wastes and to maintain waste tracking capability and integrity.

D3.5 MANAGEMENT OF IGNITABLE OR REACTIVE WASTES IN TANK SYSTEMS

WAC 173-303-640(9); -806(4)(c)(x)

Ignitable and reactive wastes are stored in tanks at the TSD Facility. In compliance with the National Fire Protection Association's (NFPA 30) buffer zone requirements, storage tanks containing ignitable wastes are located at an adequate distance from: 1) property lines that are or can be built upon, including the opposite side of a public way, minimum distance 15 feet, and 2) the nearest side of any public way or from the nearest important building on the same property, minimum distance five feet. Actual buffer zone distances for the TSD Facility area:

- Nearest property line that is or can be built upon – 700 feet.
- Opposite side of nearest public way, Highway 303 – 750 feet.
- Nearest side of any public way – 700 feet.
- Nearest important building on the same property, Building 951 – 60 feet.

NUWC Division, Keyport is not subject to local building codes and is regulated by the Department of Defense, which has reviewed and approved the building design for the TSD Facility.

Ignitable wastes are consolidated for storage with other compatible, ignitable, and non-ignitable wastes in tanks TSD -104 and 105. Because these waste streams are tested to ensure the WIT is accurate as set forth in Section C (Waste Analysis), testing is not performed on each waste stream every time wastes of the same WIT are consolidated. The ignitable storage tanks are protected from any material or conditions which could cause the waste to ignite, in compliance with WAC 173-303-640 (9) (a) (ii). Operating precautions and design features used in the TSD Facility to prevent the ignition or reaction of ignitable wastes are discussed in Section F (Procedures to Prevent Hazards). Warning signs against smoking and open flames are posted prominently throughout the TSD Facility, as well as in the tank area.

All tanks storing reactive wastes are certified for use by an independent Professional Engineer pursuant to the requirements of WAC 173-303-640 (3) (a). Cyanide bearing wastes are stored in tanks TSD -103 and 106. Total cyanide concentrations (in solution) are typically 100 ppm. The highest range of cyanide concentrations has historically been <2,500 ppm. The pH of the processes, which generate the cyanide-containing waste streams, are consistently neutral or alkaline. Cyanide bearing waste solutions are not exposed to pH fluctuations, which minimizes the chance of off gassing of cyanide containing gases. Because these waste streams are tested to ensure the profile is accurate prior to shipping, as set forth in Section C (Waste Analysis), prior testing is not performed on individual compatible waste streams consolidated into these tanks.

Waste fuel is from a process that consists of propylene glycol dinitrate (PGDN) as the fuel source. This waste fuel is generally classified as a D001 unless there is a visible layer of fuel, and then it is classified as a D003. The fuel waste streams are stored in tanks TSD -104 and 105. According to Rev 8 of the U.S. Navy Technical Manual for Fuel dated 28 February 2019, PGDN is a non-corrosive, liquid monopropellant with an extremely low vapor pressure. The low vapor pressure minimizes the risk of potential hazards. Fuel can be made to detonate, but the conditions and stimulus required are so extreme that it is considered non-explosive. The 2-nitrodiphenylamine constituent in the fuel acts as a stabilizer to control the decomposition rate of the propylene glycol dinitrate. Fuel is thermally stable at temperatures of 150º F for several years, up to 180º F for a few months, and becomes unstable at 265° F. The temperatures in the TSD Facility are well within the recommended storage limits of -18º to 140º F. Fuel has a high flashpoint and other safety characteristics that permit it to be classified as a low fire-hazard material.

TSD Facility operation and design measures, including the electrical-grounding circuit and sprinkler system of the building, and prohibition of smoking and open flames, prevents the existence of strong initiating sources or heating-under-confinement of liquid waste in tanks in accordance with WAC 173-303-090 (7) (vi). Provisions for electrical grounding of tank trucks is provided by a truck-grounding bar and cable/clamp, which is connected to the grounding circuit and located adjacent to the manifold-hose-connection station. Electrical grounding is used whenever wastes are transferred to tanks TSD -103, 104, 105 and 106 (Fuel waste tanks).

D3.6 MANAGEMENT OF INCOMPATIBLE WASTES IN TANK SYSTEMS

WAC 173-303-640(10); -806(4)(c)(x)

Each storage tank is dedicated to storing specific, compatible wastes as shown in Table D2-2. New waste streams are tested for compatibility with wastes already in the tank prior to consolidating for storage. Because waste streams are tested to ensure the WIT is accurate as set forth in Section C (Waste Analysis), testing is not performed on each waste stream every time wastes of the same WIT are consolidated. Incompatible wastes or materials are not stored in the same tank or in an unwashed tank that previously held an incompatible material unless the requirements of WAC 173-303-395 (1) (b) are met.

Verification procedures in Section C (Waste Analysis) conducted at the time a waste stream is accepted to the TSD Facility will verify the identity of the waste stream. In the future, wastes generated by new processes may be stored in these tanks after profiling as set forth in Section C (Waste Analysis) to ensure compatibility with the existing waste streams in the receiving tank.

D3.7 PROCESS EQUIPMENT AND CONTROLS

WAC 173-303-640(5), (9), (10), (11); -806(4)(c)(iii), (iv), (xii), (xiii)

The process of separating materials by utilizing differing specific gravities to separate liquid-solid systems is performed in tanks 104/105 and 101/102. Decanting is used to separate two-phase systems from their natural separated equilibrium states. These include the following two-phase systems:

- Oil and water (Tanks 101/102)
- Solvents and water (Tanks 104/105)

The water from the oil and water decanting process is shipped separately or will be discharged in accordance with the SWDP #ST0007353. Designation from this process is from generator knowledge and lab analysis.

The decanting process of the solvent/water tank is being done to consolidate the solvents in order to increase the BTU value for this waste stream. The water from this process will be shipped separately. The designation from this process is also from generator knowledge and lab analysis.

D4 AIR EMISSIONS CONTROL

WAC 173-303-110; -640(5)(e); -690; -691; -692; -806(4)(c)(xii) and (xiii), (4)(j), (k), (m)

D4.1 PROCESS VENTS

WAC 173-303-110; -690; -806(4)(j)

D4.1.1 APPLICABILITY OF SUBPART AA STANDARDS

WAC 173-303-690

The requirements of 40 CFR 264, Subpart AA, Air Emission Standard for Process Vents, do not apply since there are no process vents associated with distillation, fractionation, thin-film evaporation, solvent extraction, or air or steam stripping operations that manage dangerous wastes with organic concentrations of at least 10 ppm by weight.

D4.2 EQUIPMENT LEAKS

WAC 173-303-806(4)(k); 691

D4.2.1 APPLICABILITY OF SUBPART BB STANDARDS

WAC 173-303-691; -806(4)(k); [40CFR Parts 264.1050-264.1063]

The requirements of 40 CFR 264 and 270.25, Subpart BB, Air Emission Standards for Equipment Leaks, apply to valves, pumps, compressors, pressure relief devices, sampling connection systems, open ended valves or lines, and flanges or other connectors that contain or contact dangerous waste with organic concentrations of at least 10 percent by weight.

D4.2.1.1 Equipment Subject to Subpart BB

Equipment (excluding tanks and containers) that contains or contacts dangerous waste streams with ≥ 10 percent organics is monitored monthly (see Section D4.2.2.1). All dangerous waste stored in tanks at the TSD Facility is assumed ≥ 10 percent organics. Appendix D11 (Subpart BB Equipment Details) lists all TSD Facility equipment, and required monitoring.

D4.2.1.2 Re-evaluating Applicability of Subpart BB Standards

WAC 173-303-691(1); [40CFR Part 264.1063(d)-(g); Part 264.1064(k)]

The applicability of Subpart BB standards does not need to be re-evaluated because the applicability is not based on the organic content of the waste stream.

D4.2.2 EQUIPMENT LEAKS – DEMONSTRATING COMPLIANCE

D4.2.2.1 PROCEDURES FOR IDENTIFYING EQUIPMENT LOCATION AND METHOD OF COMPLIANCE, MARKING EQUIPMENT, AND ENSURING RECORDS ARE UP-TO-DATE

WAC 173-303-691; -806(4)(k); [40CFR Part 264.1050-264.1064]

Appendix D11 (Subpart BB Equipment Details) contains photos of all TSD Facility equipment subject to Subpart BB standards. In accordance with 40 CFR 264.1050(d), each piece of equipment subject to Subpart BB standards is marked so that it can be distinguished readily from other pieces of equipment. The equipment subject to monitoring is marked in accordance with Navy standards as shown in Appendix D11. Changes or repairs to equipment and monitoring results will be recorded in the operating record on an on-going basis.

All dangerous waste at the TSD Facility that contacts equipment such as pumps, valves, flanges, caps and sampling ports is assumed to be ≥10percentorganics,isliquidandnevergas/vapor,and may at any time be a 'light liquid'. Therefore, the percent by weight of total organics, the dangerous waste state and the method of compliance are not individually identified for each piece of equipment. The method of compliance with the standards in 40 CFR 264.1052 through 1059 for all equipment at the TSD Facility is met through monthly monitoring and documented in the operating record pursuant to WAC 173-303-691(2) and 40 CFR 264.1064(b)(1)(vi).

The TSD Facility does not have any equipment in vacuum service subject to 40 CFR 264.1054 standards.

The TSD Facility does not have any valves designated as 'unsafe to monitor' or difficult to monitor'.

The TSD Facility does not have any pumps, compressors, or valves designated as 'for no detectible emissions'.

The TSD Facility does not have any pumps and compressors with dual mechanical seal systems.

D4.2.2.2 Demonstrating Compliance with D4.2.1 and D4.2.2 Procedures

WAC 173-303-691; -806(4)(k); [40 CFR Part 264.1050 – 264.1059]

Appendix D11 (Subpart BB Equipment Details) lists all TSD Facility equipment subject to Subpart BB standards.

A log of equipment will be maintained in the operating record of the TSD Facility including the following:

1. The equipment's identification number and where it is located in the TSD Facility.
2. The type of equipment (e.g., pump, valve, sample port).
3. Date and result of most recent monitoring, and status of repair, if required.
4. For pumps exempted due to less than 300 hours per year in contact with dangerous waste, the number of hours in contact with dangerous waste during each service cycle.
5. Method of compliance with standards.

If a leak is detected in any equipment, a label marked with the equipment ID number, the date evidence of a leak was found, and the date the leak was detected will be attached to the equipment.

INSPECTION LOG

When a leak is detected, the following information will be recorded in an inspection log and shall be kept in the TSD Facility operating record:

1. The instrument and operator ID numbers and the leaking equipment ID number.
2. The date the evidence of a potential leak was found.
3. The date the leak was detected and the dates of each attempt to repair the leak.
4. Repair method applied in each attempt to repair leak.
5. 'Above 5,000' if the maximum instrument reading measured after each repair attempt is ≥ 5,000 ppm.
6. 'Repair delayed' and the reason for the delay if the leak is not repaired within 15 calendar days after discovery of the leak.
7. Documentation supporting the reason for the delay of repair of a valve in compliance with 40 CFR 264.1059 (c).
8. The signature of the operator whose decision it was that repair could not be affected without a dangerous waste management unit shutdown.
9. The expected date of successful repair of the leak if the leak is not repaired within 15 calendar days.
10. The date of successful repair of the leak.

MONITORING PROCEDURES

When monitoring procedures call out use of Method 21 in 40 CFR 60, the detection instrument will meet the performance criteria and calibration procedures as set forth in Method 21 and 40 CFR 264.1063(b). The current instrument in use is the Cosmos Portable Gas Detector XP-3160.

Leak detection will take place as follows:

1. Monitoring shall comply with Reference Method 21 in 40 CFR 60.
2. The detection instrument shall meet the performance criteria of Reference Method 21.
3. The instrument shall be calibrated before use on each day of its use by the procedures specified in Reference Method 21.
4. Calibration gases shall be:
   a) Zero air (less than 10 ppm of hydrocarbon in air).
   b) A mixture of methane of n-hexane and air at a concentration of approximately, but less than, 10,000 ppm methane or n-hexane.
   c) A mixture of methane of n-hexane and air at a concentration of approximately 5,000 ppm methane or n-hexane.
5. The instrument probe shall be traversed around all potential leak interfaces as close to the interface as possible as described in Reference Method 21, Section 8.3.
6. The leak definition concentration is 5,000 ppm.
7. If the maximum reading is ≥ 5,000 ppm, a 'leak' in the component has been identified. A maximum reading of < 5,000 ppm indicated the component does not 'leak'.

A semiannual report meeting requirements in WAC 173-303-691 and 40 CFR 264.1065 will be submitted to Ecology for any period during which leaks from valves, pumps, or compressors were not repaired according to their respective regulatory requirements.

D4.3 TANKS AND CONTAINERS

WAC 173-303-110; -692; -806(4)(m)

D4.3.1 APPLICABILITY OF WAC 173-303-692 (SUBPART CC) STANDARDS

WAC 173-303-692(1); -806(4)(m); [40 CFR 264.1080, 1083]

Subpart CC standards are assumed to apply to all tanks and containers at the TSD Facility that contain liquids. All tanks at the TSD Facility are of the 'fixed roof' design, are less than 75 m^3, with a maximum organic vapor pressure limit below 76.6 kPa. Thus, tank level one controls are installed on all tanks.

Paint and associated products are consolidated in Room 128, the drum wash area. Latex paints and compatible associated products are consolidated in a dedicated drum, and oil-based paints and compatible associated products are consolidated in a separate, dedicated drum. The drum not in use in the paint consolidator is sealed until placed in use. Aerosol cans, and pint through 5-gallon containers are punctured and drained into an open-top drum. The VOCs and propellants are captured and removed from the exhaust with a pair of carbon filters in series before venting outside the TSD Facility. See Part A, Attachment B, (TSD Facility General Layout Drawing) for the exact location of this consolidation area, and Appendix D2 (Paint Consolidation Details) for details of equipment used in this consolidation process, including carbon filter breakthrough indicator calibration and filter change-out procedures. A portable VOC meter is also used as an alternate method in measuring volatiles during this process. The waste paint containers are only open when installed in the paint can crusher and while it is in operation.

All containers between 0.1 m^3 and 0.46 m^3 containing liquids may at some time contain dangerous wastes ≥ 500 ppmw average volatile organics. Thus, these containers will be managed to Subpart CC container level one standards.

Additionally, all containers > 0.46 m^3 containing liquids may at some time contain dangerous wastes ≥ 500 ppmw average volatile organics in light liquid service. Thus, these containers will be managed to Subpart CC container level two standards.

D4.3.1.1 Containers

WAC 173-303-692(2); -806(4)(m); [40 CFR 264.1086]

All containers required to meet container level one controls will meet all applicable US Department of Transportation regulations on packaging hazardous materials for transportation. These containers will have their covers and closure devices secured and maintained in the closed position except as set forth in 40 CFR 1086 (c) (3), and will be visually inspected at the time they are accepted at the TSD Facility and daily thereafter. The visual inspection will consist of a check of the container and its cover and closure devices for visible cracks, holes, gaps or other open spaces into the interior of the container when the cover and closure devices are secured in the closed position. If a defect is detected during these inspections, the operator will make the first attempt to repair the defect within 24 hours after detection, and the repair will be completed as soon as possible thereafter but no later than 5 days after detection.

All containers required to meet container level two controls will meet all applicable US Department of Transportation regulations on packaging hazardous materials for transportation, and requirements in WAC 173-303-692 and 40 CFR 64.1086(d)(1)(ii) and (iii). Transfer of dangerous waste to and from these containers will take place with a submerged-fill pipe as specified in WAC 173-303-692 and 40 CFR 264.1086(d)(2). These containers will have their covers and closure devices secured and maintained in the closed position except as set forth in 40 CFR 1086 (d) (3), and will be visually inspected at the time they are accepted at the TSD Facility and daily thereafter. The visual inspection will consist of a check of the container and its cover and closure devices for visible cracks, holes, gaps or other open spaces into the interior of the container when the cover and closure devices are secured in the closed position. If a defect is detected during these inspections, the operator will make the first attempt to repair the defect within 24 hours after detection, and the repair will be completed as soon as possible thereafter but no later than 5 days after detection.

D4.3.1.2 Tank Systems

WAC 173-303-692(2); -806(4)(m); [40 CFR 264.1086]

All waste streams stored in tanks at the TSD Facility are evaluated bi-annually as set forth in Section C (Waste Analysis).

All tanks at the TSD Facility have spring-loaded pressure-vacuum relief valves that vent to the atmosphere during normal operations for the purpose of maintaining the tank internal pressure in accordance with the tank design specifications. These vents are designed to become operational at 0.75 oz/in^2 pressure or vacuum, with no detectible emissions when the device is secured in the closed position.

All fixed roof tanks and their closure devices are inspected annually by the operator to visually check for defects that could result in air pollutant emissions. Appendix D13 (Subpart CC Equipment Details) provide inspection and equipment details for these devices.

The following operating records will be maintained at the TSD Facility for five years:

1. The tank identification number.
2. A record of each inspection including:
   - i) Date inspection was conducted.
   - ii) For each defect detected during the inspection:
     - (1) The location of the defect.
     - (2) A description of the defect.
     - (3) The date of detection.
     - (4) Corrective action taken to repair the defect.
     - (5) If the repair was not completed, the reason for the delay and the expected completion date.

SECTION D

APPENDIX D1

PORTABLE TANK SPECIFICATIONS

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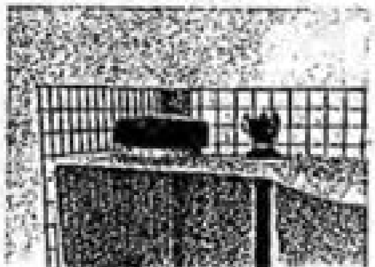
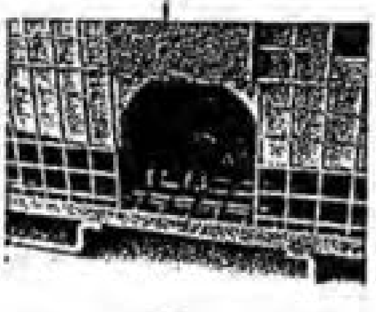
Introducing TUFF TANK. The safest, easiest, most cost effective way to handle hazardous liquids.



The top discharge option includes a 1-inch quick disconnect fitting and cap, suction line and foot valve/strainer in a recessed sump.



The bottom discharge option includes a 2-inch ball valve, quick disconnect coupling and cap, in a recessed sump.

U.S. Patent Pending

TUFF TANK SPECIFICATIONS

	220 Gal. (840 liter)	330 Gal. (1250 liter)
DOT Authorization:	DOT-E9052	DOT-E9052
Dimensions:	40" x 48" x 48" H	40" x 48" x 62" H
Tare Weight:	420 lbs.	550 lbs.
Authorized Gross Weight:	3790 lbs.	5600 lbs.
Maximum Liquid Density: (When filled)	15.3 lbs./gal.	15.3 lbs./gal.

Now you can see the remarkable TUFF Tank System in action. We'll send you a VHS copy of our video presentation demonstration unique features and benefits of TUFF TANK.
For more information write or call:

CHEMICAL HANDLING EQUIPMENT CO., INC.
5451 Enterprise Blvd.
Toledo, Ohio 43612
(419) 729-3935

CHEMICAL HANDLING EQUIPMENT CO., INC.
5451 Enterprise Blvd.
Toledo, Ohio 43612
(419) 729-3935

PRODUCTS Liquitote®

Back to Products

Nominal Capacity	Nominal Length	Nominal Width	Nominal Height	Approx. Tare Weight	Max Gross Weight
300gal (1113L)	42" (1066mm)	48" (1219mm)	45" (1143mm)	440lbs (197kg)	5192lbs (2360kg)
350gal (1298L)	42" (1066mm)	48" (1219mm)	51" (1295mm)	475lbs (215kg)	6017lbs (2735kg)
400gal (1484L)	42" (1066mm)	48" (1219mm)	57" (1447mm)	520lbs (235kg)	6853lbs (3115kg)
450gal (1670L)	42" (1066mm)	48" (1219mm)	63" (1600mm)	550lbs (248kg)	7678lbs (3490kg)
550gal (2040L)	42" (1066mm)	48" (1219mm)	75" (1905mm)	650lbs (203kg)	9350lbs (4250kg)
255gal (946L)	42" (1066mm)	42" (1066mm)	45" (1143mm)	403lbs (183kg)	4444lbs (2020kg)
300gal (1113L)	42" (1066mm)	42" (1066mm)	51" (1295mm)	431lbs (196kg)	5129lbs (2360kg)
350gal (1298L)	42" (1066mm)	42" (1066mm)	57" (1447mm)	470lbs (214kg)	6017lbs (2735kg)
400gal (1484L)	42" (1066mm)	42" (1066mm)	63" (1600mm)	510lbs (231kg)	6853lbs (3115kg)
480gal (1780L)	42" (1066mm)	42" (1066mm)	75" (1905mm)	585lbs (266kg)	8195lbs (3725kg)

Liquitote

Liquitote is the original intermediate bulk container (IBC) for liquids. Hoover introduced this revolutionary concept over 40 years ago as an efficient, sensible alternative to 55-gallon drums for the shipping and storing of most liquids. Liquitote is the leading metal IBC on the market. Built to last, the Liquitote features 10-gauge construction throughout, and a patented one-piece sloped bottom for virtually complete drainage. They're built to UN specification in an ISO 9001 certified manufacturing plant.

More durable than standard 55-gallon drums, Liquitote helps control risk to the environment. One 550-gallon Liquitote replaces ten drums, minimizing the amount of handling required which lowers the risk of handling accidents. Liquitote is a cost-effective, sound capital investment which can be amortized over its long life. They are refillable and durable. Many of the first models made over 40 years ago are still in use today.

Liquitote is available in stainless steel or carbon steel.

Liquitote Features:

Feature (a): 3" metal or poly combination filling cap and fusible vent. Benefit: Cover can remain sealed during filling.

Feature (b): 22" EPDM gasket, zinc-plated bolted clamp ring, formed neck.

Feature (c): 2" top fill bung with EPDM gasket. Benefit: Optional accessories.

Feature (d): Informational decals. Benefit: Safety.

Feature (e): 6 1/2" high, radius corner legs with caps. Benefit: Designed to avoid catching on floor obstructions.

Feature (f): 2" bottom discharge assembly. Stainless includes: 316 ss three-piece valve assembly, 316 ss locking handle ball valve, plastic valve plug. Carbon includes: three-piece valve assembly, ball valve, plastic valve plug.

Feature (g): Patented one-piece sloped bottom. Benefit: Facilitates virtually complete drainage.

Feature (h): T304 stainless steel w/2B Finish or TGIC polyester powder paint finish on carbon. 10-gauge construction throughout. Benefit: Durable and rust resistant.

Feature (i): UN markings. Benefit: Worldwide recognition and compliance.

Feature (j): Heavy-duty lifting lugs and leg positioners. Benefit: Easy stacking and lifting.

Feature (k): 22 5/16" top opening. Benefit: Easy cleaning.

Feature (l): Bar code label (includes serial number).

Full-length valve guard with 3" x 7" cutout for ease in fitting connections.
4-year warranty on all new standard units.
UN 31A Qualified on Standard Sizes. Stainless steel: all sizes up to 550-gallon, carbon steel: all sizes up to 528 gallons.
Custom sizes available.

UN and DOT Qualifications

DOT UN31A permits shipment of flammable and combustible liquids authorized by Title 49 CFR. Allowable modes of transportation: motor vehicle, rail freight, cargo vessel, or air freight. NMFC Item 41032, Sub 1, Class 125.

SECTION D

APPENDIX D2

PAINT CONSOLIDATION DETAILS

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CAN, PAIL AND AEROSOL CRUSHER
SUPER 6PJ-VC

Pierces, drains, and crushes cans, pails and aerosols.

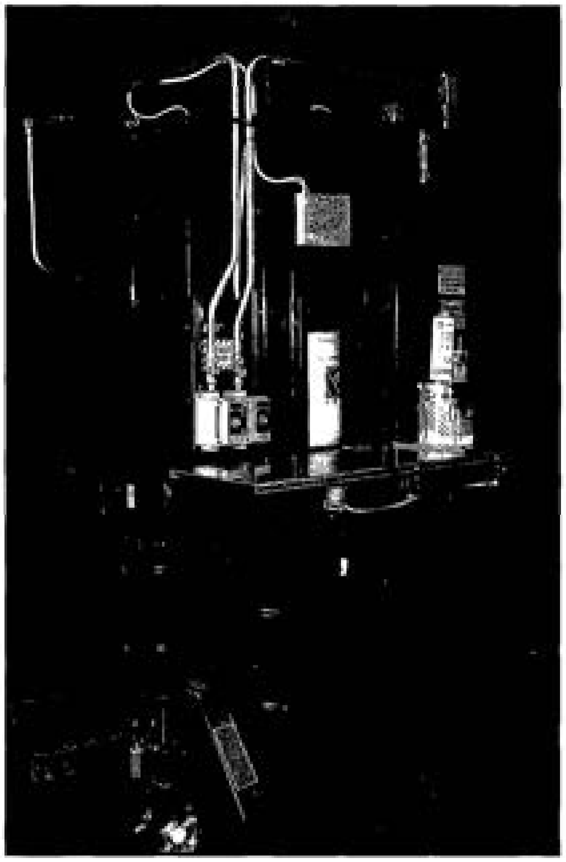
Cans are Empty by EPA Definition.

No need to remove lids!

The Super 6PJ-VC offers features not found anywhere else in the industry.

- Captures VOCs and propellants, keeps them out of work area, environment. Eliminates need for respirators.
- Compact design to save valuable floor space.

With the proven reliability of our Super 6PJ and the addition of the Vapor Collection System, TeeMark Offers a Complete Package at an economical price.



VERSATILE:
Processes containers from half pints to 6-gallon pails, **PLUS** 4 to 12-inch long Aerosol cans.

CAPTURES:
VOCs, Propellants, and Vapors.

SAFE, EXPLOSION PROOF

Units will not operate with door open. These crushers are completely explosion proof with self-contained explosion proof controls and power supplies. They are suitable for use with solvent based paints, aerosols propellants, and other flammable liquids.

RESULTS!

The TeeMark Super 6PJ-VC pierces, empties, crushes, and ejects up to 240 containers per hour. The Vapor Collection System collects the gases from the crushing chamber and collection drums and delivers it to a 5-inch duct.

TeeMark SUPER 6PJ-VC SPECIFICATIONS

POWER SYSTEM ALTERNATIVES:
- 1-1/2 hp' 115/230 v 1ph 20/10a w/ starter, 12/20 second cycle time
- 3 hp' 208-230/460 v, 3ph, 11-10/5a w/o starter, 12 sec cycle

Explosion Proof Class 1, Div. D

CRUSHING FORCE: 30,000 pounds
CYCLE TIME: 12 to 20 seconds
MACHINE DIMENSIONS: 55"w x 72"d x 107"h
CRUSHING CHAMBER: 16"w x 16"d x 18"h
SHIPPING WEIGHT: 1300 pounds

AIR REQUIREMENTS:
5cfm @ 80psi

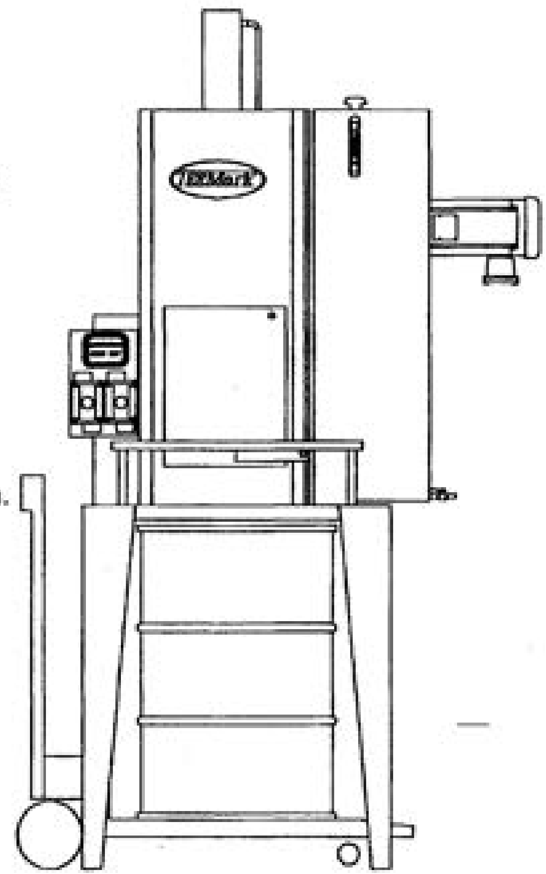
COLLECTION SYSTEM:
1 hp, 115/230 volt, 1ph 12/6 amp dedicated circuit
Explosion proof motor and motor controls
Moves up to 500 cfm of air
Exhausts through a 5-inch duct

TeeMark Crushers • Aitkin, MN • 1-800-428-9900 • Fax: (218) 927-2333 • email: teemark@aitkin.com
Crusher homepage: www.teemarkcorp.com

CAN, PAIL AND AEROSOL CRUSHER
SUPER 6PJ-VC

Full cans, pails, and aerosol cans are pierced and crushed by EPA definition in twenty seconds or less. VOCs and propellants are collected and removed from work area.

MULTIPURPOSE CRUSHING!
This machine crushes six-gallon pails and most anything that is smaller. Aerosol cans, oil filters, and a variety of pails and cans are all crushed by this machine.
This crusher opens closed containers and empties the contents before crushing them flat.



Pallet jack and roller conveyor provided

AUTOMATIC EJECTION!
The Super 6PJ-VC automatically ejects crushed containers out of crusher and into a collection devise.

CRUSHING FORCE OF 30,000 POUNDS
Crushes steel containers so you can put up to 15 crushed cans in the space required by a whole can.

CRUSHER STAND
Provides 41 inches of clearance for a 55-gallon drum on a pallet jack.

LIQUID COLLECTION CAPABILITY
Liquids that are squeezed from containers are collected in a 55-gallon drum or tote.

PERMANENT, TOTAL ENCLOSURE
Blower pulls VOCs, propellants, and vapors from crushing compartment, crushed can collection drum and liquid collection drum.

TEEMark **CORPORATION**

Aitkin, Minnesota 56431
218/927-2200 • 800/428-9900
email: teemark@aitkin.com
Crusher homepage: www.teemarkcorp.com

For more information, call us:

TOLL FREE 800/428-9900

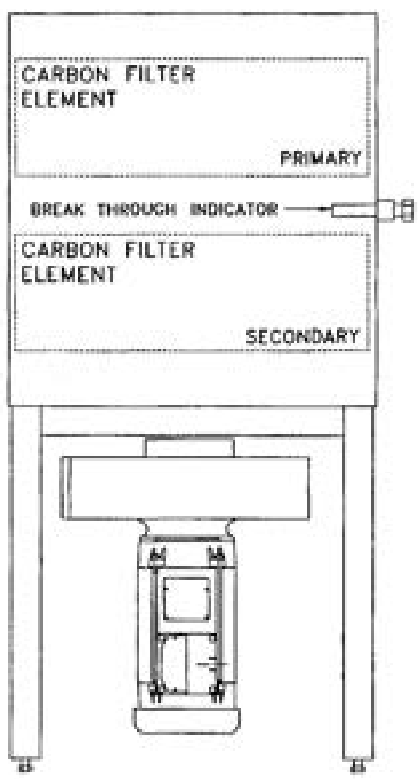
From half pints to 110 gallons, TeeMark Can and Drum Crushers prepare containers and their contents for recycling or disposal. Specifications subject to change without notice.

OPERATION AND MAINTAINENCE OF THE CARBON FILTRATION SYSTEM

CAUTION!
THE PRESENCE OF CERTAIN VOC'S WILL CAUSE
A HEAT BUILDUP WITHIN THE FILTER ELEMENTS.
UNDER THESE CONDITIONS THE BLOWER MUST BE RUN FOR
A MINIMUM OF ONE HALF HOUR AFTER PROCESSING.

The Carbon Filtration System consists of two Carbon Filter elements and a Breakthrough Indicator housed within the auxiliary cabinet located directly under the main bag filter cabinet. A Cycle Counter is also provided to track the number of cans processed. A single carbon element will adsorb the vapors from approximately 20,000 full std 12 oz. aerosol cans. As throughput approaches 15,000 cans the Breakthrough Indicator should be inspected at the end of each shift to monitor filter saturation.

Once the primary filter element has become saturated and will no longer adsorb processing vapors, the breakthrough indicator media will change from its original **purple** color to a **brown** color. At this point the primary filter element should be removed, the secondary filter element moved into the primary position, and a new element installed in the secondary position.



A new breakthrough indicator should be installed and the cycle counter reset to zero.

The filter element frames may be reused by replacing the saturated carbon with fresh carbon. The carbon is replaced by removing the side panel on the filter frame, dumping out the saturated carbon and pouring in the new carbon.

Each filter frame holds 45 lbs of carbon. New carbon is available in either 50 pound bags or 200 pound drums.
Contact the TeeMark corporation to obtain replacement carbon.

From this point the saturated carbon is handled as a hazardous waste and should be disposed of in accordance with local and federal regulations. Contact your local waste contractor for disposal.

Paint Can Crusher Carbon Filter Breakthrough test.

The carbon filter diagram on the previous page is not correct for our application because we inverted the filter unit. Thus, the primary filter is at the bottom of the filter housing, and the secondary filter is on the top of the filter housing.

In order to ensure that VOC breakthrough from the primary filter is detected before breakthrough of the secondary filter occurs, perform VOC Air Emissions check, using Method 21 test equipment and procedure as follows:

1. At the end of every Paint Can Crusher operation cycle, calibrate the VOC meter as instructed in the VOC meter users manual and method 21 in 40 CFR 60.
2. Remove the sample port plug from the intermediate sample port, and insert the sampling probe while the exhaust fan is in operation.
3. Operate the VOC meter as set forth in the VOC meter users manual and Method 21 in 40 CFR 60, and record the result in the Can Crusher Operating Record. Replace the sample port plug.
4. Repeat steps 2 and 3 for the exhaust sample port following the secondary filter.
5. Record the VOC readings for the intermediate and the exhaust sample ports in the TSDF Operating Record along with the time, date and inspector's name.
6. If sampling at the intermediate sample port indicates VOCs are present at or above 500 ppm, cycle the carbon filters as set forth below and notify the TSDF supervisor of the change and of the records in the TSDF Operating Record.

Paint Can Crusher Carbon Filter Replacement.

1. Shut down power supply to the paint can crusher.
2. Remove the carbon filter access panel.
3. Remove the lower (primary) carbon filter cartridge from the filter housing and place on a workbench.
4. Move the upper (secondary) carbon filter cartridge to the vacated lower carbon filter cartridge location in the carbon filter housing.
5. Unscrew the filter end panels of the upper carbon filter cartridge. Remove the waste carbon filter material, deposit in a hazardous waste container, and label as required. The used carbon filter material is a hazardous waste and must be handled and stored as such. Reassemble the carbon filter cartridge with new carbon filter material.
6. Place the recharged carbon filter cartridge in the vacated upper carbon filter cartridge location in the carbon filter housing.
7. Replace the carbon filter access panel.
8. Turn power to the paint can crusher on and turn exhaust fan on.
9. Sample intermediate and exhaust sample ports for VOCs as set forth above.

SECTION D

APPENDIX D3

TSDF FLOOR PLANS AND DETAILS

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REVISIONS				
SYM	DESCRIPTION	PREP'D BY	DATE	APPROVED
1	"AS-BUILT" CONDITIONS SHOWN	DFC	JAN/96	MBW

STRUCTURAL NOTES & DESIGN DATA

1.0 GENERAL NOTES

1.1 GENERAL CONDITIONS

1.1.1 THE CONTRACTOR IS RESPONSIBLE FOR THE SAFETY OF ALL CONSTRUCTION. ADEQUATE SHORING, BRACING, TIES, AND SUPPORTS SHALL BE USED TO ENSURE PROPER TEMPORARY STRUCTURAL INTEGRITY DURING ALL PHASES OF CONSTRUCTION

1.1.2 THE CONTRACTOR IS RESPONSIBLE FOR COORDINATION OF WORK SHOWN ON THE DRAWINGS AND VERIFICATION OF EXISTING CONDITIONS AT THE SITE ANY DISCREPANCIES SHALL BE IMMEDIATELY REPORTED TO THE CONTRACTING OFFICER FOR RESOLUTION BEFORE PROCEEDING

1.1.3 THE CONTRACTOR IS RESPONSIBLE FOR COORDINATION OF PENETRATIONS AND EMBEDMENTS IN STRUCTURAL ELEMENTS

1.1.4 SHOP DRAWINGS FOR STRUCTURAL STEEL, PRECAST CONCRETE AND REINFORCING SHALL BE SUBMITTED AND APPROVED BY THE CONTRACTING OFFICER PRIOR TO FABRICATION

1.2 GOVERNING SPECIFICATIONS

1.2.1 PROJECT SPECIFICATIONS

1.2.2 CODES AND REFERENCES

TRI-SERVICES MANUAL, NAVFAC P-355
- "MANUAL FOR SEISMIC DESIGN"

MILITARY DESIGN HANDBOOKS MIL-HDBK-1002

AMERICAN CONCRETE INSTITUTE "BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE, 301, 304, 347, AND ACI 318-89

UNIFORM BUILDING CODE, UBC-91

AMERICAN WELDING SOCIETY
- AWS D1, STRUCTURAL WELDING CODE - STEEL
- AWS D4, STRUCTURAL WELDING CODE - REINFORCING STEEL

AMERICAN INSTITUTE OF STEEL CONSTRUCTION
- MANUAL OF STANDARD PACTICE

2.0 STRUCTURAL NOTES

2.1 STRUCTURAL CONCEPT OF COMPLETED STRUCTURE

2.1.1 GRAVITY LOADS

THE ROOF DECK CONDUCTS VERTICAL LOADS TO PURLINS & BEAMS. ROOF PURLINS REACT GRAVITY LOADS AS CONCENTRATED FORCES THROUGH CONNECTIONS ON PRECAST CONCRETE WALL PANELS. PRECAST WALL PANELS ARE LOCATED ON A STRUCTURAL CONCRETE FLOOR SYSTEM THAT IS SUPPORTED ON CONTINUOUS GRADE BEAMS. ALL GRADE BEAMS BEAR ON A GRID OF AUGER CAST PILES WITH CAPS

2.1.2 VERTICAL UPLIFT

VERTICAL UPLIFT LOADS ARE TRANSMITTED TO THE PILE SYSTEM IN THE SAME MANNER AS GRAVITY LOADS

2.1.3 LATERAL LOADS

THE ROOF DIAPHRAGM TRANSMITS HORIZONTAL LOADS (WIND AND SEISMIC) TO PRECAST CONCRETE SHEAR WALLS. SHEAR LOADS ARE CONDUCTED THROUGH THE STRUCTURAL FLOOR TO GRADE BEAMS. GRADE BEAMS RESIST LATERAL LOADS BY MEANS OF PASSIVE EARTH PRESSURE

2.2 FOUNDATIONS

2.2.1 ALLOWABLE PILE LOADS

AUGER CAST WITH 120 KIP CAPACITY IN COMPRESSION

A ONE-THIRD INCREASE IN ALLOWABLE LOAD IS ACCEPTABLE FOR LOADING COMBINATIONS WHICH INCLUDE SHORT DURATION LOADS, SUCH AS WIND OR SEISMIC

AUGER CAST PILES HAVE UP-LIFT CAPACITIES EQUAL TO ONE-THIRD THE COMPRESSIVE CAPACITY

2.3 MATERIALS

2.3.1 CAST IN PLACE CONCRETE

28-DAY COMPRESSIVE STRENGTH	
PILE CAPS & PILES	3,000 PSI
GRADE BEAMS & COLUMNS	4,000 PSI
STRUCTURAL SLAB	4,500 PSI
MAXIMUM SLUMP	4"

2.3.2 REINFORCING STEEL

REINFORCING BARS - #5 & LARGER:	GRADE 60
REINFORCING BARS - #4 & SMALLER:	GRADE 40
WELDED WIRE FABRIC	ASTM A185
LAP SPLICES OF REINFORCEMENT:	40 DIAMETERS

2.3.3 GROUT AT COLUMN AND EQUIPMENT BASE CONNECTIONS

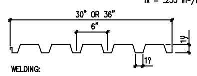
NON-SHRINK, NON-GASEOUS, NON-METALLIC, PRE-MIX TYPE, 3-DAY COMPRESSIVE STRENGTH - 5,000 PSI GROUT SHALL BE BE COMPATIBLE WITH ANY COATING APPLIED TO ITS SURFACE

2.3.4 STRUCTURAL AND MISCELLANEOUS STEEL

- STEEL PLATES AND SHAPES: ASTM A36 (THIS DOES NOT PERTAIN TO THE RACK SYSTEM))
- SQUARE TUBING: A500 GRADE B, Fy = 46 KSI
- FABRICATION AND WELDING: PER SPECIFICATIONS
- STRUCTURAL BOLTS: ASTM A325, UN USE LOAD INDICATOR WASHERS WHERE NOTED
- ANCHOR BOLTS, EXPANSION ANCHORS, NUTS AND WASHERS: ASTM A307, UN
- WELDING ELECTRODES: E70XX, UN

2.3.5 LIGHT WEIGHT INSULATING CONCRETE ROOF DIAPHRAGM:

DESIGN SHEAR CAPACITY	932 LBS/FT (MAX) SEE WALL PANEL DWG'S
METAL ROOF DECK	
MINIMUM YIELD	33 KSI
MINIMUM SIZE	24 GA x 1ÿ DEEP
SECTION MODULUS	Sx = .252 in^3/FT
	Ix = .233 in^3/FT



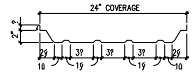
WELDING:

- ÿ? PUDDLE WELD AT EACH FLUTE AT BEAMS AND WALLS
- 1ÿ SEAM WELD AT 2'-0"
- ÿ? PUDDLE WELD AT 12" OC TO WALLS PARALLEL TO FLUTES

LIGHTWEIGHT CONCRETE	
MINIMUM COMPRESSIVE STRENTH	125 PSI
DRY DENSITY	22 LBS/FT^3

2.3.6 METAL ROOF PANEL (CANOPY)

MINIMUM YIELD STRENGTH	40 KSI
MATERIAL GAGE	24 GA
STRUCTURAL PROPERTIES	Sx = .156 in^3/FT



2.3.7 OFFSITE PRECAST CONCRETE ITEMS

28 DAY COMPRESSIVE STRENGTH:	5,000 PSI MIN
ALL WALL PANEL TO PANEL CONNECTIONS ARE CONCEALED 4 HOUR FIRE RATED	
WALL PANEL THICKNESS (UN)	8 INCHES
HOLLOW CORE FLOOR PLANK DEPTH	8 INCHES
PILASTER SIZE (OPTIONAL)	12" x 12"

2.3.8 EMBEDDED ITEMS

COORDINATE ALL EMBEDMENTS WITH PRECAST MANUFACTURER PRIOR TO CONSTRUCTION

ALL WELDED STUD (WS) FASTENERS TO HAVE A MINIMUM ALLOWABLE SHEAR OF 10.00 Ksi AND A MINIMUM ALLOWABLE TENSION OF 20.00 Ksi

2.3.9 REINFORCED HOLLOW MASONRY

CONCRETE MASONRY UNITS - ASTM C 90, TYPE II
8" THICK, NORMAL WEIGHT

MORTAR - TYPE S, f'm = 1500psi MIN

GROUT - 2000 PSI IN 28 DAYS

PLACE GROUT IN ALL CELLS

ALL BLOCKS SHALL BE PLACED IN A RUNNING BOND PATTERN

3.0 DESIGN CRITERIA

3.1 ROOF LOADS - DEAD

ROOFING	6.0 PSF
CELLULAR, INSULATING CONCRETE	8.0 PSF
FRAMING (SELF WEIGHT)	6.0 PSF
MECHANICAL, ELECTRICAL, SPRINKLERS, HVAC, PIPING, ETC	3 PSF

3.2 ROOF LOADS - LIVE

UNIFORM	20 PSF
CONCENTRATED (ON DECK)	250 LB ON 2' X 2' AREA

3.3 FLOOR LOADS - LIVE

PALLET STORAGE	818 PSF (12 KIPS AT RACK LEGS)
OPERATIONS:	
WHEEL LOAD	6 KIPS
LIVE LOAD	480 PSF
MEZZANINES:	
LIVE LOAD	50 PSF
MECHANICAL LOAD	50 PSF
OFFICE:	
LIVE LOAD	50 PSF

3.4 ROOF LOADS -SNOW

Pf (FLAT ROOF SNOW LOAD) WHERE:	0.7 CeCtIPg
Ce (WIND EXPOSURE)	0.8
Ct (THERMAL FACTORS, FREEZE PROTECTED)	1.1
I (IMPORTANCE FACTOR)	1.1
Pg (GROUND SNOW LOAD)	20 PSF
SNOW DRIFT	CALCULATED IN ACCORDANCE WITH MIL-HDBK 1002,
Pfmin = Pg x I	22 PSF

3.5 SEISMIC (UBC SEISMIC ZONE 3)

V (BASE SHEAR) WHERE:	ZIKCSW
Z	0.30
I	1.25
CS	0.14
K	1.33
W	BUILDING WEIGHT
Fp (COMPONENT FORCE)	ZICpWp
Cp	0.75
Wp	WEIGHT OF COMPONENT

Fp = 0.28Wp

3.6 WIND (MIL-HDBK 1002/2)

p = .0025V ChI
WHERE:

V = PEAK GUST VELOCITY	83 MPH
Ch = HEIGHT COEFFICIENT	1.0
I = IMPORTANCE FACTOR	1.15

p = 20.2 PSF
CANOPY UPLIFT (2p) = 40PSF

3.7 OVERPRESSURE AT FLAMMABLE 1A 200 PSF

REQUIRED VENT SIZE = 0.17(NET SURFACE AREA)/1.39 PSI
= 893 SF

3.8 CATWALKS & STAIRS

UNIFORM LOAD	100 PSF
CONCENTRATED LOAD	300 lb
LATERAL LOAD	0.28 Wp

ABBREVIATIONS

BM	BEAM	LBS	POUNDS
BOP	BOTTOM OF PANEL	LLH	LONG LEG HORIZONTAL
BOT	BOTTOM	LLV	LONG LEG VERTICAL
℄	CENTER LINE	MANUF	MANUFACTURER
COL	COLUMN	MAX	MAXIMUM
CJ	CONSTRUCTION JOINT	MECH	MECHANICAL
CLR	CLEAR	MIN	MINIMUM
CMU	CONCRETE MASONY UNIT	NTS	NOT TO SCALE
CONC	CONCRETE	OC	ON CENTER
CONT	CONTINUOUS	OPEN'G	OPENING
DIM	DIMENSION	OPP	OPPOSITE
DN	DOWN	PL	PLATE
EA	EACH	PLF	LBS PER LINEAR FOOT
EF	EACH FACE	PSF	LBS PER SQUARE FOOT
EL	ELEVATION	PSI	LBS PER SQUARE INCH
ELEC	ELECTRICAL	REINF	REINFORCED/REINFORCING
EMBED	EMBEDDED	RO	ROUGH OPENING
EQ	EQUAL	SJ	SAW-CUT CONTROL JOINT
EXP JT	EXPANSION JOINT	SHT	SHEET
EW	EACH WAY	SIM	SIMILAR
FB	FLAT BAR	SQ	SQUARE
FF	FINISH FLOOR	STIFF	STIFFENER
FOC	FACE OF CONCRETE	TOP	TOP OF PANEL
GA	GAGE	TWS	THREADED WELDED STUD
GR BM	GRADE BEAM	TYP	TYPICAL
HORZ	HORIZONTAL	UN	UNLESS NOTED
K	KIPS (1000 LBS)	VERT	VERTICAL
		W/	WITH
		WS	WELDED HEADED STUD
		WWF	WELDED WIRE FABRIC

IF SHEET IS LESS THAN 28" X 40" IT IS A REDUCED PRINT - SCALE REDUCED ACCORDINGLY

S-1

REGISTERED PROFESSIONAL ENGINEER
EDWARD H. ADAMSON
No. 40462
Exp. 3/31/
CIVIL
STATE OF CALIFORNIA
OCT 19 1993

SJO CONSULTING ENGINEERS, INC.
Portland, Oregon

DSGN. EHA | DR. RFL | CHK. MBW
SUPV. | CH. ENGR.
SUBMITTED BY | DATE 10/ /93
FIRM MEMBER (TITLE)
E.I.C. | FIRE PROT.
SEC. HD. | DIV. HD.
SATISFACTORY TO | DATE
TITLE

CONCURRENCE	DATE

APPROVED	DATE
EFD FOR COMMANDER NAVFAC	

DEPARTMENT OF NAVY NAVAL FACILITIES ENGINEERING COMMAND
ENGINEERING FIELD ACTIVITY, NW
SILVERDALE, WASHINGTON

NAVAL UNDERSEA WARFARE CENTER DIVISION
KEYPORT, WA
HAZARDOUS WASTE
TSD (P-370)
LEGEND SHEET AND NOTES

SIZE	CODE IDENT NO.	NAVFAC. DRAWING NO.
F	80091	6405171
		CONST. CONTR. NO. N44255-94-C-7397
SCALE NONE		SPEC. 12-92-3618 / SHEET 35 OF

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REVISIONS				
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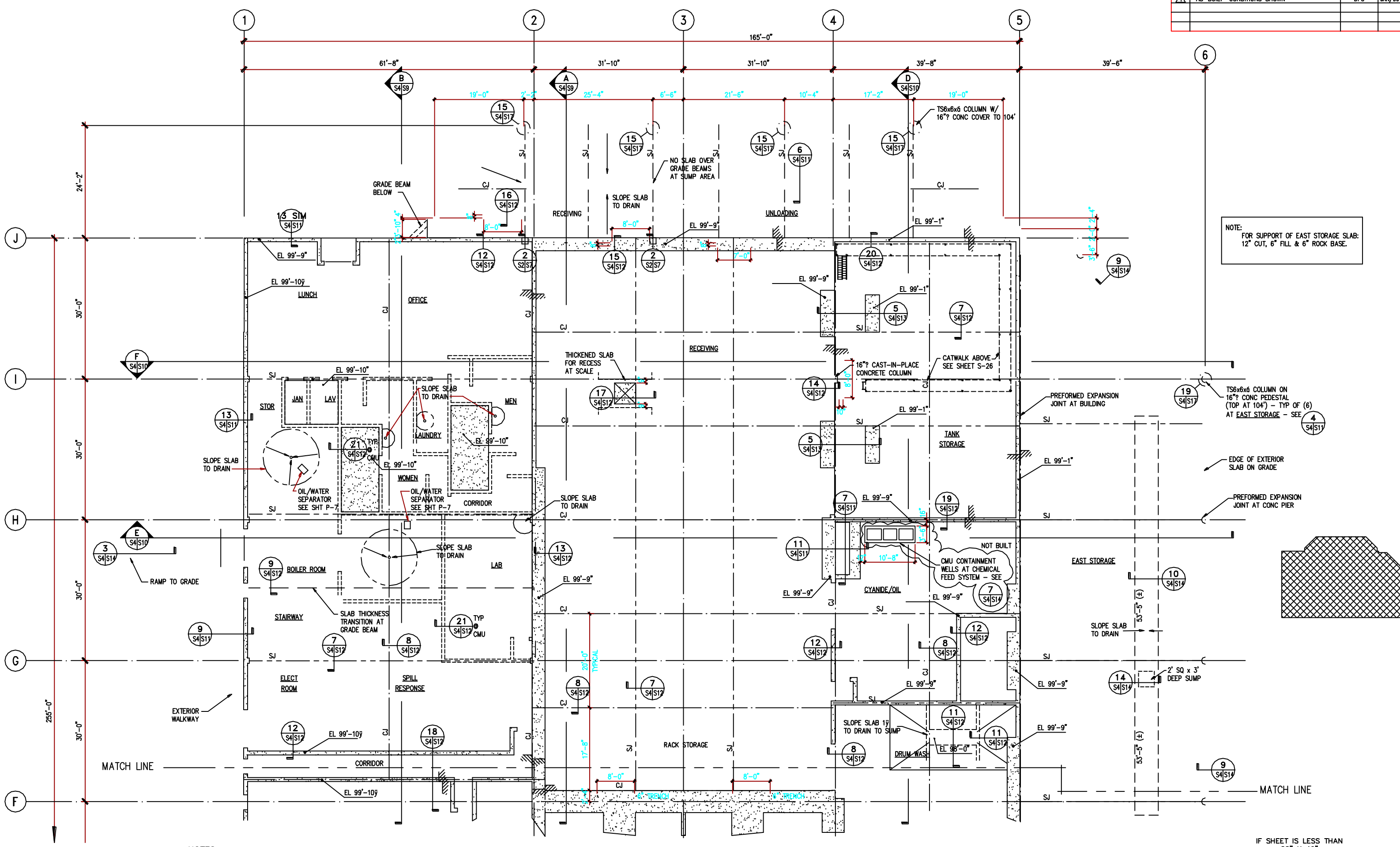
1	"AS-BUILT" CONDITIONS SHOWN	DFC	JAN/96	MBW



NOTES:

1. PLACE FLOOR SLAB ON 2" OF CLEAN MOIST SAND OVER 10 MIL VAPOR BARRIER BETWEEN GRADE BEAMS
2. SEE SHEET S-12 FOR SLAB THICKNESS AND REINFORCING
3. SEE SHEET S-13 FOR DEFERRED SLAB AREAS
4. SEE ARCHITECTURAL FOR FINISH FLOOR AND TOP OF DEFERRED SLAB ELEVATIONS
5. COORDINATE WALL ANCHORAGE PLATE LOCATIONS WITH WALL PANEL MANUFACTURER
6. SEE MECHANICAL FOR UNDER SLAB PIPING LOCATION AND ELEVATIONS
7. PROVIDE WATERSTOPS AT ALL SLAB COLD JOINTS

N

1 S4|S4 NORTH FLOOR SLAB PLAN
SCALE: 1/8" = 1'-0"

LEGEND

- CMU WALLS
- 1ÿ DEPRESSION FOR WALLS, DEFERRED SLABS AND RAMPS
- TRENCH DRAINS PER ARCH'L PLANS
- SUMPS – SEE ARCH'L PLANS
- SLAB STEP PER ARCH'L DWGS
- STEEL BOLLARD – SEE 13 S4|S14

GRAPHIC SCALE
1/8" = 1'-0" 5' 0 5' 10' 15' 20' 25'

IF SHEET IS LESS THAN 28" X 40" IT IS A REDUCED PRINT – SCALE REDUCED ACCORDINGLY

S-4

CONCURRENCE	DATE

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SEC. HD.		DIV. HD.
SATISFACTORY TO		DATE
TITLE		
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SILVERDALE, WASHINGTON

NAVAL UNDERSEA WARFARE CENTER DIVISION
KEYPORT, WA
HAZARDOUS WASTE
TSD (P-370)
NORTH FLOOR SLAB PLAN

SIZE	CODE IDENT NO.	NAVFAC. DRAWING NO.	
F	80091	6405174	
		CONST. CONTR. NO. N44255-94-C-7397	
SCALE AS NOTED		SPEC. 12-92-3618	SHEET 38 OF

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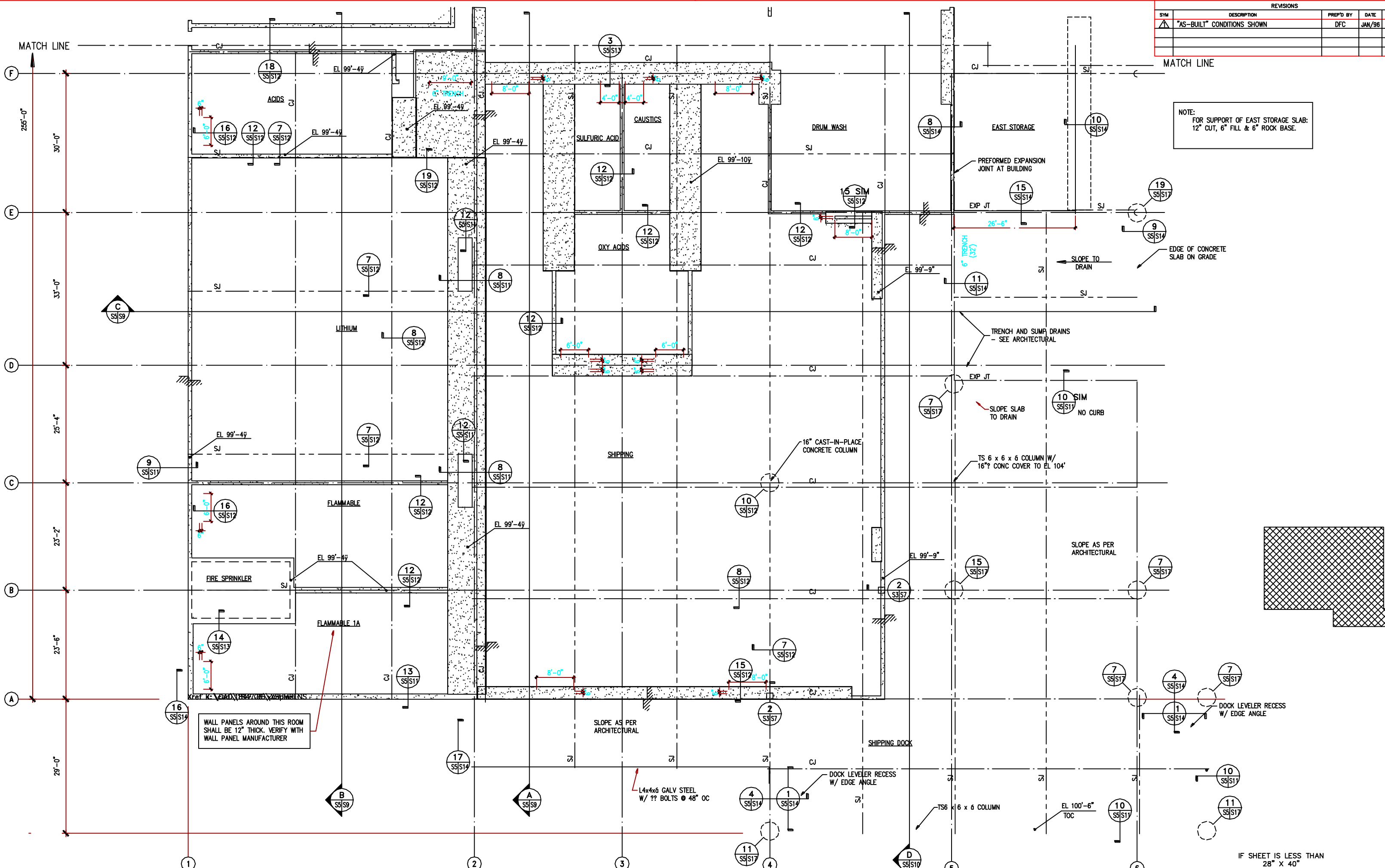

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S–5

NOTES:

1. PLACE FLOOR SLAB ON 2" OF CLEAN MOIST SAND OVER 10 MIL VAPOR BARRIER BETWEEN GRADE BEAMS
2. SEE SHEET S–12 FOR SLAB THICKNESS AND REINFORCING
3. SEE SHEET S–13 FOR DEFERRED SLAB AREAS
4. SEE ARCHITECTURAL FOR FINISH FLOOR AND TOP OF DEFERRED SLAB ELEVATIONS
5. COORDINATE WALL ANCHORAGE PLATE LOCATIONS WITH WALL PANEL MANUFACTURER
6. SEE MECHANICAL FOR UNDER SLAB PIPING LOCATION AND ELEVATIONS
7. PROVIDE WATERSTOPS AT ALL SLAB COLD JOINTS

N

1 (A5/S5) SOUTH FLOOR SLAB PLAN

SCALE: 1/8" = 1'–0"

LEGEND

- CMU WALLS
- 1ÿ DEPRESSION FOR WALLS, DEFERRED SLABS AND RAMPS
- TRENCH DRAINS PER ARCH'L PLANS
- SUMPS – SEE ARCH'L PLANS
- SLAB STEP PER ARCH'L DWGS
- STEEL BOLLARD – SEE 13 (S5/S14)

GRAPHIC SCALE

1/8" = 1'–0"   5' 0 5' 10' 15' 20' 25'

CONCURRENCE   DATE

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SUPV. | CH. ENGR.
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SILVERDALE, WASHINGTON

NAVAL UNDERSEA WARFARE CENTER DIVISION
KEYPORT, WA
HAZARDOUS WASTE
TSD (P–370)
SOUTH FLOOR SLAB PLAN

SIZE F | CODE IDENT NO. 80091 | NAVFAC. DRAWING NO. 6405175
CONST. CONTR. NO. N44255–94–C–7397
SCALE AS NOTED | SPEC. 12–92–3618 | SHEET 39 OF

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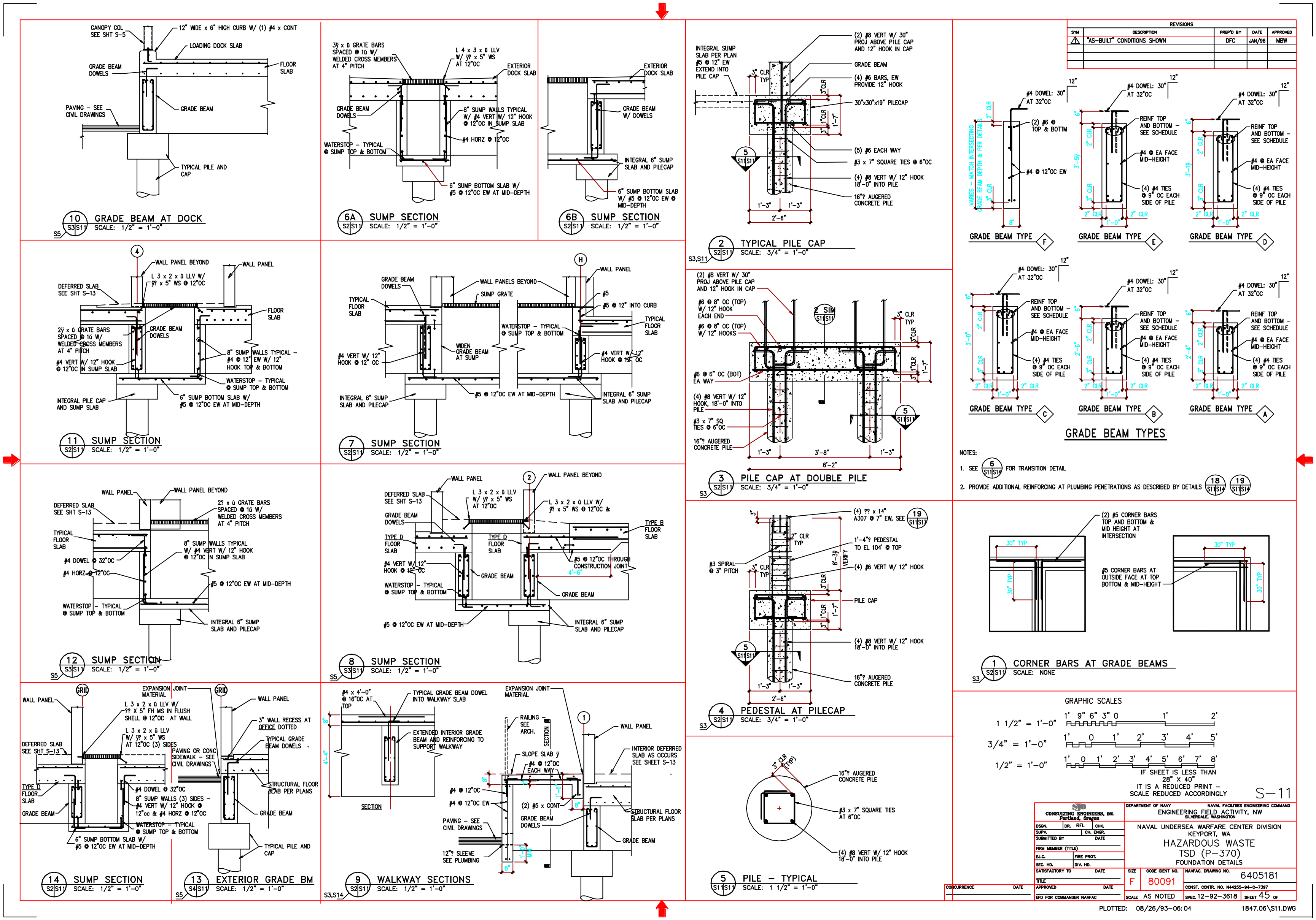

10 GRADE BEAM AT DOCK SCALE: 1/2" = 1'-0"
6A SUMP SECTION SCALE: 1/2" = 1'-0"
6B SUMP SECTION SCALE: 1/2" = 1'-0"
2 TYPICAL PILE CAP SCALE: 3/4" = 1'-0"
11 SUMP SECTION SCALE: 1/2" = 1'-0"
7 SUMP SECTION SCALE: 1/2" = 1'-0"
3 PILE CAP AT DOUBLE PILE SCALE: 3/4" = 1'-0"
12 SUMP SECTION SCALE: 1/2" = 1'-0"
8 SUMP SECTION SCALE: 1/2" = 1'-0"
4 PEDESTAL AT PILECAP SCALE: 3/4" = 1'-0"
14 SUMP SECTION SCALE: 1/2" = 1'-0"
13 EXTERIOR GRADE BM SCALE: 1/2" = 1'-0"
9 WALKWAY SECTIONS SCALE: 1/2" = 1'-0"
5 PILE - TYPICAL SCALE: 1 1/2" = 1'-0"
GRADE BEAM TYPE F
GRADE BEAM TYPE E
GRADE BEAM TYPE D
GRADE BEAM TYPE C
GRADE BEAM TYPE B
GRADE BEAM TYPE A
GRADE BEAM TYPES
NOTES:
1. SEE 6/S11 FOR TRANSITION DETAIL
2. PROVIDE ADDITIONAL REINFORCING AT PLUMBING PENETRATIONS AS DESCRIBED BY DETAILS 18/S14 19/S14
1 CORNER BARS AT GRADE BEAMS SCALE: NONE
(2) #5 CORNER BARS TOP AND BOTTOM & MID HEIGHT AT INTERSECTION
#5 CORNER BARS AT OUTSIDE FACE AT TOP BOTTOM & MID-HEIGHT
REVISIONS
"AS-BUILT" CONDITIONS SHOWN DFC JAN/96 MBW
GRAPHIC SCALES
1 1/2" = 1'-0"
3/4" = 1'-0"
1/2" = 1'-0"
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S-11
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NAVAL UNDERSEA WARFARE CENTER DIVISION KEYPORT, WA
HAZARDOUS WASTE TSD (P-370)
FOUNDATION DETAILS
SIZE F CODE IDENT NO. 80091 NAVFAC DRAWING NO. 6405181
CONST. CONTR. NO. N44255-94-C-7397
SCALE AS NOTED SPEC. 12-92-3618 SHEET 45
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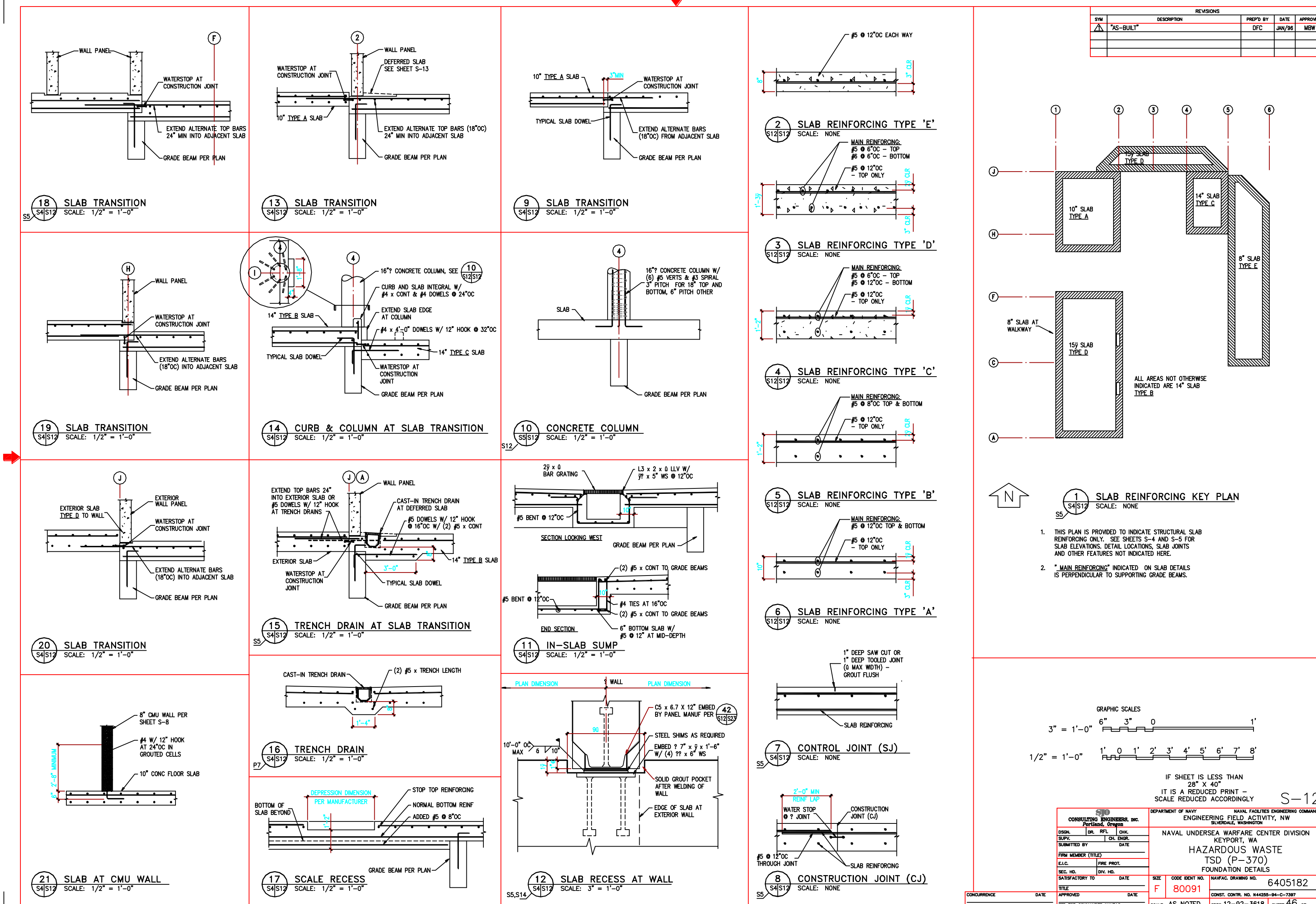

1. THIS PLAN IS PROVIDED TO INDICATE STRUCTURAL SLAB REINFORCING ONLY. SEE SHEETS S-4 AND S-5 FOR SLAB ELEVATIONS, DETAIL LOCATIONS, SLAB JOINTS AND OTHER FEATURES NOT INDICATED HERE.
2. "MAIN REINFORCING" INDICATED ON SLAB DETAILS IS PERPENDICULAR TO SUPPORTING GRADE BEAMS.

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HAZARDOUS WASTE
TSD (P-370)
FOUNDATION DETAILS

SIZE F | CODE IDENT NO. 80091 | NAVFAC DRAWING NO. 6405182
SCALE AS NOTED | SPEC. 12-92-3618 | SHEET 46

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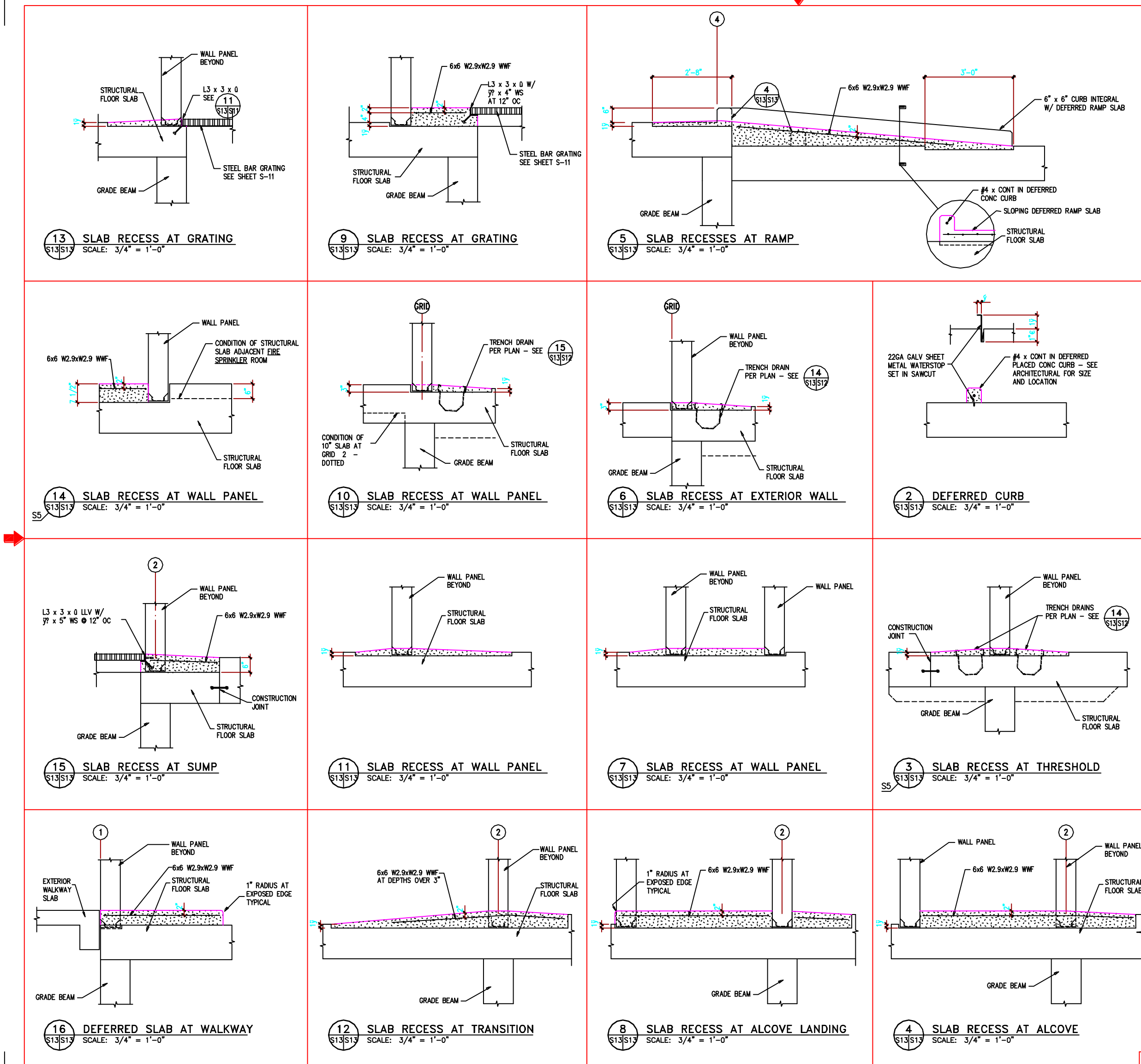

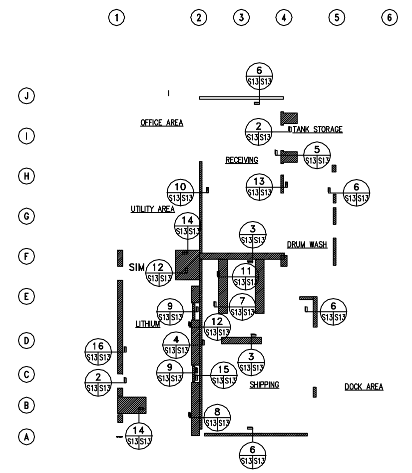

N

1 DEFERRED SLAB PLAN
SCALE: 1/32"= 1'-0"

NOTES & LEGEND

INDICATES AREAS OF DEFERRED SLABS TO BE PLACED AFTER ERECTING WALLS

1. SEE SHEETS S4, S5 AND S12 FOR STRUCTURAL FLOOR SLAB CONSTRUCTION AND DETAILS
2. SEE ARCHITECTURAL FOR FINISH FLOOR ELEVATIONS AND DEFERRED SLAB LOCATIONS AND DIMENSIONS
4. SEE MECHANICAL, PLUMBING AND ELECTRICAL DRAWINGS FOR DEFERRED CONCRETE HOUSEKEEPING PADS AND PEDESTALS
5. APPLY EPOXY BONDING COMPOUND TO HARDENED CONCRETE PRIOR TO PLACING DEFERRED SLAB
6. PROVIDE WIRE MESH REINFORCING AT SLAB THICKNESSES IN EXCESS OF 3"

GRAPHIC SCALES

1/32" = 1'-0" 20' 0 20' 40' 60' 80' 100'

3/4" = 1'-0" 1' 0 1' 2' 3' 4' 5'

IF SHEET IS LESS THAN 28" X 40" IT IS A REDUCED PRINT - SCALE REDUCED ACCORDINGLY

S-13

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TITLE
CONCURRENCE DATE
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SILVERDALE, WASHINGTON

NAVAL UNDERSEA WAREFARE CENTER DIVISION
KEYPORT, WA
HAZARDOUS WASTE
TSD (P-370)
DEFERRED SLAB PLAN AND DETAILS

SIZE F | CODE IDENT NO. 80091 | NAVFAC. DRAWING NO. 6405183
CONST. CONTR. NO. N44255-94-C-7397
SCALE AS NOTED | SPEC. 12-92-3618 | SHEET 47 OF

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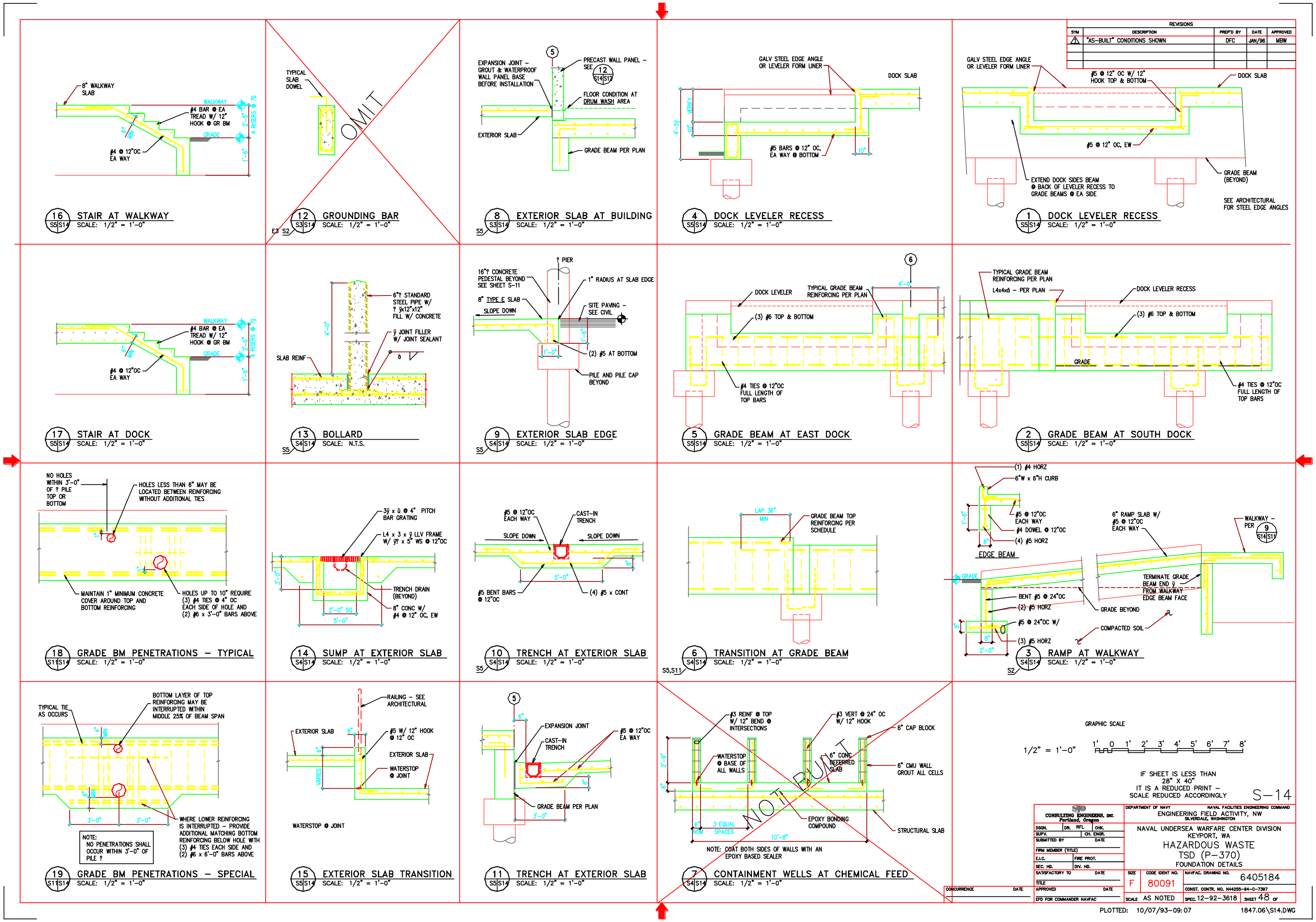

REVISIONS
"AS-BUILT" CONDITIONS SHOWN DFC JAN/96 MBW
16 STAIR AT WALKWAY SCALE: 1/2" = 1'-0"
12 GROUNDING BAR SCALE: 1/2" = 1'-0"
OMIT
8 EXTERIOR SLAB AT BUILDING SCALE: 1/2" = 1'-0"
4 DOCK LEVELER RECESS SCALE: 1/2" = 1'-0"
1 DOCK LEVELER RECESS SCALE: 1/2" = 1'-0"
17 STAIR AT DOCK SCALE: 1/2" = 1'-0"
13 BOLLARD SCALE: N.T.S.
9 EXTERIOR SLAB EDGE SCALE: 1/2" = 1'-0"
5 GRADE BEAM AT EAST DOCK SCALE: 1/2" = 1'-0"
2 GRADE BEAM AT SOUTH DOCK SCALE: 1/2" = 1'-0"
18 GRADE BM PENETRATIONS – TYPICAL SCALE: 1/2" = 1'-0"
14 SUMP AT EXTERIOR SLAB SCALE: 1/2" = 1'-0"
10 TRENCH AT EXTERIOR SLAB SCALE: 1/2" = 1'-0"
6 TRANSITION AT GRADE BEAM SCALE: 1/2" = 1'-0"
3 RAMP AT WALKWAY SCALE: 1/2" = 1'-0"
19 GRADE BM PENETRATIONS – SPECIAL SCALE: 1/2" = 1'-0"
15 EXTERIOR SLAB TRANSITION SCALE: 1/2" = 1'-0"
11 TRENCH AT EXTERIOR SLAB SCALE: 1/2" = 1'-0"
7 CONTAINMENT WELLS AT CHEMICAL FEED SCALE: 1/2" = 1'-0"
NOT BUILT
GRAPHIC SCALE
1/2" = 1'-0"
IF SHEET IS LESS THAN 28" X 40" IT IS A REDUCED PRINT – SCALE REDUCED ACCORDINGLY
S–14
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NAVAL UNDERSEA WARFARE CENTER DIVISION KEYPORT, WA
HAZARDOUS WASTE TSD (P–370)
FOUNDATION DETAILS
F 80091 6405184
CONST. CONTR. NO. N44255-94-C-7397
SCALE AS NOTED SPEC. 12-92-3618 SHEET 48
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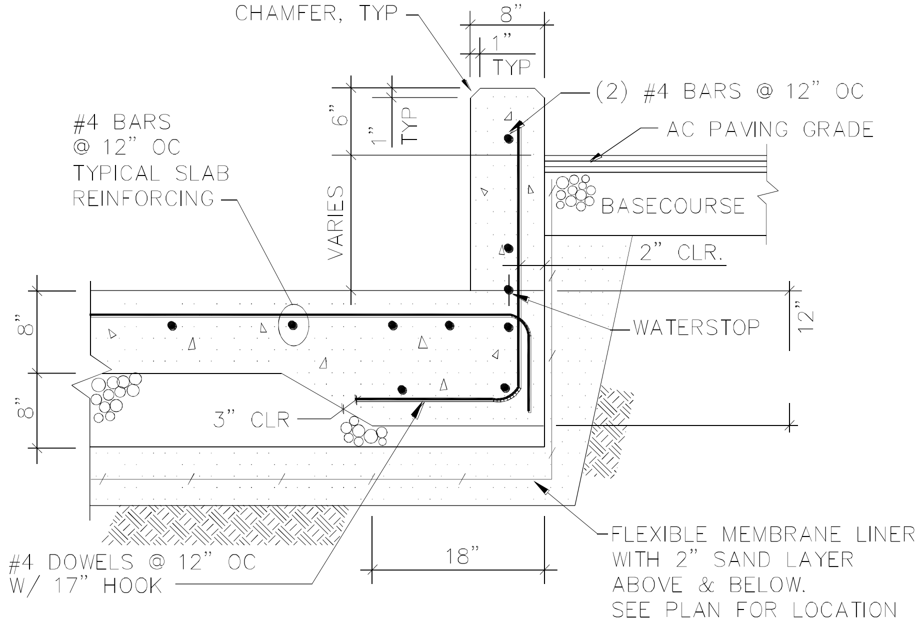
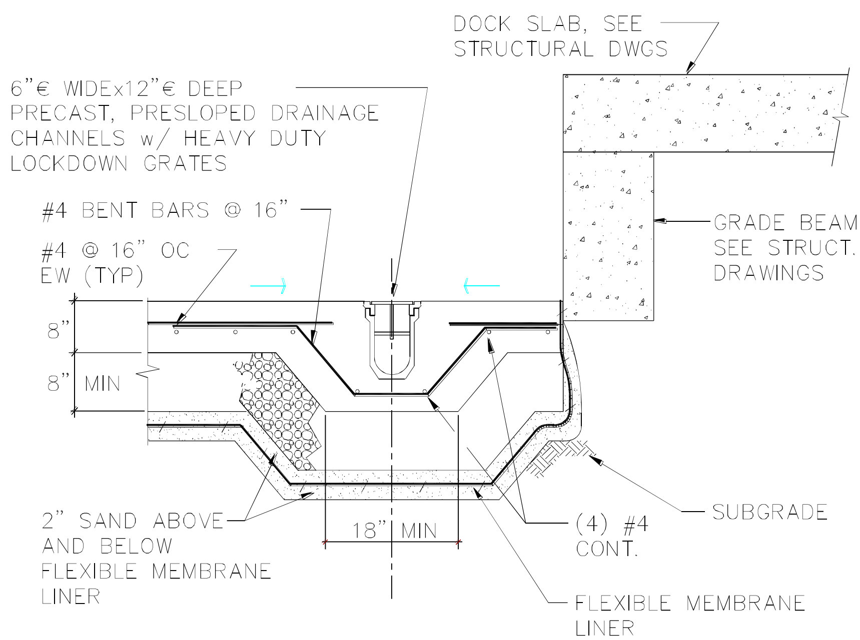


11 RAMP RETAINING WALL
C5 C9 SCALE: NONE



12 PRECAST TRENCH DRAIN W/ LINER
C6 C9 SCALE: NONE
C10

SECTION D

APPENDIX D4

FLOOR COATING SPECIFICATIONS

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1.7 QUALIFICATIONS OF INSTALLER

Installation shall be performed by an applicator approved by the manufacturer of the floor surfacing materials. The Contractor shall furnish a written statement from the manufacturer that the installer is acceptable.

PART 2 PRODUCTS

2.1 MATERIALS

Materials used in the flooring shall be the products of a single manufacturer. Materials shall meet the following requirements:

2.1.1 Complete System

40 CFR 264.175: The complete system must be sufficiently impervious to contain leaks or spills.

2.1.2 Primer or Floor Wall Sealer

One coat, high build, 2 component epoxy, clear, VOC compliant primer that is recommended by the manufacturer to penetrate into the pores of the substrate and bond with the floor or wall surfacing matrix to form a permanent monolithic bond between substrate and surfacing matrix or act as a chemical and wear resistant floor general purpose sealer with 96 percent solids by volume and a dry film thickness of 6.0 to 8.0 MILS.

2.1.3 Binder

Thermo-setting epoxy or medium reactive non-thixotropic modified polyester.

2.1.4 Fillers

Insert mineral or cellulosic material as recommended by the manufacturer for use with the binder.

2.1.5 Top Coating Color

Light gray as selected from manufacturer’s standard colors.

2.1.6 Physical Properties

The complete system after curing shall have the following properties when tested in accordance with the test methods listed for each property.

2.1.6.1 Epoxy Matrix Floor Surfacing – Do not use in Room 139 (Oxy-acids)

a. Compressive Strength: ASTM C 579; 10,000 psi minimum at 7 days.

b. Tensile Strength: ASTM C 307; 1,500 psi minimum at 7 days.

c. Flexural Modulus of Elasticity: ASTM C 580; 500,000 psi minimum at 7 days.

d. Thermal Coefficient of Expansion: ASTM C 531; 0.00004 inches per inch-degree F maximum.

e. Shrinkage: ASTM C 531; 0.5 percent maximum.

f. Bond Strength: ACI 503R, 300 psi minimum with 100 percent concrete failure (2,500 psi Compressive Strength Concrete).

g. Flame Spread Index: ASTM E 162; 25 maximum.

h. Smoke Deposited: ASTM E 162, 4 mg maximum.

i. Abrasion Resistance: ASTM D 4060; 15 mg maximum weight loss.

j. Impact Resistance: MIL-D-3134; no visible signs of chipping, cracking, or detachment and not more than 0.05 inch of permanent indentation.

k. Indentation: MIL-D-3134; no signs of cracking or detachment with initial indentation not to exceed two percent.

l. Resistance to Elevated Temperature: MIL-D-3134; no flow or slip exceeding 0.063 inch; no softening.

m. Non-slip Properties: MIL-D-3134; factors of friction not less than shown in Table II.

TABLE II

Contracting Surface	Factor of Static Friction Condition			Factors of Sliding Friction Condition		
	Dry	Wet	Oily	Dry	Wet	Oily
Leather	0.60	0.50	-----	0.30	0.40	-----
Rubber	0.60	0.70	0.30	0.40	0.70	0.10

n. Moister Absorption: MIL-D-3134; 1.0 percent maximum.

o. Chemical Resistance: ASTM D 1308; no effect when exposed to the following reagents for 7 days:

(1) Acetic Acid: 28 percent solution
(2) Ammonium Hydroxide: 10 percent solution
(3) Citric Acid: 5 percent solution
(4) Coffee
(5) Coca Cola Syrup
(6) Isopropyl Alcohol
(7) Mineral Oil
(8) Sodium Hydroxide: 50 percent solution
(9) Tri-Sodium Phosphate: 5 percent solution
(10) Urea: 6.6 percent solution
(11) Sulfuric Acid: 18 and 93 percent solutions

2.1.6.2 Polyester Matrix Floor Surfacing – Use only in Room 139

a. Compressive Strength: ASTM C 579; 10,000 psi minimum at 7 days.

b. Tensile Strength: ASTM C 307, 1,500 psi minimum at 7 days.

c. Flexural Modulus of Elasticity: ASTM C 580; 1,000,000 psi minimum at 7 days.

d. Thermal Coefficient of Expansion: ASTM C 531; 0.00004 inches per inch degree F maximum.

e. Shrinkage: ASTM C 531; 1.0 percent maximum.

f. Bond Strength: ACI 503R, 300 psi minimum with 100 percent concrete failure.

g. Flame Spread Index: ASTM E 162; 25 maximum.

h. Smoke Deposited: ASTM E 162; 4 gm maximum.

i. Abrasion Resistance: ASTM D 4060; no more than 1.0 mil loss of thickness.

j. Porosity: ASTM D 4060; no more than 8 percent gain in weight and no evidence of cracking, peeling, blistering, or loss of adhesion.

k. Impact Resistance: ASTM D 4060; no evidence of cracking, spalling, or loss of adhesion.

l. Fungistatic and Bacteriostatic Resistance: ASTM D 4060; no support for growth of fungus or bacteria.

m. Ultraviolet Light Resistance: ASTM D 4060; no evidence of chalking, cracking, peeling, blistering, or loss of adhesion.

n. Thermal Shock Resistance: ASTM D 4060; no evidence of cracking, peeling, blistering, spalling, or loss of adhesion.

o. Stain Resistance: ASTM D 4060; no permanent staining.

p. Adhesion: ASTM D 4060; 90 percent failure of concrete substrate.

q. Non-Slip Properties: MIL-D-3134; factors of friction not less than show in Table III.

TABLE III

Contracting Surface	Factor of Static Friction Condition			Factors of Sliding Friction Condition		
	Dry	Wet	Oily	Dry	Wet	Oily
Leather	0.60	0.50	-----	0.30	0.40	-----
Rubber	0.60	0.70	0.30	0.40	0.70	0.10

r. Chemical Resistance: ASTM D 1308; no effect when exposed to the following reagents for 7 days.

(1) Acetic Acid: 28 percent solution
(2) Ammonium Hydroxide: 10 percent solution
(3) Citric Acid: 5 percent solution
(4) Coffee
(5) Coca Cola Syrup
(6) Isopropyl Alcohol
(7) Mineral Oil
(8) Sodium Hydroxide: 5 percent solution
(9) Tri-Sodium Phosphate: 5 percent solution
(10) Urea: 6.6 percent solution
(11) Nitric Acid: 30 percent solution

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Remove all dirt, dust, debris, and other loose particles by sweeping or vacuum cleaning.

3.1.1 Concrete Surfaces

3.1.1.1 Acid Etching

Apply a 10 percent solution of muriatic acid at a rate of one quart per each 10 square feet of concrete surface. Allow the solution to stand until it stops bubbling but not less than five minutes. Remove the acid and wash the surfaces several times, as required, to remove all traces of the acid. Always dilute acid by pouring into water. Use face shield rubber gloves, and other safety equipment when using acids, alkalies, or solvents.

SECTION D

APPENDIX D5

CONTAINMENT CALCULATIONS

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There are two exterior spill containments around the NUWC, Keyport Treatment, Storage and Disposal Facility:

1. THE NORTH LOADING AREA (fire zone 5):

Picture 1: the north spill containment area viewed from the northwest.

Picture 2: the north spill containment area viewed from the northeast.

The north area is used to offload solid dangerous wastes, offload bulk liquid dangerous waste in drums and portable totes from 55 gallons to 500 gallons, and to transfer Otto Fuel II waste from a tank truck that holds up to 750 gallons, from an oily wastewater tank truck that holds up to 1,500 gallons, and to a bulk liquid dangerous waste tank truck that holds up to 5,000 gallons. Transfers occur four to six times per year: three to five involving Otto Fuel II/Alcohol, one involving Otto Fuel II/Cyanide.

The blind sump measures 83' X 2' X (56"/12) deep for a containment volume of 5,795 gallons.

The blind sump contains five buttresses for internal support. The volume of each buttress is (41.5"/12) X 1' X 2', for a total volume of 52 gallons each.

Pictures 3 & 4: The north area blind sump. Pictures of the sump and buttresses are not feasible because the grates prevent showing any detail.

The net volume of the blind sump is 5,795 gallons minus 5 buttresses of 52 gallons each for a net volume of 5,535 gallons.

1.1 Fire Flow Calculations for the North Loading Area.

In addition to the sump and floor containment areas, overflow from the blind sump flows to a small trench that flows to two exterior containment areas before it overflows the perimeter berms. Fire flow calculations are provided in the table below. Note that the fire containment area valves remain open and overflow to a retention pond unless a fire occurs.

1.1 Spill -Only Calculations for the North Loading Area.

Spill containment capacity of the blind sump is 5,535 gallons.

From the P-370 drawings, the elevation difference between the top of the blind sump and the small trench that flows to the two exterior containment areas before it overflows the perimeter berms is one inch.

The location of the small trench is about 5 ft. away from the back wall (see the drawing). Thus, 1974 ft^2 containment area is subject to 1-in depth for a spill containment capacity of 1,230 gallons.

Total north loading area spill containment capacity is 5,535 + 1,230 = 6,765 gallons.

The worst case spill is 5,000 gallons from a tank truck for offsite shipping.

The north loading area excess spill containment capacity is 6,765 – 5,000 = 1,765 gallons.

There are six compartments in the blind sump, so each can fill to 1,765 / 6 = 294 gallons before the excess capacity is met. At 156” X 24” = 3,744 in^2, each compartment can fill to 294 gallons * 231 in^3/gal / 3,744 in^2 = 18” deep before the excess capacity is met.

Per WAC 173-303-630(7)(b), given the above excess capacity, it may be used to contain run-on during periods in between transfers. Pumping out any collected rainwater immediately prior to a scheduled transfer is encouraged, and considered a best management practice. Pumping out all collected rainwater throughout the trench will be required when the stormwater level in any one compartment exceeds 17 inches deep, or during the period of October through May, every 30 days, whichever comes sooner. Under no circumstance will rainwater be allowed to collect up to 15 inches of depth in four or more compartments.

No equipment other than the 5,000 gallon shipping tank truck shall be located in the north loading area more than five feet from the building wall during transfers to the shipping truck.

2. THE SOUTH SHIPPING DOCK (fire zone 2):

Pictures 5 & 6: the south loading dock spill containment area and associated sump.

2.2 Spill and Fire Flow Calculations for only the South Shipping Dock Area.

The South Shipping Dock sump measures 7’ X 5’ X (65”/12) deep for a containment volume of 1,418 gallons, at which point the contents flow automatically to the storm drain, which drains to a sedimentation pond that is equipped with an oil/water separator prior to discharge to the lagoon.

From the table the fire flow requirement for the shipping dock is 402 gallons.

As calculated above, the capacity of the sump is 1,418 gallons. The maximum spill is 55 gallons.

The excess capacity for the shipping dock area is 1,418 – 402 – 55 = 961 gallons

The alarm float activates when the tank contents reach 3 ft. deep, at which time there is 785 gallons in the sump, so when the alarm goes off, 176 gallons of spill capacity remains in the sump, or more than three times the expected maximum spill volume.

Per WAC 173-303-630(7)(b), given the above excess capacity, it may be used to contain run-on during periods in between transfers. Pumping out any collected rainwater immediately prior to a scheduled transfer operation is encouraged, and considered a best management practice. Pumping will be required when the south spill containment sump fills to the alarm activation level or during the period of October through May, every 30 days, whichever comes sooner. The sump high level alarm system will be checked for functionality on an annual basis.

SECONDARY AND FIRE FLOW CONTAINMENT CALCULATIONS

ROOM NAME	SECONDARY CONTAINMENT							FIRE FLOW											
COLUMN	B	C	D	E	F	G	H	I	J	K	L	N	N	O	P	Q	R	S	T
receiving	123N	4,870	2	6,071	550	3,410	341	0.35	3,000	1,124	0	1,124	20	22,470	23,020	16,949	1+2	31,790	14,841
ORM	123S	2,627	2	3,275	55	10,560	1,056	included in receiving calculation											
DW tanks	124	2,320	8	11,569	5,000	30,000	3,000	0.35	2,400	899	0	899	20	17,976	22,976	11,407	1+2	31,790	20,383
cyanides/sulfides	125	35	52	1,118	55	330	55	0.35	60	22	0	28	20	560	615	0	1+2	31,790	31,790
drum wash	128	1,948	2	2,429	0	0	0	0.35	1,950	730	0	730	20	14,606	14,606	12,177	1+2	31,790	19,613
oxidizers (trench & sump)	129			296	55	495	55	0.35	100	37	0	37	20	749	804	508	1+2	31,790	31,282
acids	130	1,017	6	3,804	550	1,980	550	0.35	1,020	382	0	382	20	7,640	8,190	4,386	3	7,480	3,094
dangerous when wet	131	4,070	6	15,222	55	18,700	1,870	no fire flow											
poisons	132	35	52	1,118	55	330	55	0.35	60	22	0	28	20	560	615	0	1+2	31,790	31,790
organic peroxides	133	35	52	1,118	55	220	55	0.35	60	22	0	28	20	560	615	0	1+2	31,790	31,790
flammables/combustibles	134	1,163	6	4,350	550	7,920	792	0.25	1,170	313	394	707	20	14,140	14,690	10,340	5	26,928	16,588
flammable 1A (comp gas)	136	1,152	6	4,308	55	3,300	330	0.60	1,200	770	394	1,164	20	23,288	23,343	19,035	5	26,928	7,893
toner cartridges	137	385	2	480	150	660	150	0.35	380	142	0	142	20	2,846	2,996	2,516	3	7,480	4,964
caustics	138	385	2	480	150	1,320	150	0.35	380	142	0	142	20	2,846	2,996	2,516	4	3,366	850
used oil	139	844	2	1,052	55	2,970	297	0.35	860	322	0	322	20	6,441	6,496	5,444	3	7,480	2,036
ORM	140/19	1,090	2	1,359	55	6,600	660	0.35	1,090	408	0	408	20	8,164	8,219	6,860	1+2	31,790	24,930
room 140S (shipping)	140	8,488	2	10,582	55	9,350	935	0.35	1,910	715	0	715	20	14,306	14,361	3,779	1+2	31,790	28,011
north loading area		2,584	1	6,765	5,000	5,000	5,000	0.35	3,340	1,251	0	1,251	20	25,017	30,017	23,252	1+2	31,790	8,538
south shipping dock		435		1,418	55	220	55	0.35	435	45	0	45	9	402	457	no flow to ext cont'ments			

COLUMN EXPLANATION:

A - Room Name
B - Room Number
C - Room Area in square feet from the P-370 table
D - 2^0 Containment Height in inches is from onsite measurement
E - 2^0 Containment Vol. in gals, is column C * column D converted to gals
F - Single Largest Container in the room from the Permit Appl. app D-10 table
G - Tot Liquid Storage Cap in the room from the Permit Appl. table D1-4
H - Minimum Spill Containment Volume for the room, the larger of 10% of column G or all of column F from the Permit Application table D1-4
I - Fire Flow Density (gallons per minute per square foot) from the P-370 table
J - Fire Flow Design Area from the P-370 table
K - Ceiling Flow from the P-370 table, it is column I multiplied by column J multiplied by FF=1.07
L - In-Rack Flow from the P-370 table
M - Maximum Fire Flow in GPM from the P-370 table, it is column K plus column L w/ a 28 GPM min
N - Fire Flow Time in minutes from the P-370 table
O - Total Fire Flow is column M multiplied by column N
P - Total Fire Flow Plus Largest Single Container is column F plus column
Q - Overflow to Exterior Containments, in gallons is column P minus column E
R - Exterior Containment Compartment Number, from the drawings
S - Exterior Containment Volume, from the drawings
T - Volume in gallons, column S minus column Q

ABBREVIATIONS			
BLDG	BUILDING	NO	NORMALLY OPEN
BOP	BOTTOM OF PIPE	OH	ORDINARY HAZARD
CENTR.	CENTRIFUGAL	OS&Y	OUTSIDE STEM & YOKE
EH	EXTRA HAZARD	RM	ROOM
F	FIRE LINE	TYP	TYPICAL
FDC	FIRE DEPARTMENT CONNECTION	T.S.	TAMPER SWITCH
FF	FINISH FLOOR		
FIN CLG	FINISH CEILING		
FIN FLR	FINISH FLOOR		
LH	LIGHT HAZARD		
NC	NORMALLY CLOSED		

SYMBOLS

- IN-RACK SPRINKLER HEAD (AT DIFFERENT LEVELS)
- IN-RACK SPRINKLER RISER
- GATE VALVE (HANDLE FACING VIEWER)
- BALL VALVE
- DIAPHRAGM VALVE
- S SOLENOID VALVE
- GATE VALVE (OS&Y)
- GLOBE VALVE
- CHECK VALVE
- PS PRESSURE SWITCH

REVISIONS				
SYM	DESCRIPTION	PREP'D BY	DATE	APPROVED
1	"AS-BUILT"	DFC	JAN/96	MBW

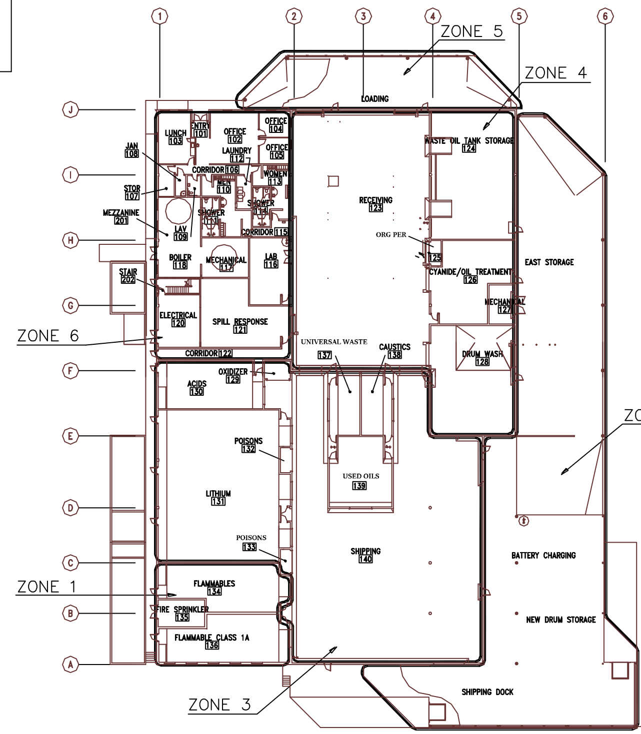
NOTES:

1. IN-RACK SPRINKLERS IN ROOMS 134 AND 136 AT EACH RACK LEVEL. CALCULATE 6 HEADS ON EACH LEVEL.
2. SPRINKLER HEADS IN ZONES 2 AND 5 AND ROOMS 130, 137, 138, AND 139 TO BE CORROSION RESISTANT.
3. ALL EXPOSED PIPING TO BE PAINTED.
4. FOR PIPE PENETRATIONS THROUGH FIRE WALLS REFER TO ARCHITECTURAL DETAIL 18 & 19 ON DRAWING A-21.

ROOM #	AREA	HAZARD CLASS	OVERHEAD DENSITY (gpm/ft^2)	DESIGN AREA ROOM	DESIGN AREA AS DESIGN	TYPE	ZONE OVERHEAD	ZONE IN-RACK	HEAD TEMP. OVERHEAD	HEAD TEMP. IN-RACK
101	ENTRY	ORDINARY	0.16	130	3000	WET PIPE	6	NONE	165°F	NONE
102	OFFICE			528						
103	LUNCH ROOM			360						
104	OFFICE			168						
105	OFFICE			168						
106	CORRIDOR			172						
107	STORAGE			105						
108	JANITOR'S CLOSET			32						
109	LAVATORY			54						
110	WOMEN'S RESTROOM			384						
111	WOMEN'S SHOWER			144						
112	LAUNDRY			88						
113	MEN'S RESTROOM			332						
114	MEN'S SHOWER			144						
115	CORRIDOR			72						
116	LABORATORY		0.20	645						
117	MECHANICAL ROOM			378						
118	BOILER ROOM			703						
119	STAIR		0.16	133						
120	ELECTRICAL			456						
121	SPILL RESPONSE			1065						
122	CORRIDOR			349						
123	RECEIVING	EX HAZ	0.35	7497			4		286°F	
124	WASTE OIL TANK STORAGE			2301						
125	ORG PER			58						
126	CYANIDE / OIL TREATMENT			1208						
127	MECHANICAL			216						
128	DRUM WASH			1900						
129	OXIDIZER			96			3			
130	ACIDS			1028			3			
131	LITHIUM		NONE	4154	NONE	NONE	NONE		NONE	
132	POISONS		0.35	58	3000	WET PIPE	3	NONE	286°F	
133	POISONS		0.35	58			3	NONE		NONE
134	FLAMMABLES		0.25	1210			1	1A		165°F
135	SPRINKLER RISER ROOM		0.16	252			1	NONE	165°F	NONE
136	FLAMMABLES IA		0.60	1170			1	1B	286°F	165°F
137	UNIVERSAL WASTE		0.35	381			3	NONE		NONE
138	CAUSTICS			381			3			
139	USED OILS			864			3			
140	SHIPPING			9468			3			
201	MEZZANINE	ORD	0.20	5124			6			
LD DOCK	NORTH LOADING DOCK	EX HAZ	0.35	2477	3900*	DRY PIPE	5			
E STOR	EAST STORAGE			6362			2			
BATT CHRG	BATTERY CHARGING			760						
DRUM STOR	DRUM STORAGE			1520						
SHIP DOCK	SHIPPING DOCK			2878						

* 130% OF DESIGN AREA

1 FP1 FP1 FIRE PROTECTION SCHEDULE
SCALE: NONE



2 FP1 FP1 FIRE PROTECTION ZONES
SCALE: NONE

IF SHEET IS LESS THAN 28" X 40" IT IS A REDUCED PRINT – SCALE REDUCED ACCORDINGLY

FP–1

MELOTT AND ASSOCIATES INC
11650 S.W. BEL AIRE LANE BEAVERTON OR 97005
VOICE OR FAX (503) 643-5608

SJO CONSULTING ENGINEERS, INC. Portland, Oregon

DSGN. RM	DR. JHJ	CHK.
SUPV.	CH. ENGR.	
SUBMITTED BY	DATE 10/25/93	
FIRM MEMBER/TITLE		
E.I.C.	FIRE PROT.	
SEC. HD.	DIV. HD.	
SATISFACTORY TO	DATE	
TITLE		
APPROVED	DATE	
EFD FOR COMMANDER NAVFAC		
CONCURRENCE	DATE	

DEPARTMENT OF NAVY — NAVAL FACILITIES ENGINEERING COMMAND
ENGINEERING FIELD ACTIVITY, NW
SILVERDALE, WASHINGTON

NAVAL UNDERSEA WARFARE CENTER DIVISION
KEYPORT, WA
HAZARDOUS WASTE
TSD (P–370)
LEGEND, SCHEDULE & FP ZONES

SIZE	CODE IDENT NO.	NAVFAC DRAWING NO.
F	80091	6405225
SCALE NONE		CONST. CONTR. NO. N44255-94-C-7397
	SPEC. 12-92-3618	SHEET 89 OF

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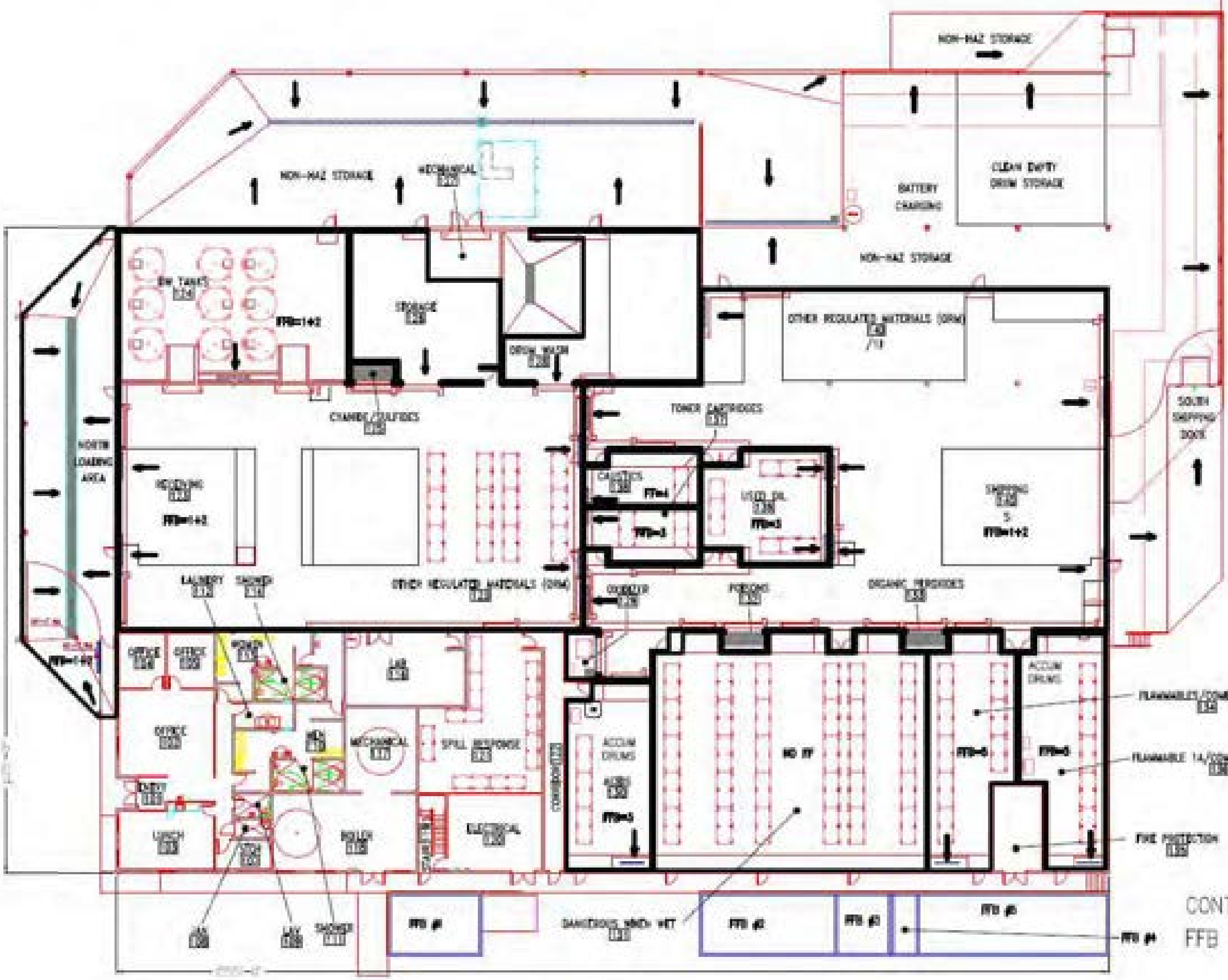

CONTAIMENT CALCULATION DRAWING
FFB = FIRE FLOW BASIN

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SECTION D

APPENDIX D6

FLEXIBLE MEMBRANE LINER SPECIFICATIONS

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2.1 FLEXIBLE MEMBRANE LINER

2.1.1 HDPE Liner Specifications

Liners to be ASTM D 1248 High Density Polyethylene, 60 mil thickness, according to the following specifications:

Property	Test Method	Value	Units
Specific Gravity, Min.	ASTM D 1505	0.94	
Tensile Strength @ Yield, Min.	ASTM D 638-IV	2200	PSI
Tensile Strength @ Break, Min.	ASTM D 638-IV	3500	PSI
Tear Resistance, Min.	ASTM D 1004-C	700	PSI
Carbon Black Content		2 – 3	%
Env. Stress Resistance	ASTM D 1693	1500	Hrs.

2.2 WELD MATERIAL

All welding material shall be of a type recommended and supplied by the manufacturer and shall be delivered in the original sealed containers – each with an indelible label bearing the brand name, manufacturer's mark number, and complete directions as to proper storage.

2.3 PENETRATIONS

Provide manufacturer's standard factory fabricated penetration assemblies. Make penetration assemblies of the same base material as liner

PART 3 EXECUTION

3.1 SURFACE PREPARATION

3.1.1 Soil or Granular Subgrade in accordance with Section 02221, "Earthwork for Structures and Pavements." Remove vegetation, boulders, and rocks larger than ¾ inch (20 mm) in size and other sharp objects. Fill in holes,

SECTION D

APPENDIX D7

TANK DRAWINGS

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DESCRIPTION	DATE	BY	REV

REVISIONS

FMF Flohr Metal Fabricators, Inc.
Seattle Washington

(6) HAZARDOUS WASTE TSD TANKS T-1, T-2, T-3, T-20, T-21 AND T-40

FOR

BODENHAMMER, INC.

NAVAL UNDERSEA WARFARE CENTER KEYPORT, WA

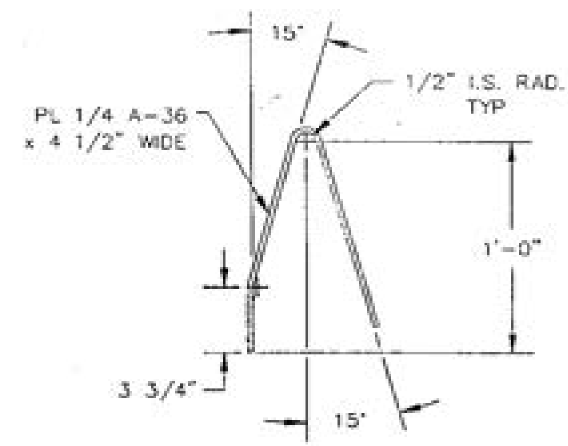
SCALE ½"=1'-0" & NOTED	DRAWN BY MRT	JOB NO. F2323
DATE 5/3/94	APPROVED	DWG NO. F23232
	CHECKED BY	SHEET 2 OF 3

NOZZLE SCHEDULE

ITEM	SIZE	TYPE	DESCRIPTION
A	2”	RFWN	DRAIN / OUTLET
B	3”	RFWN	OVERFLOW
C	2”	RFWN	INLET (TRUCK)
D	3”	RFWN	LEVEL INSTRUMENT
E	2”	RFWN	INLET (DRUM OR TOTE)
F	3”	RFWN	VENT
G	24”	PLATE	SHELL MANHOLE
H	24”	PLATE	ROOF HATCH

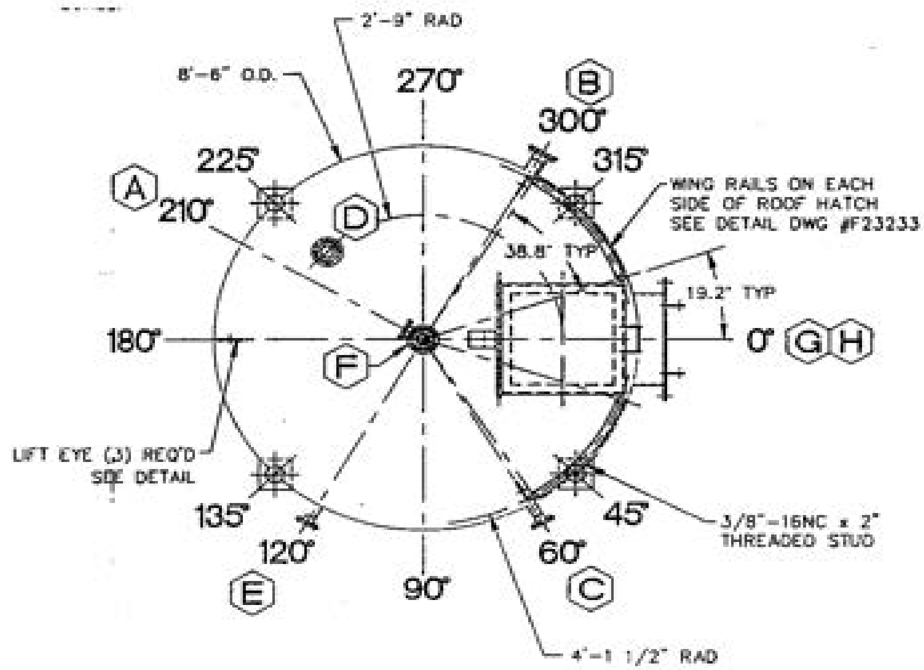
GENERAL NOTES

1. ALL DESIGN AND CONSTRUCTION SHALL BE PER API 620 AND CONTRACT SPECIFICATION #13205.
2. ALL WELDING SHALL BE PER ASME SECTION IX.
3. ALL PLATE MATERIAL SHALL BE ASTM A-36.
4. ALL PIPE MATERIAL SHALL BE ASTM 1-53B ERW.
5. ALL FLANGE MATERIAL SHALL BE ASTM A-105, CLASS 150, RAISED FACE WELDING NECK TYPE.
6. ALL PIPE FITTINGS SHALL BE ASTM A-234 WPB.
7. ALL SHELL MANHOLE AND ROOF HATCH GASKETS SHALL BE RUBBER.
8. REMOVE ALL SHARP EDGES AND CORNERS THAT MAY BE INJURIOUS TO PERSONNEL.
9. ALL BOLT HOLES SHALL STRADDLE NATURAL VESSEL CENTERLINES.
10. EXTERIOR COATING PER CONTRACT SPEC. #09874.
11. INTERIOR COATING PER CONTRACT SPEC. #09875.
12. CORROSION ALLOWANCE 1/16”.
13. 1.2 SPECIFIC GRAVITY.
14. APPL[illegible]F LABEL.



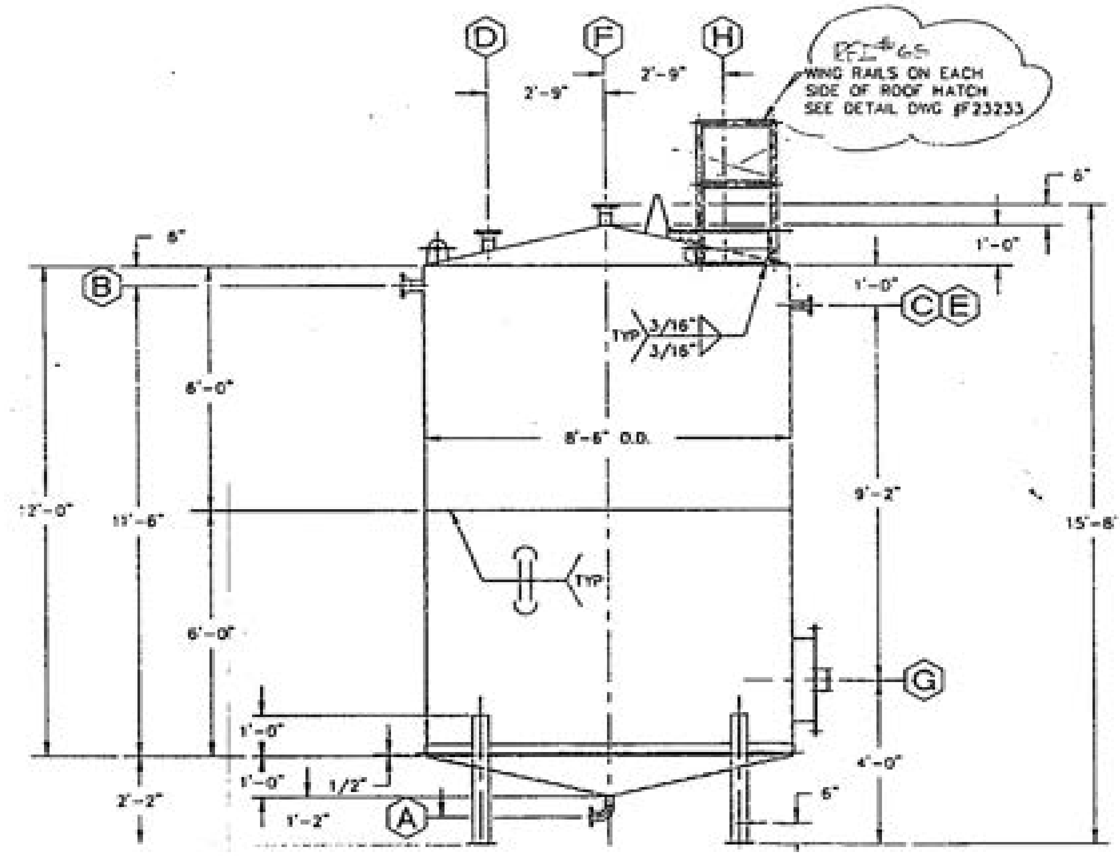
LID STOP DETAIL

SCALE: 1"=6"



PLAN VIEW

PLAN VIEW



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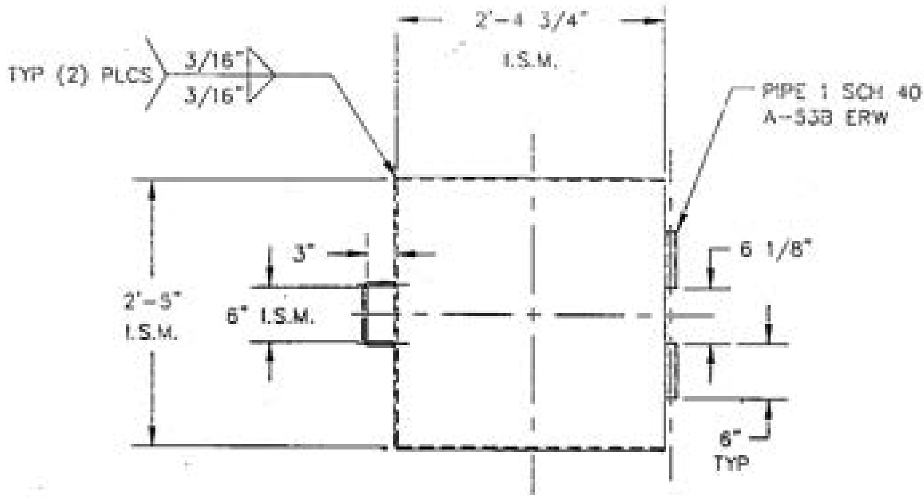
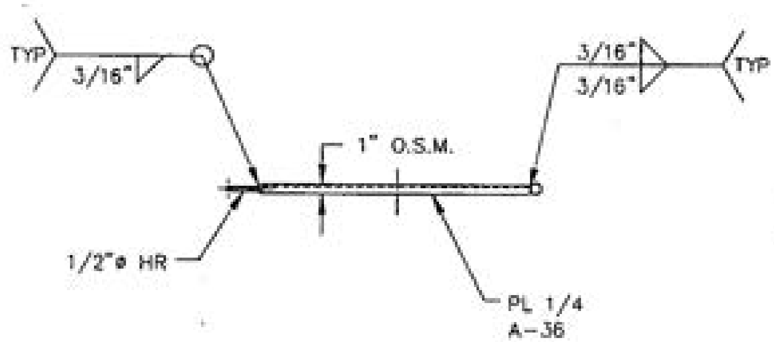
F
H
2'-9"
2'-9"
REF #65
WING RAILS ON EACH
SIDE OF ROOF HATCH
SEE DETAIL DWG #F23233
6"
6"
1'-0"
1'-0"
B
C E
TYP
3/16"
3/16"
8'-0"
8'-6" O.D.
9'-2"
12'-0"
11'-6"
15'-8"
TYP
6'-0"
G
1'-0"
1'-0"
1/2"
4'-0"
6"
2'-2"
1'-2"
A

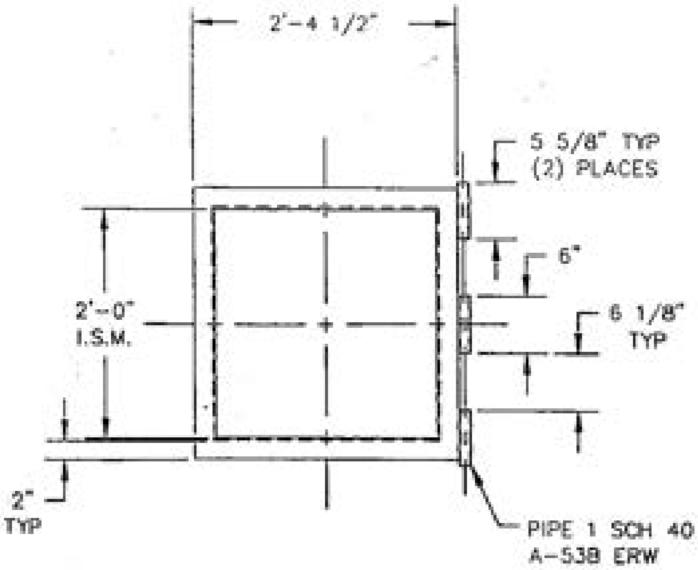


COVER PLAN DETAIL

SCALE: 1/2" = 1'-0"

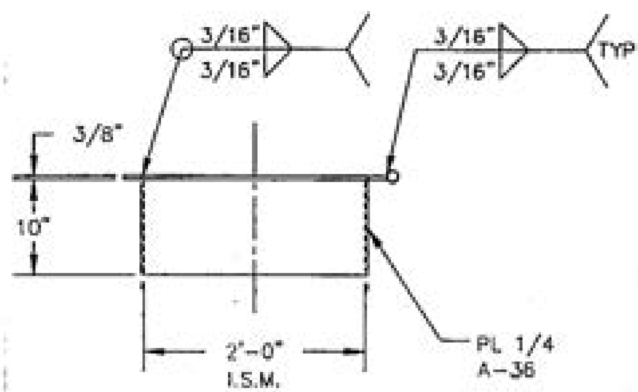


COVER ELEVATION DETAIL

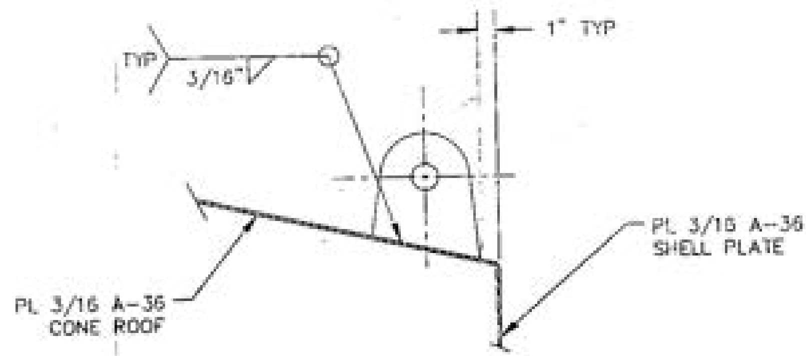


NECK/FLANGE PLAN DETAIL

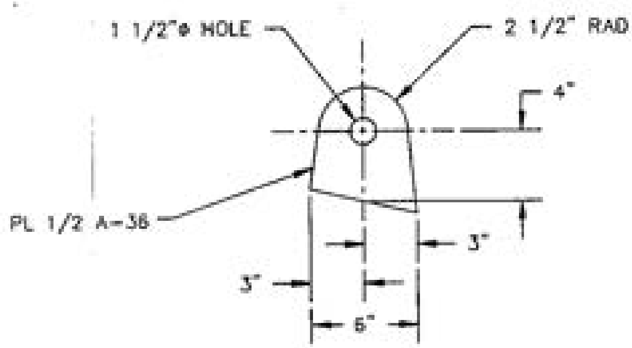
SCALE: 1/2" = 1'-0"



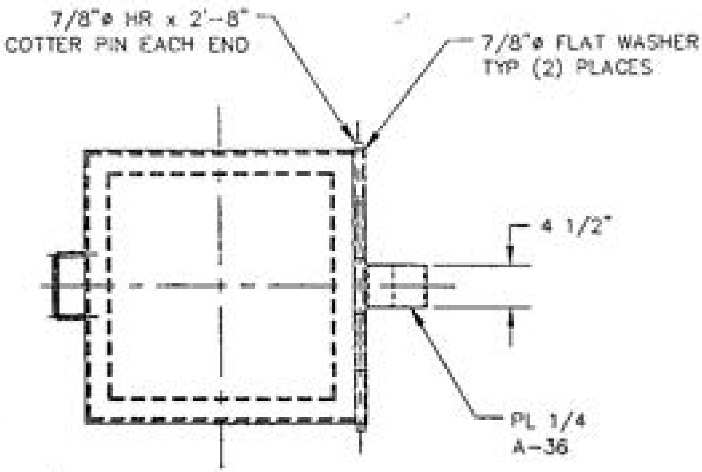
NECK/FLANGE ELEVATION DETAIL



LIFT EYE ATTACHMENT DETAIL
TYP (3) PLCS SCALE: 1"=6"

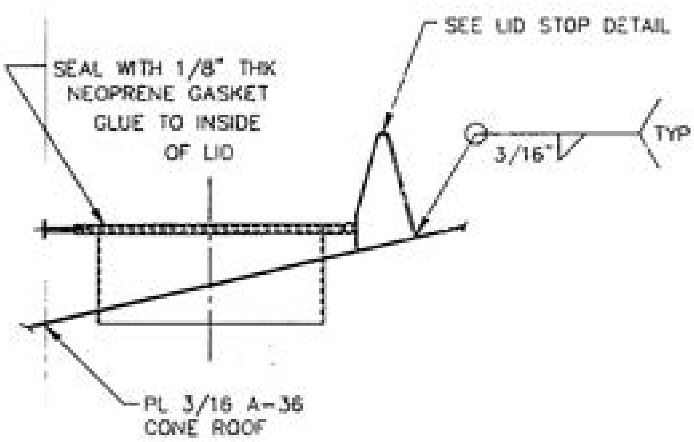


LIFT EYE DETAIL
TYP (3) PLCS SCALE: 1"=6"

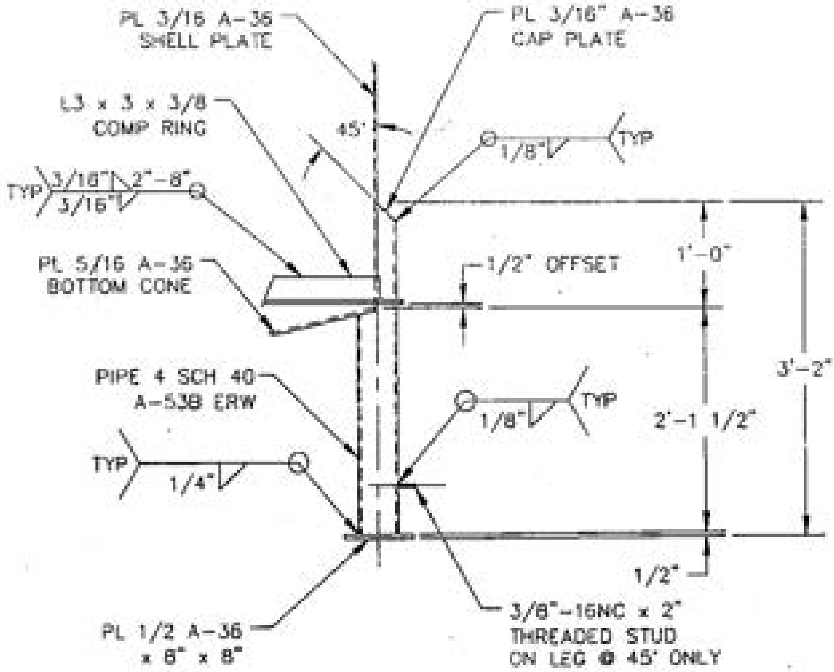


HATCH PLAN DETAIL

SCALE: 1/2" = 1'-0"

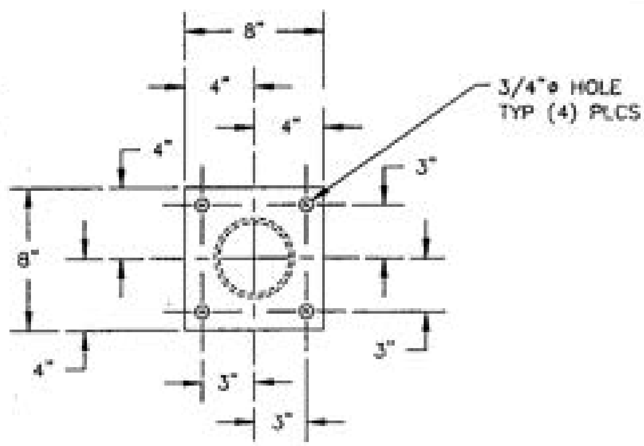


HATCH ELEVATION DETAIL



LEG DETAIL

TYP (4) PLCS SCALE: 1"=1'-0"



FOOT DETAIL

TYP (4) PLCS SCALE: 1"=6"

DESCRIPTION	DATE	BY	REV

REVISIONS

FMF Flohr Metal Fabricators, Inc.
Seattle Washington

(6) HAZARDOUS WASTE TSD TANKS
T-4, T-5 AND 5-22
FOR
BODENHAMMER, INC.
NAVAL UNDERSEA WARFARE CENTER KEYPORT, WA

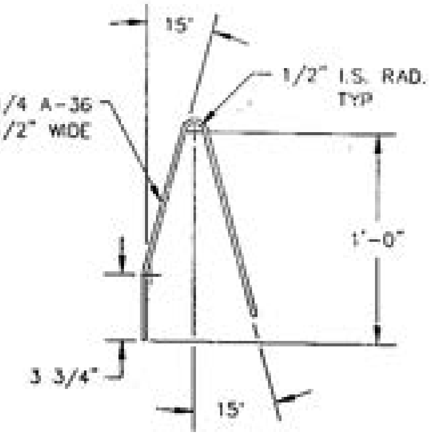
SCALE ½"=1'-0" & NOTED	DRAWN BY MRT	JOB NO. F2323
DATE 5/3/94	APPROVED	DWG NO. F23232

NOZZLE SCHEDULE

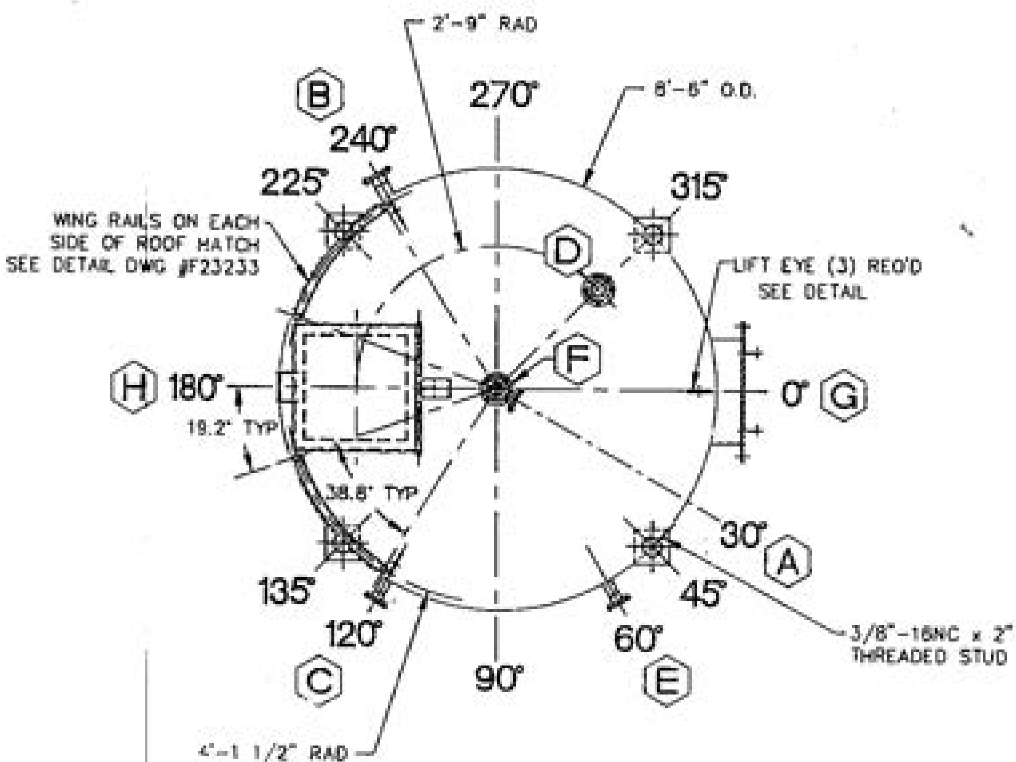
ITEM	SIZE	TYPE	DESCRIPTION
A	2”	RFWN	DRAIN / OUTLET
B	[illegible]	RFWN	OVERFLOW
C	2”	RFWN	INLET (TRUCK)
D	3”	RFWN	LEVEL INSTRUMENT
E	2”	RFWN	INLET (DRUM OR TOTE)
F	3”	RFWN	VENT
G	24”	PLATE	SHELL MANHOLE
H	24”	PLATE	ROOF HATCH

GENERAL NOTES

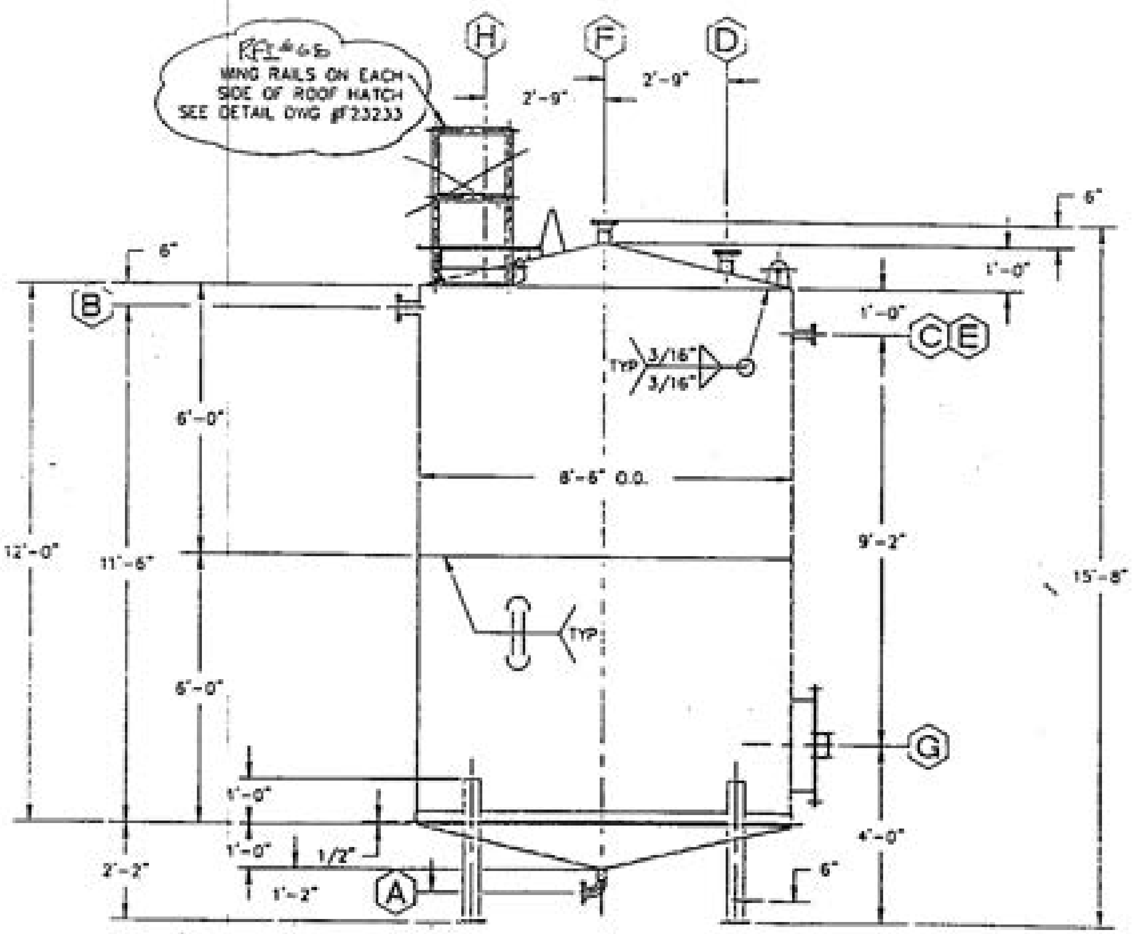
1. ALL DESIGN AND CONSTRUCTION SHALL BE PER API 620 AND CONTRACT SPECIFICATION #13205.
2. ALL WELDING SHALL BE PER ASME SECTION IX.
3. ALL PLATE MATERIAL SHALL BE ASTM A-36.
4. ALL PIPE MATERIAL SHALL BE ASTM 1-53B ERW.
5. ALL F[illegible]E MATERIAL SHALL BE ASTM A-105, CLASS 150, RAIS[illegible]CE WELDING NECK TYPE.
6. ALL PIPE FITTINGS SHALL BE ASTM A-234 WPB.
7. ALL S[illegible] MANHOLE AND ROOF HATCH GASKETS SHALL BE RUBB[illegible]
8. REMO[illegible] ALL SHARP EDGES AND CORNERS THAT MAY BE INJU[illegible] TO PERSONNEL.
9. ALL B[illegible] HOLES SHALL STRADDLE NATURAL VESSEL CENT[illegible]NES.
10. EXTE[illegible] COATING PER CONTRACT SPEC. #09874.
11. INTER[illegible] COATING PER CONTRACT SPEC. #09875.
12. COR[illegible]N ALLOWANCE 1/16”.
13. 1.2 SP[illegible]IFIC GRAVITY.
14. APPL[illegible]F LABEL.



LID STOP DETAIL
SCALE: 1"=6"

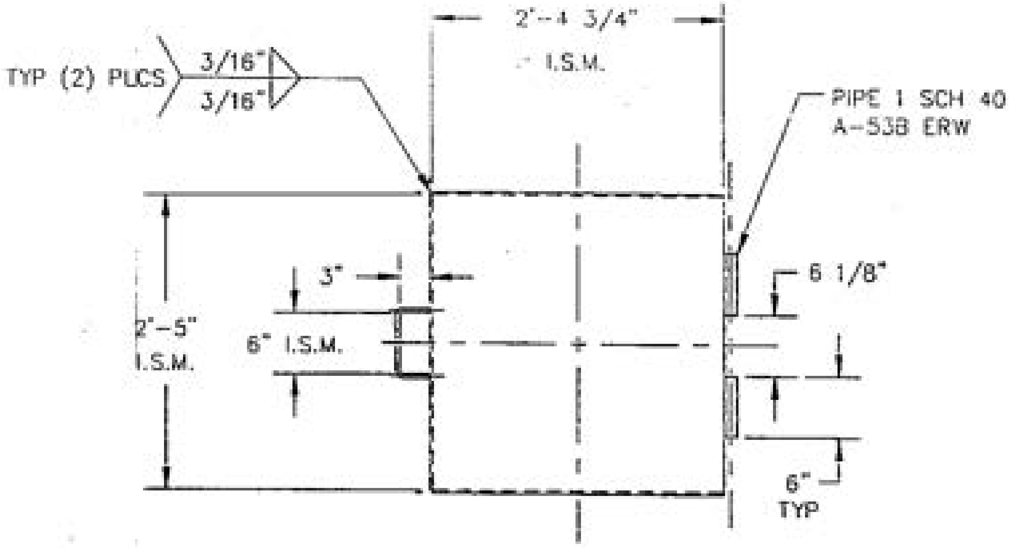


PLAN VIEW



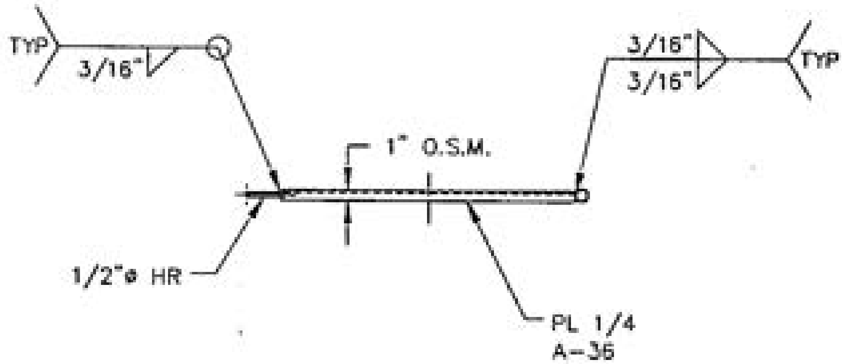
ELEVATION VIEW

SEE PLAN VIEW FOR CORRECT ORIENTATION

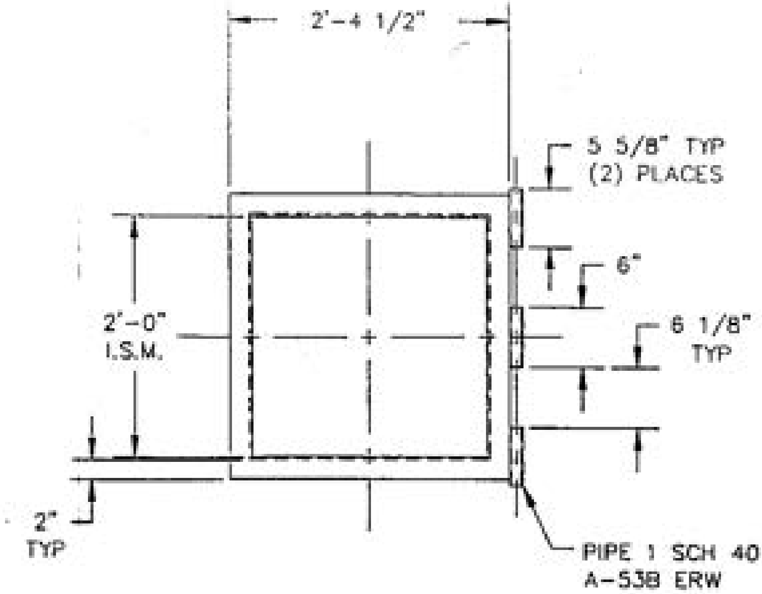


COVER PLAN DETAIL

SCALE: 1/2" = 1'-0"

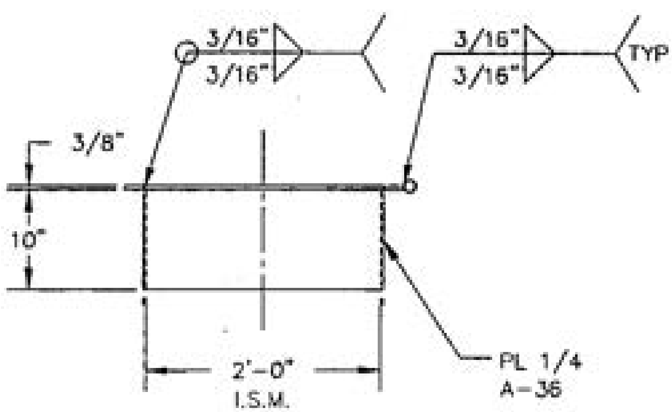


COVER ELEVATION DETAIL

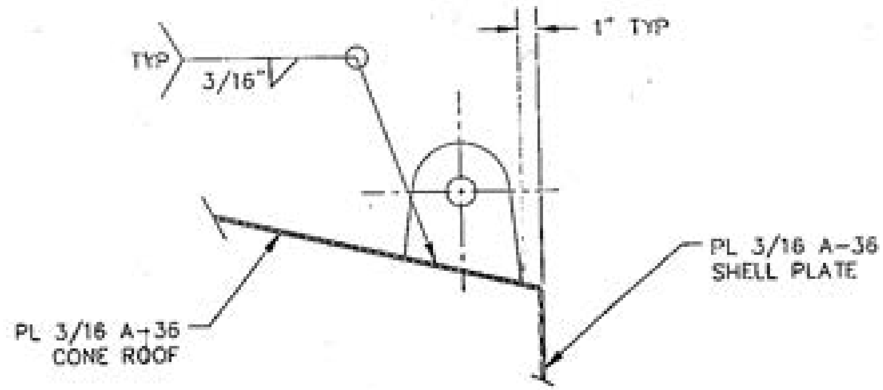


NECK/FLANGE PLAN DETAIL

SCALE: 1/2" = 1'-0"

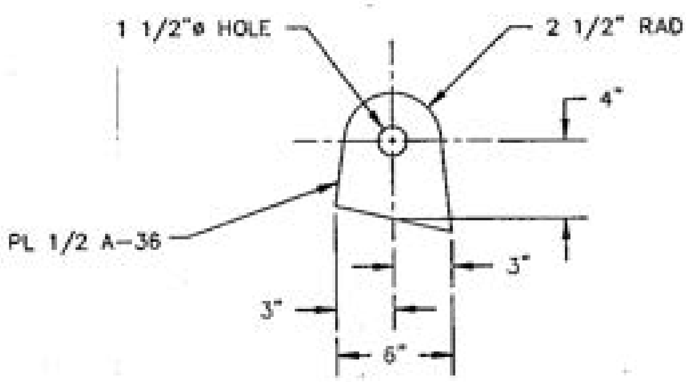


NECK/FLANGE ELEVATION DETAIL



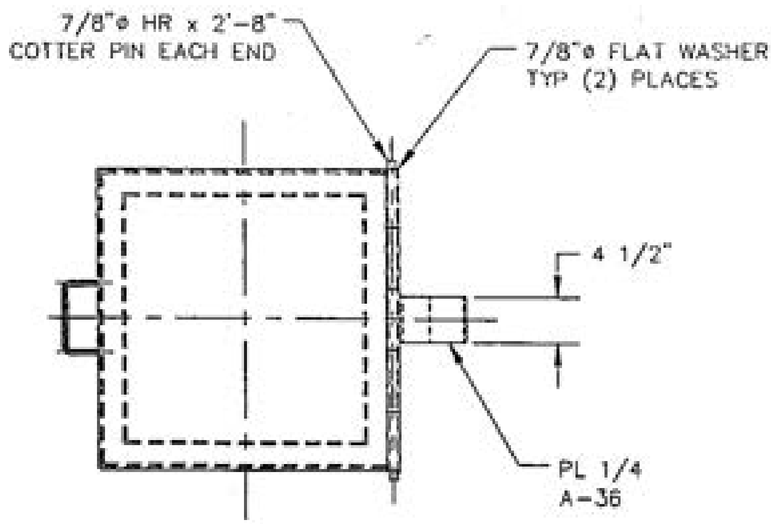
LIFT EYE ATTACHMENT DETAIL

TYP (3) PLCS SCALE: 1"=6"



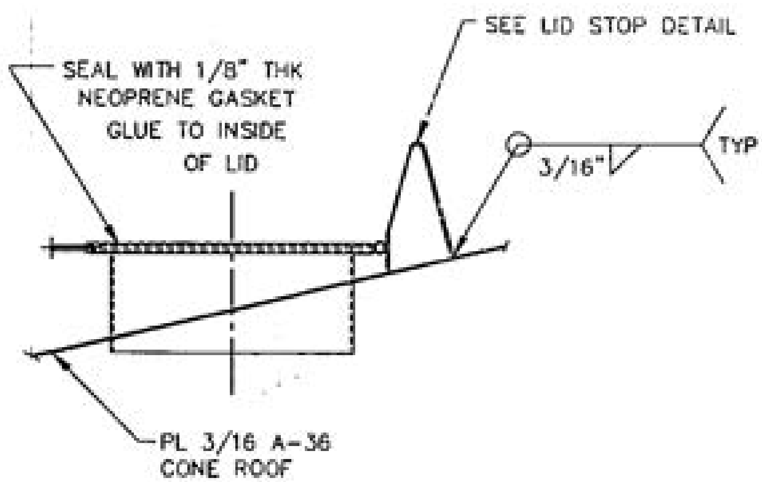
LIFT EYE DETAIL

TYP (3) PLCS SCALE: 1"=6"

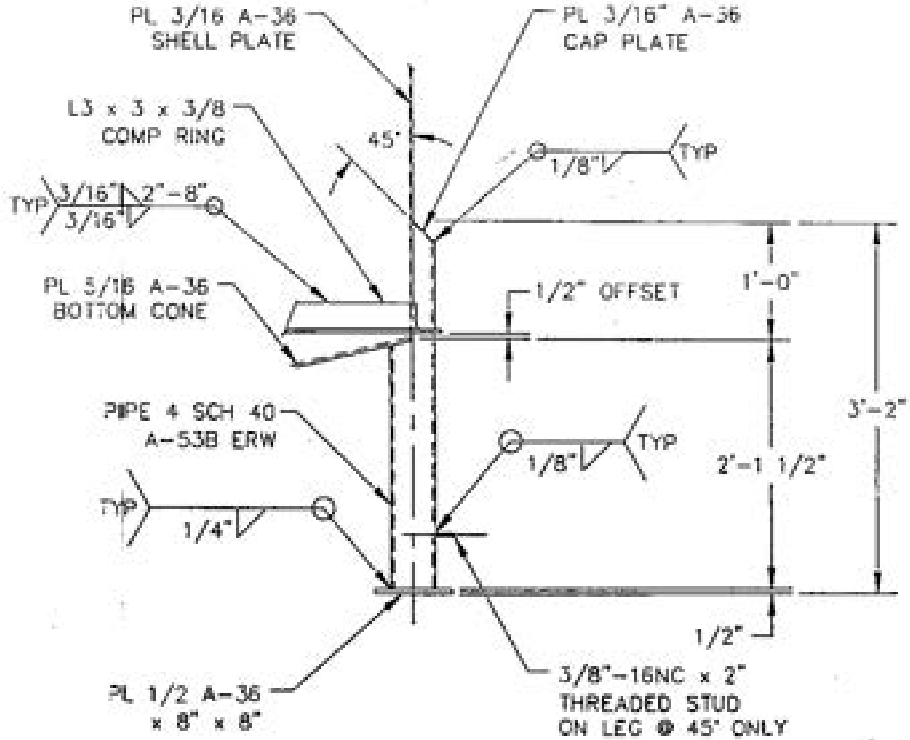


HATCH PLAN DETAIL

SCALE: 1/2" = 1'-0"

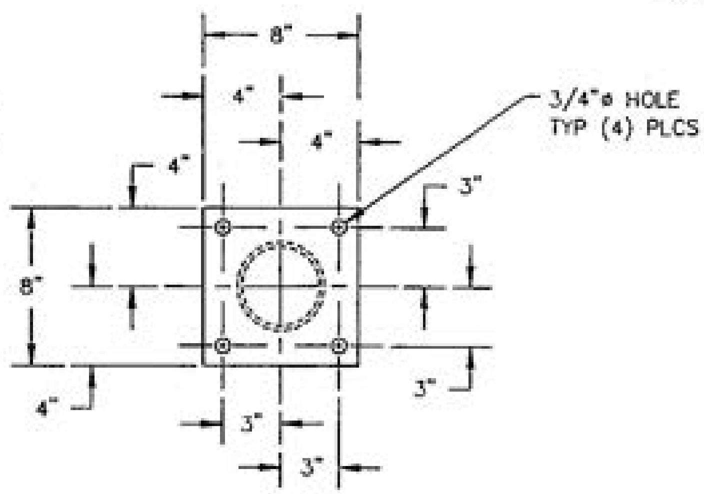


HATCH ELEVATION DETAIL



LEG DETAIL

TYP (4) PLCS SCALE: 1"=1'-0"



FOOT DETAIL

TYP (4) PLCS SCALE: 1"=6"

GENERAL NOTES

1. WORK WITH DRAWINGS #F23231 AND F23232

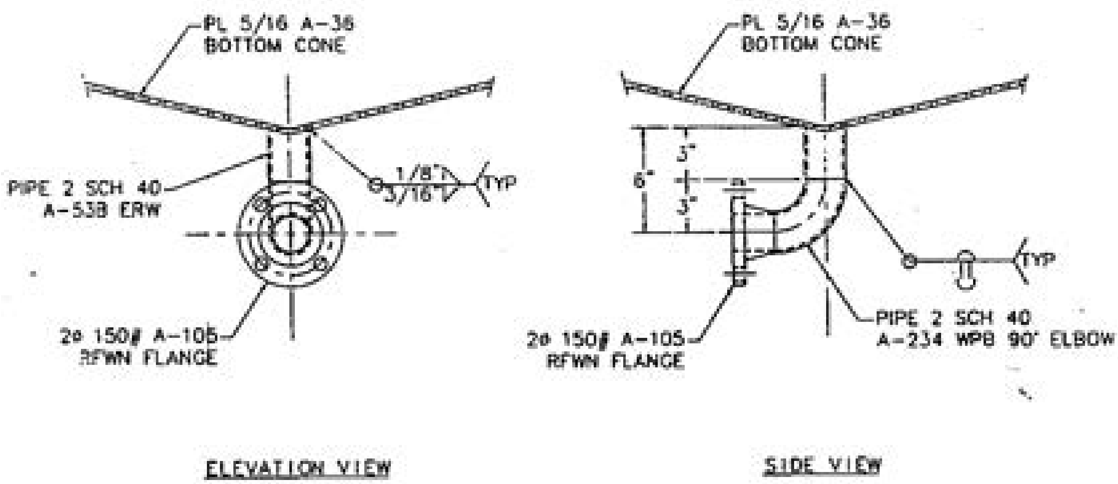
DESCRIPTION	DATE	BY	REV

REVISIONS

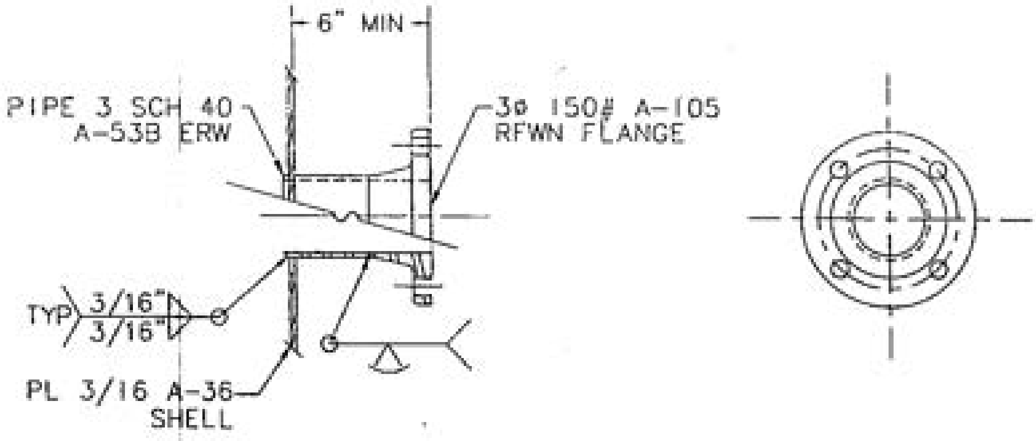
FMF Flohr Metal Fabricators, Inc.
Seattle Washington

(6) HAZARDOUS WASTE TSD TANKS
T-4, T-5 AND 5-22
FOR
BODENHAMMER, INC.
NAVAL UNDERSEA WARFARE CENTER KEYPORT, WA

SCALE 1"=6" & NOTED	DRAWN BY MRT	JOB NO. F2323
DATE 5/18/94	APPROVED	DWG NO. F23233



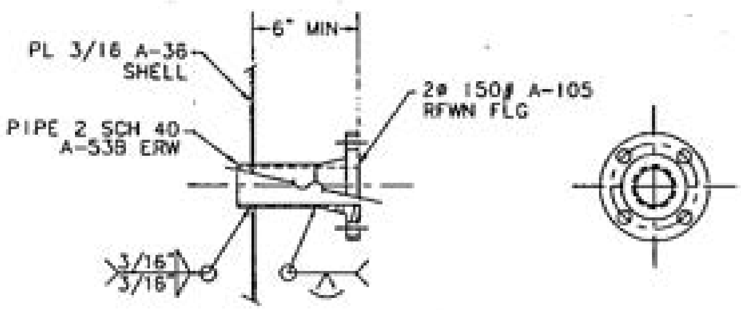
Ⓐ - DRAIN/OUTLET DETAIL



SIDE\SECTION VIEW

END VIEW

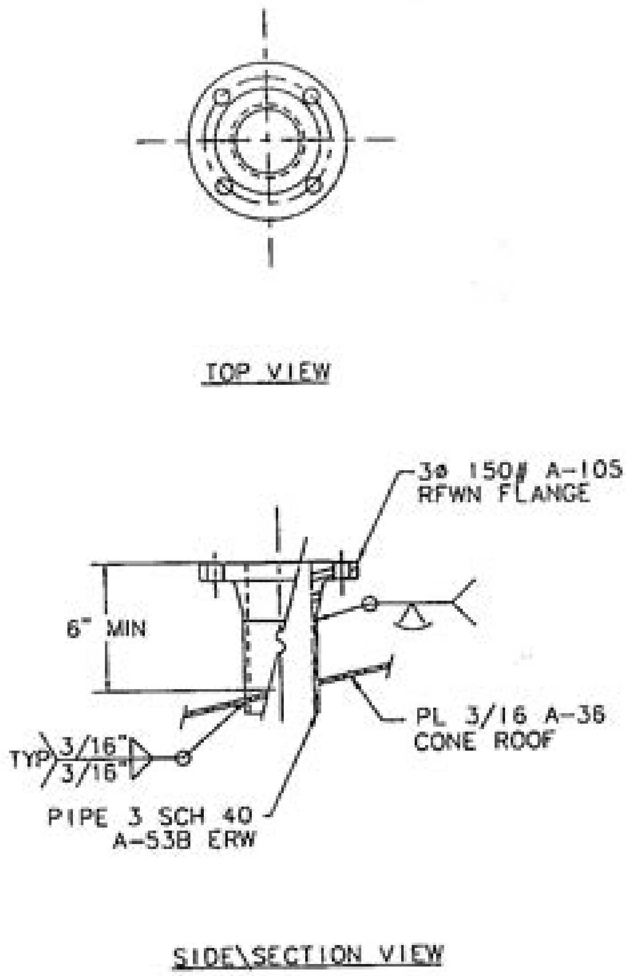
B - OVERFLOW DETAIL



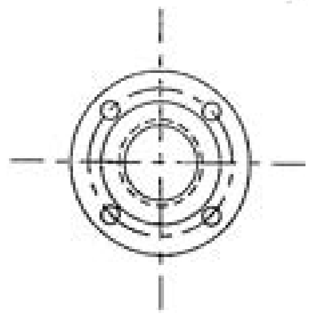
SIDE/SECTION VIEW

END VIEW

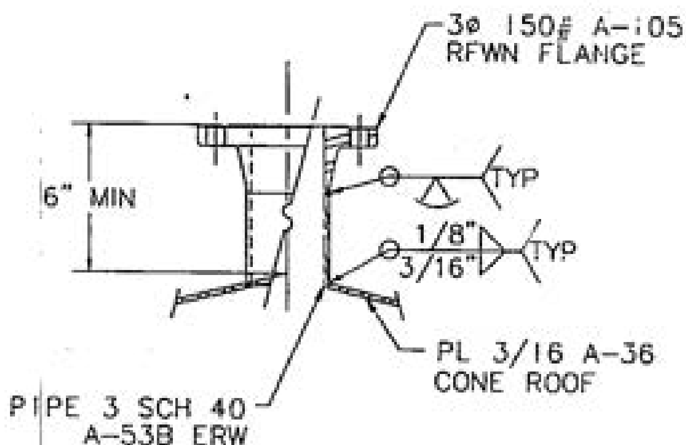
C E - INLET (TRUCK, DRUM OR TOTE) DETAIL



D - LEVEL INSTRUMENT DETAIL



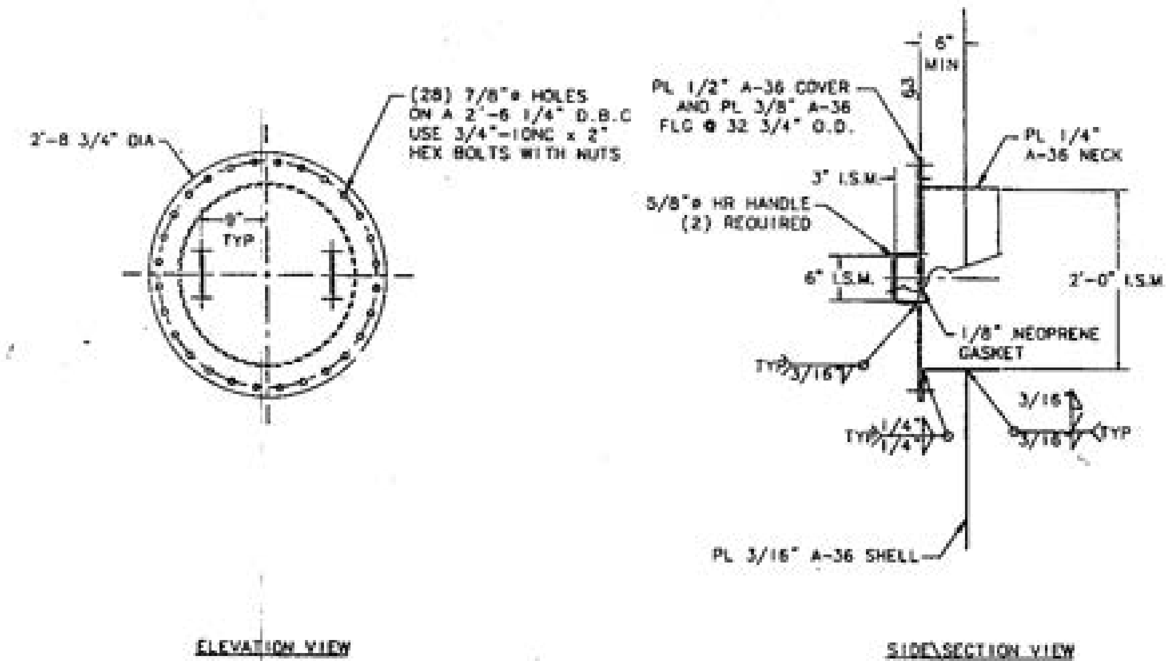
TOP VIEW



SIDE\SECTION VIEW

F - VENT DETAIL

NOTE: MACHINE FLANGE ONLY AFTER FABRICATION



G - 24" SHELL MANHOLE DETAIL

SCALE: 1 1/2" = 1'-0"

SECTION 13205

STEEL TANKS WITH FIXED ROOFS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API PUBL 2009	1988 Safe Welding and Cutting Practices in Refineries, Gas Plants, and Petrochemical Plants
API STD 601	1988 Metallic Gaskets for Raised-Face Pipe Flanges and Flanged Connections (Double-Jacketed Corrugated and Spiral-Wound)
API STD 650	1988 (Addendum 1992) Welded Steel Tanks for Oil Storage
API STD 2000	1992 Venting Atmospheric and Low Pressure Storage Tanks (Non-refrigerated and Refrigerated)
API STD 2550	1965 (Rev. 1992) Measurement and Calibration of Upright Cylindrical Tanks.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.5	1988 (Errata 1988; Addendum B16.5A-1992) Pipe Flanges and Flanged Fittings (ASME/ANSI B16.5)
ASME B16.9	1993 Factory-Made Wrought Steel Butt welding Fittings (ASME/ANSI B16.9)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 182/A 182M	1992 (Rev. A) Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A 193/A 193M	1992 (Rev. A) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service

ASTM A 194/A 194M	1992 (Rev. A) Carbon and Alloy-Steel Nuts for Bolts for High-Pressure and High-Temperature Service
ASTM A 312/A 312M	1991 (Rev. A) Seamless and Welded Austenitic Stainless Steel Pipes
ASTM A 403/A 403M	1991 Wrought Austenitic Stainless Steel Piping Fittings

MILITARY SPECIFICATIONS (MIL)

MIL-A-907	(Rev. E) Antiseize Thread Compound, High Temperature
MIL-G-1086	(Rev. E) Gasket Material, Synthetic Rubber (For Bolted Steel Tanks

1.3 SUBMITTALS

Submit the following in accordance with Section 01300, “Submittals.”

1.3.1 SD-02; Manufacturer’s Catalog Data

a. Structural steel

b. Pipe and fittings

c. Flange bolting

d. Gaskets

e. Tank level gauge

f. Venting

g. Roof manholes

h. Shell access holes

i. Oil-resistant coating system

1.3.2 SD-04, Drawings

a. Steel tank

1.3.2.1 Drawing Requirements

Drawings for the steel tank shall be prepared by a registered structural engineer. Include erection diagrams and detail drawings of tank

1.2.3 SD-05, Design Data

a. Steel tank design calculations

1.2.3.1 Data Requirements

Calculations for the steel tank design shall be prepared by a registered structural engineer.

1.2.4 SD-08, Statements

a. Welding procedures and procedure qualifications

b. Qualifications of non-destructive test examiners

c. Tank calibration experience

1.2.4.1 Test Examiners

Submit proof of compliance of non-destructive test examiners with API STD 650. Submit certified data on tank calibration experience.

1.2.5 SD-10, Test Reports

a. Structural steel tests (including toughness test data)

1.2.6 SD-18, Records

a. Tank calibration record

b. Weld inspection reports

Submit reports for inspection of welds, and radiographs, to the Contracting Officer.

1.2.7 SD-19, Operation and Maintenance Manuals

a. Venting, Data Package 2

Submit data package in accordance with Section 01730, “Operation and Maintenance Data.”

1.3 COPIES OF API PUBLICATIONS

Provide four copies of API PUBL 2009, API STD 650, API STD 2000, and API STD 2550.

1.4 RELATED REQUIREMENTS

Materials, design, fabrication, welding, erection, testing, and appurtenances shall be in accordance with API STD 650 and API STD 2000, except as otherwise specified herein. Section 15011, “Mechanical General Requirements,” applies to this section except as specified otherwise.

1.6 DESIGN REQUIREMENTS

Tank shall be designed to resist the following loads and forces:

a. Wind: 5 knots (Otto Fuel Tanks Only T50, 51, 53, 53)

b. Seismic Zone: 3

c. The following combinations of loads, with corresponding percentages of basic stresses to be used in design, shall be allowed:

Load Combination	Percentage of Allowable Stress
Dead load + live load	100
Dead load + live load + wind load	133
Dead load + live load + seismic load	133

e. Determine forces from seismic loading in accordance with API STD 650.

f. The usable capacity of the tank shall be not less than 5,000 U.S. standard gallons. The tank shall be not more than nine feet in diameter, and shall be approximately 15 feet in height.

1.6.1 Corrosion Allowance

Make allowance of 1/16 inch in thickness of steel for corrosion loss. Corrosion allowance shall be applied to the interior of the shell, roof, and to surfaces of interior structural members.

1.6.2 Design Metal Temperature

API STD 650 60° F, API STD 650 20° F. (Otto Fuel Tanks Only.)

1.7 TANK CALIBRATION EXPERIENCE

Perform calibration of the tank using a qualified organization that can certify to at least two years of prior successful and accurate experience in calibrating tanks of comparable type and size.

PART 2 PRODUCTS

2.1 MATERIALS

Conform to the following requirements except that materials not definitely specified shall conform to API STD 650.

2.3.1 Inlet and Outlet Piping

Stainless Steel for Inlet and Outlet.

2.3.1.1 Pipe

ASTM A 312/A 312M, Schedule 40, Type 304L or 316L.

2.3.1.2 Fittings

a. Butt welding: ASTM A 403/A 403M, Class WP, Schedule 40, Type 304L or 316L.

2.3.1.3 Flanges

ASME B16.5 Class 150, ASTM A 182/A 182M, Type 304L or 316L.

2.3.1.4 Flange Bolting

Bolts: ASTM A 193/A 193M, Grade B7; nuts: ASTM A 194/A 194M, Grade 7.

2.4 PIPE FLANGE GASKETS

API STD 601, spiral-wound type

2.5 GASKETS FOR MANHOLES, CLEANOUTS, CONNECTIONS, AND COVERS

Provide rubber gaskets, MIL-R-6855, for covers which are not bolted.

2.6 INTERIOR PROTECTIVE COATING SYSTEM

Section 09875, “Interior Coating System for Welded Steel Petroleum Storage Tanks.”

2.7 EXTERIOR PROTECTIVE COATING SYSTEM

Section 09874, “Exterior Coating System for Welded Steel Petroleum Storage Tanks.”

2.8 APPURTENANCES

2.8.1 Tank Level Gauge

Tank level gauge shall be provided as specified under Section 16402, “Interior Wiring Systems.”

2.8.2 Venting

Provide open vent at the center or as indicated with galvanized steel bird screen with ¼ inch (6.3 mm) opening and a 0.135 inch (3.43 mm) minimum wire diameter.

2.8.3 Roof Manholes

Provide one 24 inch (610 mm) minimum square manholes for access to the interior of the tank through the roof. Locate one manhole adjacent to the platform of the stairway on one end of a diameter of the tank. Provide other manholes as indicated. Provide hinged and weathertight manhole covers with a formed fit.

2.8.4 Shell Access Holes

Provide one 30-inch (762-mm) diameter access holes. Locate the access hole in the tank shell as indicated and at a height convenient for personnel access into the tank. Provide access holes with welded steel plate frames and covers. Secure the cover plates with corrosion-resistant bolts and nuts. Provide access holes with gaskets and smooth gasket seats.

2.8.5 Fittings and Piping

provide fittings and piping and other miscellaneous items as necessary to permit tank operations.

2.8.5.1 Product Inlet Connections

Product inlet connections shall consists of an external flange, a nozzle through the tank shell, supports, and an internal expanding cone, as indicated. The flange shall be 150-pound, conforming to ASME B16.5 with slip-on or welded neck.

2.8.5.2 Product Outlet Connection

Product outlet connection shall consist of an external flange, a nozzle located to bottom of tank, elbows, product withdrawal line assembly, and supports, as indicated.

3.2.1.1 Prohibition of Protective Coatings on Surfaces to be Welded

Remove protective coatings on surfaces to be welded and on surfaces not less than one inch from weld preparation. “Weld-through” inorganic zinc coatings and similar coatings will not be permitted.

3.2.2 Nozzles

Nozzles less than two inches in size shall be flanged. Sizes two inches in size or larger shall be flanged and shall have reinforcing plate. Nozzles for pipe connections inside the tank shall be flanged inside and outside of tank. Reinforcing plates for shell nozzles shall be rolled to the curvature o the shell.

3.3 INSTALLATION

3.3.1 Tanks

Install tanks on concrete base, with anchor bolts, set, and level, and grout in place in accordance with Section 03300, "Cast-in-Place Concrete."

3.3.2 Equipment Foundations

Locate equipment foundations as shown on the drawings. Size, weight, and design shall preclude shifting of equipment under operating conditions. Foundations shall meet the requirements of the equipment manufacturer. Concrete shall conform to Section 03300, "Cast-in-Place Concrete," and grout shall be approved non-shrinking.

3.3.3 Equipment Installation

Install equipment in accordance with installation instructions of the manufacturers. Grout equipment mounted on concrete foundations before installing piping. Install piping in such a manner so as not to place a strain on the equipment. Do not bolt flanged joints tight unless they match. Grade, anchor, guide, and support piping without low pockets.

3.3.4 Grounding

Connect building grounding to tank grounding log in accordance with Section 16402, "Interior Wiring Systems."

3.4 FIELD QUALITY CONTROL

The Contracting Officer will conduct field inspections and witness field tests and trial operations specified in this section. The Contractor shall perform all trial operations and field tests and provide all labor, equipment, and incidentals required for testing.

3.4.1 Weld Inspection

Perform inspection of welds in accordance with API STD 650. Inspect butt welds requiring complete penetration and complete fusion by the radiographic method.

3.4.2 Tightness Test and Welding Repairs

Perform tightness test and repairs in accordance with API STD 650, except as modified herein, prior to blast cleaning and application of the protective coating.

3.4.2.1 Test of Tank Bottom

Test tank bottom immediately after completion and prior to installing any columns. Test seams in bottom of tank by applying a commercial soap film and subjecting the seam to a vacuum. Use a glass top vacuum box with hypalon or neoprene sealing gasket. Apply a commercial bubble forming solution to the weld or area to be tested; position the vacuum box over the solution the area and slowly pull a partial vacuum. Observe the solution film for bubble formation between 0-2 psi differential pressure. Continue to open the valve until a differential pressure of 5 psi (34.5 kPa) or 11.5 feet (3.61-m) of water or 10.2-inches (259 mm) of mercury is achieved and hold for at least 20 seconds while continuing to observe the solution for bubbles.

3.4.4 Re-testing

Deficiencies found shall be rectified and work effected by such deficiencies shall be completely re-tested at the Contractor's expense.

3.4.5 Tank Level Gauge

Test the tank level gauge system in accordance with the manufacturer's testing procedure.

SECTION 15400

PLUMBING SYSTEMS

PART 1 GENERAL

1.1 GENERAL

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A112.19.5	1979 (Rev. 1990) Trim for Water-Closet Bowls, Tanks and Urinals
ANSI A112.36.2M	1991 Cleanouts
ANSI B16.18	1984 Cast Copper Alloy Solder Joint Pressure Fittings
ANSI B16.23	1992 Cast Copper Alloy Solder Joint Drainage Fittings – DWV
ANSI B16.24	1991 (Errata 1991) Cast Copper Alloy Pipe Flanges and Flanged Fittings Class 150, 300, 400, 600, 900, 1500, and 2500
ANSI Z21.22	1986 (Addenda 1990) Relief Valves and Automatic Gas Shutoff Devices for Hot Water Supply Systems
ANSI Z358.1	1990 Emergency Eyewash and Shower Equipment

AMERICAN PETROLEUM INSTITUTE

API STD 601	1988 Metallic Gaskets for Raised-Face Pipe Flanges and Flanged Connections (Double-Jacketed Corrugated and Spiral-Wound)

AIR-CONDITIONING AND REFRIGERATION INSTITUTE (ARI)

ARI 1010	1984 Drinking-Fountains and Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME A112.6.1M	1979 Supports for the Off-the-Floor Plumbing Fixtures for Public Use
ASME A112.18.1M	1989 Plumbing Fixture Fittings
ASME/ANSI A112.19.1M	1987 Enameled Cast Iron Plumbing Fixtures
ASME/ANSI A112.19.2M	1990 Vitreous China Plumbing Fixtures
ASME/ANSI A112.19.3M	1987 Stainless Steel Plumbing Fixtures (Designed for Residential Use)
ASME A112.21.1M	1991 Floor Drains
ASME/ANSI B16.1	1989 Cast Iron Pipe Flanges and Flanged Fittings
ASME/ANSI B16.5	1988 (Errata 1988) Pipe Flanges and Flanged Fittings (ASME/ANSI B16.9)
ASME/ANSI B16.22	1989 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
ASME/ANSI B16.26	1988 Cast Copper Alloy Fittings for Flared Copper Tubes
ANSI/ASME B16.29	1986 Wrought Copper and Wrought Copper Alloy Solder Joint Draining Fittings – DWV
ANSI/ASME B16.32	1984 Cast Copper Alloy Solder Joint Fittings for Solvent Drainage Systems.

AMERICAN SOCIETY OF SANITARY ENGINEERING (ASSE)

ASSE 1003	1981 Water Pressure Reducing Valves for Domestic Water Supply Systems
ASSE 1019	1978 Wall Hydrants, Frost Proof Automatic Draining, Anti-Backflow Types

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 47	1990 Ferritic Malleable Iron Castings
ASTM A 53	1990 (Rev. B) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 74	1987 Cast Iron Soil Pipe and Fittings
ASTM A 182/A 182M	1998 (Rev. A) Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service
ASTM A 183	1983 (Rev. 1990) Carbon Steel Track Bolts and Nuts
ASTM A 193/A 193M	1990 (Rev. A) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 240	1992 (Rev. B) Heat Resisting Chromium and Chromium Nickel, Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
ASTM A 312/A 312M	1992 (Rev. A) Seamless Copper and Welded Austentic Stainless Steel Pipes
ASTM A 403/A 403M	1991 Wrought Austenitic Stainless Steel Piping Fittings
ASTM A 536	1984 Ductile Iron Castings
ASTM B 32	1992 Solder Metal
ASTM B 42	1992 (Rev. A) Seamless Copper Pipe, Standard Sizes
ASTM B 88	1992 Seamless Copper Water Tube
ASTM B 306	1992 Copper Drainage Tube (DWV)
ASTM C 564	1988 Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM D 2000	1990 Rubber Products in Automotive Applications
ASTM D 2665	1991 (Rev. B) Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM F 441	1989 Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104/A21.4	1990 Cement-Mortar Lining for Ductile-Iron Pipe for Water
AWWA C105/A21.5	1988 Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids
AWWA C111/A21.11	1990 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115/A21.15	1988 Flanged Ductile-Iron Pipe with Threaded Flanges
ANSI/AWWA C151/A21.51	1991 Ductile-Iron Pipe, Centrifually Cast, for Water or Other Liquids
AWWA C651	1986 (Addendum 1990) Disinfecting Water Mains

CAST IRON SOIL PIPE INSTITUTE (CISPI)

CISPI HSN	1985 Neoprene Rubber Gaskets for Hub and Spigot Cast Iron Soil Pipe and Fittings
CISPI 301	1990 Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications
CISPI 310	1990 Couplings for Use in Connection with Hubless Cast Iron Soil Pipe and Fitting

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR-USC	1992 List of Approved Backflow Prevention Assemblies

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)

IAPMO UPC	1991 Uniform Plumbing Code

MILITARY SPECIFICATIONS (MIL)

MIL-C-27487	(Rev. G) Coupling Halves, Quick-Disconnect, Cam-Locking Type
MIL-G-1086	(Rev. E) Gasket Material, Synthetic Rubber (For Bolted Steel Tanks)
MSS SP-69	1991 Pipe Hangers and Supports – Selection and Application
MSS SP-80	1987 Bronze Gate, Globe, Angle and Check Valves

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211	1992 Chimneys, Fireplaces, Vents, and Solid Fuel Burning Applications

UNDERWRITERS LABORATORIES INC. (UL)

UL 430	1986 Waste Disposers

1.2 RELATED REQUIREMENTS

Selection 15011, “Mechanical General Requirements,” applies to this section with the additions and modifications specified herein.

1.3 SYSTEM DESCRIPTION

Provide new plumbing systems, complete and ready for operation. Plumbing systems including manufacturer’s products shall be in accordance with the required and advisory provisions of IAPMO UPC. Plumbing systems include piping less than 5 feet outside of building walls and piping beyond 5 feet outside of building walls including connections to existing exterior distribution system.

1.4 SUBMITTALS

Submit the following in accordance with Section 01300, “Submittals.”

a. Pipe and fittings

b. Valves

c. Plumbing fixtures

d. Water heaters

e. Pipe hangers and supports

f. Pressure gages

g. Water meters

h. Strainers

i. Drains

k. electric water coolers

l. Thermometers

For pumps, include certified pup test curves.

1.4.2 SD-19, Operation and Maintenance Manuals

a. Water heaters, Data Package 2

b. Electric water coolers, Data Package 2

Submit operation and maintenance data in accordance with Section 01730, “Operation and Maintenance Data.”

1.5 QUALITY ASSURANCE

Plumbing systems including fixtures, equipment, materials, installation, and workmanship shall be in accordance with the Plumbing Code except as modified herein. In the Plumbing Code referred to herein, the advisory provisions shall be considered to be mandatory, as though the word “shall” had been substituted for the word “should” wherever it appears; reference to the “authority having jurisdiction,” the Administrative Authority, the Plumbing Official, and the Design Engineer shall be interpreted to mean the Contracting Officer. Capacity of equipment shall be not less than that indicated.

PART 2 PRODUCTS

2.1 DRAIN, WASTE, AND VENT (DWV) PIPE AND FITTINGS

Fittings shall be long radius fittings, except fittings in vent piping may be short radius fittings. Minimum size piping shall be 2 inches for buried piping and 1.5 inches for aboveground piping.

2.1.1 Buried Piping

Provide piping up to but not more than six inches aboveground or floor slab on grade.

2.1.1.1 Cast-Iron Hubless Pipe and Fittings

CISPI 301 with CISPI 310 couplings.

2.1.1.2 Cast-Iron Hub and Spigot Pipe and Fittings

ASTM A 74 with ASTM C 564 or CISPI HSN rubber compression gasket joints.

2.1.1.3 Plastic Pipe, Fittings, and Solvent Cement

a. Polyvinyl Chloride (PVC) System: ASTM D 2665

2.1.2 Aboveground Piping

2.1.2.1 Cast-Iron Hubless Pipe and Fittings

CISPI 301 with CISPI 310 couplings.

2.1.2.2 Cast-Iron Hub and Spigot Pipe and Fittings

ASTM A 74 with ASTM C 564 or CISPI HSN rubber compression gasket joints.

2.1.2.3 Plastic Pipe, Fittings, and solvent Cement

a. Polyvinyl Chloride (PVC) System: ASTM D 2665

2.1.2.4 Copper Tubing

ASTM B 306, with ANSI B16.23, ANSI/ASME B16.29, or ANSI/ASME B16.32 solder joint fittings using ASTM B 32, alloy Grade Sb5 or alloy Grade Sn96 solder, and flux containing not more than 0.2 percent lead.

2.1.2.5 Grooved-End Steel Piping for Roof Drainage Only

ASTM A 53, Schedule 40, hot-dip galvanized, cut grooved-end steel pipe; ASTM A 47 or ASTM A 536, hot-dip galvanized, grooved-end fittings, and mechanical couplings; ASTM A 183 coupling nuts and bolts; ASTM D 2000 rubber gaskets or water service. Fittings, mechanical couplings, and rubber gaskets shall be supplied by the same manufacturer.

2.1.2.6 Stainless Steel Pipe and Fittings for Process Piping

a. Pipe: ASTM A 312/A 312M, Schedule 40, Type 304L or 316L.

b. Welding: Butt fittings shall conform to ASME B16.9.

c. Fittings: Butt welding per ASTM A 403/A 403M, Class WP Schedule 40, Type 304L or 316L.

Threaded per ASME/ANSI B16.1, Class 3000 lb., ASTM A 182/A 182M, Type 304L or 316L, forged.

d. Flanges: ASME/ANSI B16.5, Class 150, ASTM A 182/A 182M, Type 304L or 316L.

e. Flange Bolts: ASTM A 193/A 193M, Grade B7.

f. Flange Nuts: ASTM A 193/A 193M, Grade 7.

g. Flange Gasket: API STD 601, spiral-wound type.

h. Hose Connections: MIL-C-27487, threaded end.

i. Ball Valves: ASTM A 182/A 182M, Type 304L or 316L, Flanged end, 150#.

j. Check Valves: ASTM A 182/A 182M, Type 304L or 316L, Flanged end, 150#.

2.1.3 Cleanouts

ANSI A112.36.2M; provide threaded bronze or thermoplastic or PVC plastic cleanout plugs.

2.1.3.1 Floor Cleanouts

Provide cast-iron or ductile-iron floor cleanout with anchor flange, adjustable height polished bronze, nickel bronze, stainless steel, or chromium-plated copper alloy rim an scoriated floor plate with “CO” cast in the plate, and countersunk screws for installing floor plate flush with finished floor.

2.1.3.2 Wall Cleanouts

Provide polished stainless steel or chromium-plated copper alloy cover plate and secure to cleanout plug with countersunk stainless steel screw.

2.1.3.3. Cleanouts Exterior to Buildings

Provide cast-iron or polyvinyl chloride (PVC) cleanouts and countersunk plugs. Provide cast-iron cleanout box with cover.

2.1.4 Drains

ASME A112.21.1M; provide cast-iron or ductile-iron drains and clamping rings for use with membrane waterproofing. Provide P-traps for each floor drain.

2.1.4.1 Flush Strainer Floor Drains

Provide with double drainage flange, perforated or slotted cast bronze or nickel bronze, polished stainless steel, or chromium-plated copper alloy strainer, and adjustable collar. Drains of sizes 2, 3, and 4 inches shall have strainers with minimum free drainage area of 5, 11, and 18 square inches, respectively.

2.1.4.2 Shower Floor Drains

Provide as specified for flush strainer floor drains, except that finish shall be polished stainless steel or chromium-plated copper alloy where fire separation requirements are not violated.

2.1.4.3 Extended Rim Floor Drains

Provide as specified for flush strainer floor drains, except strainer body shall have one-inch extended rim installed flush with finished floor.

2.1.4.4 Floor Sinks (Drains)

Provide cast-iron body with white acid-resisting porcelain enameled or epoxy interior, double drainage flange, nickel bronze rim and slotted grate, removable stainless steel or aluminum slotted buckets, and P-trap.

2.1.5 Overview Piping (Containment Drainage)

2.1.5.1 Ductile Iron Piping (DIP)

a. Pipe and Fittings: Ductile-iron pipe shall conform to AWWA C104/A21.4, AWWA C105/A21.5, and ANSI/AWWA C151/A21.51 and shall be Thickness Class 50 minimum. Fittings shall have pressure rating at least equivalent to that of the pipe. Ends of pipe and fitting shall be suitable for the joints specified in the following paragraph.

b. Joints, General: Joints for pipe and fittings shall be flanged. Push-on or mechanical joints conforming to AWWA O111/A2.11 for below grade ductile-iron pipe for overflow containment. (RFI-1)

2.1.5.2 Poly Vinyl Chloride (PVC) Plastic Piping

a. Pipe and Fittings: ASTM D 2655; provide PVC pipe and fittings, Schedule 40, with solvent welded end joints.

b. End Connections, General: Pipe sections are belled on one end for solvent welding. Flanged ends may be used for connections to outlet valves.

2.1.5.3 Flag Valve

ASTM A 240, Type 304 Stainless Steel fabrication, with clamping band as indicated on drawings.

2.2 DOMESTIC WATER PIPING

2.2.1 Buried Piping and Aboveground Piping

2.2.1.1 Copper Tubing

ASTM B 88, Type L for aboveground piping, Type K for buried piping, with ANSI B16.18 or ASME/ANSI B16.22 solder joint fittings; or with ASME/ANSI B16.26 flared joint fittings. Provide ASTM B 42 copper pipe nipples with threaded end connections. Provide ASTM B 32, alloy Grade Sb5 or alloy Grade Sn96 lead-free solder (less than 0.2% lead). Provide copper tubing for pipe sizes four inches or smaller.

2.2.1.2 Cast Ductile-Iron Piping

Sizes larger than four inches, outside coated, AWWA C104/A21.4 cement mortar lined, ANSI/AWWA C151/A21.51 ductile-iron pipe, AWWA C111/A21.11 rubber gasket joints, and AWWA C110/A21.10 fittings. Provide concrete thrust blocks at the elbow where the buried piping turns up toward the floor, and restrain the pipe riser with steel rods from the elbow to the flange above the floor. Aboveground piping shall have flanged end connections conforming to AWWA C115/A21.15 for flanged pipe and AWWA C110/A21.10 for flanged fittings.

2.2.2 Water Valves

Provide valves suitable for minimum of 125 psig and minimum of 180° F hot water. Valves shall have threaded end connections with a union on all but one side of the valve, or solder end connections for connections between bronze valves and copper tubing. Ball valves may be provided in lieu of gate valves. Provide blue finish and red finish on handwheels for valves in cold domestic water piping and hot domestic water piping, respectively.

2.2.2.1 Gate Valves

MSS SP-80, Class 125.

2.2.2.2. Globe and Angel Valves

MSS SP-80, Class 125.

2.2.2.3 Check Valves

MSS SP-80, Class 125, swing check.

2.2.2.4 Ball Valves

Full port design, copper alloy. Valves shall have two-position lever handles.

2.2.2.5 Hose Bibbs

Provide angle type copper alloy hose bibb with lockshield and removable handwheel or tee-handle. Inlet shall have internal threads. Outlet shall have vacuum breaker with 0.75 inch external hose threads.

2.2.2.6 Non-freeze Wall Hydrant

ASSE 1019, cast bronze, with lockshield and removable handwheel or tee-handle, one-inch external thread inlet, 0.75-inch external hose thread outlet with automatic draining vacuum breaker. Hydrant shall be of sufficient length to extend through walls and place the valve seat inside the building or in the crawl space. Bonnet and valve stem shall be removable from outside of the building.

2.2.2.7 Combination Pressure and Temperature Relief Valves

ANSI Z21.22 copper alloy body, automatic reseating, test lever, and discharge capacity based on AGA temperature steam rating.

2.2.2.8 Pressure Relief Valves

ANSI Z21.22 copper alloy body, automatic reseating with test lever.

2.2.2.9 Water Temperature Mixing Valves

Provide Copper alloy or cast-iron body valve of the pressure equalizing type. Valve shall be of the adjustable thermostatic type and shall mix the hot water and cold water to deliver hot water at a set temperature.

2.2.2.10 Water Pressure Reducing Valves

ASSE 1003, bronze body, threaded end, with separate, attached strainer. Set point range from 0 psig to 100 psig.

2.2.3 Strainers

Strainers shall have blow off outlet with pipe nipple and gate valve and discharge pipe nipple. Copper alloy or cast-iron body. Provide stainless steel strainer element with perforations of 0.047 inch.

2.2.4 Pressure Gates

Provide single style pressure gage for water with 4.5 inch dial, brass or aluminum case, bronze tube, gate cock, pressure snubber, and siphon. Provide scale range suitable for the intended service.

2.2.5 Thermometers

Provide bi-metal dial type thermometers with stainless steel case, stem, and fixed thread connection; 5-inch diameter dial with glass face gasketed within the case; accuracy within 2 percent of scale range. Provide scale range suitable for the intended service.

2.2.6 Dielectric Connections

Provide at connections between copper and ferrous metal piping materials. ASTM F 441, Schedule 80, CPVC threaded pipe nipples, four inch minimum length, may e provided for dielectric connections in pipe sizes two inches and smaller.

2.2.7 Backflow Preventers (RPBFP)

Reduced pressure principle type. Furnish proof that each make, model/design, and size of backflow preventer being furnished for the project is approved by and has a current "Certificate of Approval" from the FCCCHR-USC. Listing of the particular make, model/design, and size in the current FCCCHR-USC will be acceptable as the required proof.

2.3 MISCELLANEOUS PIPING MATERIALS

2.3.1 Flanges

ASME/ANSI B16.1, Class 125, for use in ferrous piping; SAME/ANSI B16.22 or ANSI B16.24 or use in copper tubing; with MIL-R-2855 full face flat type synthetic rubber gaskets.

2.3.2 Escutcheon Plates

Provide one piece or split hinge metal plates for piping entering floors, walls, and ceilings in exposed spaces. Provide chromium-plated or polished stainless steel finish on copper alloy plates in finished spaces. Provide paint finish on metal in unfinished spaces.

2.3.3 Pipe Sleeves

2.3.3.1 Sleeves in Masonry and Concrete Walls, Floors, Roofs

ASTM A 53, Schedule 40 or Standard Weight, hot-dip galvanized steel, pipe sleeves.

2.3.3.2 Sleeves in Non-Masonry or –Concrete Walls, Floors, and Roofs

Provide 26 gage hot-dip galvanized steel sheet.

2.3.4 Pipe Sleeves

Provide where piping passes entirely through walls, ceilings, roofs, and floors. Secure sleeves in position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, ceilings, roofs, and floors. Provide one-inch minimum clearance between exterior of piping or pipe insulation, and interior of sleeve or core-drilled hole. Firmly pack space with mineral wool insulation. Seal space at both ends of sleeve or core-drilled hole with plastic waterproof cement which will dry to a firm but pliable mass, or provide a mechanically adjustable segmented elastomeric seal. In fire walls and fire floors, seal both ends of sleeves or core-drilled holes with UL listed fill, void, or cavity material.

a. Sleeves in masonry and concrete walls, floors, and roofs: Provide steel pipe sleeves. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.

b. Sleeves in other than masonry and concrete walls, floors, and roofs: Provide 26 gage galvanized steel sheet.

2.3.5 Pipe Hangers and Supports

Provide MSS SP-58 and MSS SP-60, Type 1 with adjustable type steel support rods, except as specified or indicated otherwise. Attach to steel joints with Type 19 or 23 clamps and retaining straps. Attach to Steel W or S beams with Type 22, 28, 29, or 30 clamps. Attach to steel angles with vertical web steel channels with Type 20 clamp with beam clamp channel adapter. Attach to horizontal web steel channel and wood with drilled hole on centerline and double nut and washer. Attach to concrete with Type 18 insert or drilled expansion anchor. Provide Type 40 insulation protection shield for insulated piping.

2.3.6 Access Doors

Provide 12- by 12-inch factory prefabricated and primed flush face steel access doors including steel door frame with continuous hinges and turn-screw-operated latch. Door frame shall be for installation in plaster and masonry walls. Furnish doors under this section to provide proper access to concealed valves; install doors under the appropriate section of this specification.

2.3.7 Washing Machine Connector Box

Provide recessed wall box fabricated of aluminum, PVC plastic stainless steel, or hot-dip galvanized steel. Provide hot-dip galvanized steel with epoxy or baked-on enamel finish. Provide drain nipple and locknut with cover nut for locking drain outlet to box. Provide bras pipe fittings for connecting each supply pipe to valve and locking to box. Provide hot water and cold water supply valves similar to hose bibbs, except valve inlet connections shall be of the compression type or union type.

2.4 FIXTURES, FITTINGS, ACCESSORIES, AND SUPPLIES

Provide control-stop valves in each supply to each fixture. The finish of fittings, accessories, and supplies exposed to view shall be chromium-plated per ASME A112.18.1M. Centerset faucets shall be top-mounted with inlets on not greater than four-inch centers. Provide special roughing-in for wheelchair fixtures.

2.4.1 Tank Type Water Closets (P-1)

ASME A112.19.2M, close-coupled, white vitreous china, water conservation type, floor-mounted, floor or wall outlet as indicated, siphon jet, elongated bowl, black solid plastic elongated open-front seat with cover, and ANSI A112.19.5 trim. Non-float swing type flush valves are not acceptable. Water flushing volume shall not exceed 3.5 gallons per flush.

2.4.2 Flush Valve Type Urinals (P-2)

ASME A112.19.2M, white vitreous china, wall-mounted, wall outlet, siphon jet, integral trap, extended side shields, and ANSI A112.19.5 trim. Provide large diaphragm (not less than 2.625 inches upper chamber inside diameter at the point where the diaphragm is sealed between the upper and lower chambers), non-hold-open flush valve of chrome plated cast brass, including vacuum breaker and angle (control-stop) valve with back check. Water flushing volume of the flush valve and urinal combination shall not exceed 1.5 gallons per flush from 15 to 90 psi. Provide ASME A11.6.1M concealed wall hangers with thru-bolts and back plates for mounting.

2.4.3 Lavatories (P-3A)

ASME/ANSI A112.19.1M, white enameled cast-iron, or ASME A112.19.2M white vitreous china with ASME A112.6.1M concealed arm carrier support, shelf back type, minimum dimensions of 20 inches wide by 18 inches front to rear. Provide ASME A112.18.1M copper alloy centerset single handle faucets with pop-up drain fittings, and 1.25 inch adjustable P-traps. Provide ASME A112.6.1M concealed wall hangers with thru-bolts and back plates for mounting.

2.4.4 Wheelchair Lavatories (P-3B)

ASME/ANSI A112.19.1M, white vitreous china, contoured front rim, front concealed overflow, ASME A112.6.1M concealed arm carrier support and chair carrier, minimum dimensions of 20 inches wide by 27 inches front to rear, 29 inch minimum clearance from bottom of front rim to floor, 34 inch from rim height above floor. Provide ASME A112.18.1M copper alloy centerset single handle faucets, gooseneck spout with aerator 5 inches above rim, 4 inch wrist action handles, perforated grid strainers with offset tailpiece, and 1.25 inch adjustable P-trap. Faucets with wrist action handles shall open within one-quarter turn in opposite directions.

2.4.5 Countertop (Kitchen) Sinks (P-12)

ASME/ANSI A112.19.3M, 20 gage stainless steel with integral mounting rim, minimum dimensions of 25 inches wide by 22 inches front to rear, 7 inches deep single compartment with ledge back and undersides coated with sound dampening material. Provide top-mounted ASME A112.18.1M copper alloy centerset single handle faucets, swing spout with aerator, and stainless steel drain outlets with cup strainers. Provide 1.5 inch adjustable P-trap with drain piping to vertical vent stack. Provide UL 430 waste disposer unit in right compartment.

2.4.6 Wheelchair Electric Water Cooler (P-7)

ARI 1010, wall-mounted bubbler style with ASME A112.6.1M concealed chair carrier, air-cooled condensing unit, 4.75 gph minimum capacity, stainless steel splash receptor, and all stainless steel cabinet, with 27 inch minimum knee clearance from front to bottom of unit to floor and 36 inch maximum spout height above floor. Bubblers shall also be controlled by push levers, by push bars, or touch pads one on each side or one on front and both sides of cabinet.

2.4.7 Shower Supply Fittings

ASME A112.18.1M, ball joint, self-cleaning adjustable spray pattern shower heads with 3-gpm flow control devices, connected to concealed pipe connected to copper alloy pressure balance single control type mixing valves with front access integral screwdriver stops. Anchor the mixing valves and the pipe to each showerhead in wall to prevent movement.

2.4.8 Mop Sink (P-4)

Precast terrazzo Mop Sink: Terrazzo shall be made of marble chips cast in white Portland cement to produce a compressive strength of not less than 3000 psi 7 days after casting. Provide brass body drains with nickel bronze strainers cast integral with terrazzo. Provide stainless steel rim guard for mop sink.

2.4.9 Combination Emergency Shower and Eyewash (P-5)

ANSI Z358.1, column mounted on a floor flange. Design combination unit so components can be operated individually from a common fixture supply line. Provide a 10 inch diameter stainless steel deluge showerhead with elbow, stay-open ball valve operated by pull rod and 8 inch diameter ring or triangular handle, and eyewash with stainless steel receptor and two spray outlets. Provide eyewash with stay-open ball valve operated by foot treadle and push handle.

2.4.10 Oil Interceptors

Cast iron or welded steel coated inside and outside with white acid resistance epoxy, with internal air relief bypass, bronze cleanout plug, double wall trap seal, removable combination pressure equalizing and flow diffusing baffle and sediment bucket, horizontal baffle, vent connection gas and watertight gasketed nonskid cover. Sized for 15 gpm with inlet and outlet connections as indicated.

2.5 DOMESTIC WATER HEATERS GAS

Gas-fired water heaters, glass-lined steel tanks, high efficiency type insulated with polyurethane foam insulation, replaceable anodes, with adjustable range thermostat to allow hot water settings between 110° and 180° F. Provide posted operating instructions for water heaters.

2.5.1 Gas Vents

NFPA 211, Type B, of the prefabricated multi-wall UL listed type.

2.5.2 Gas Piping System

See Section 15492, “Fuel Gas Piping.”

PART 3 EXECUTION

3.1 INSTALLATION

Installation of plumbing systems including fixtures, equipment, materials, and workmanship shall be in accordance with the Plumbing Code, except as modified herein. When fixtures require both hot water and cold water supplies, provide the hot water supply to the left of the cold water supply. Plastic piping shall not penetrate firewalls or fire floors and shall be used on one side of firewalls and fire floors not closer than six inches to the penetration.

3.1.1 Threaded Connections

Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread paste, pipe cement and oil, or PTFE powder and oil; apply only on male threads. Provide exposed ferrous pipe threads with one coat of primer applied to a minimum dry film thickness of 1.0 mil.

3.1.3.1 Piping to Receive Insulation

Provide temporary wood spacers between the insulation protection shield and the pipe in order to properly slope the piping and to establish final elevations. Temporary wood spacers shall be of the same thickness as the insulation to be provided under Section 15250, “Insulation of Mechanical Systems.”

3.1.3.2 Maximum Spacing Between Supports

a. Vertical Piping: Support metal piping at each floor, but at not more than 10 foot intervals, with pipe riser clamps or offset pipe clamps.

b. Horizontal Piping: Support cast-iron piping at five foot intervals, except for pipe exceeding five foot length, provide supports at intervals equal to the pipe length but not exceeding 10 feet. Support steel piping and copper tubing as follows:

MAXIMUM SPACING (FEET)

Nominal Pipe Size (inches)	One and under	1.25	1.5	2	
Steel Pipe	7		8	9	10
Copper Tube	6		7	8	8

3.1.4 Encased Buried Piping

Completely encase buried copper water piping and cast iron DWV and water piping with polyethylene tube or sheet in accordance with AWWA C105/A21.5.

3.1.5 Installation of Pipe Sleeves

Provide pipe sleeves where piping passes through walls, floors, roofs, and partitions. Secure Sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide not less than 0.25-inch space between exterior of piping or pipe insulation and interior of sleeve. Firmly pack space with mineral wool insulation. Seal at both ends of the sleeve with plastic waterproof cement which will dry to a firm but pliable mass, or provide a segmented elastomeric seal. Seal both ends of penetrations through fire walls and fire floors to maintain fire resistive integrity with UL listed fill, void, or cavity material. Extend sleeves in floor slabs three inches above the finished floor, except sleeves are not required where DWV piping passes through concrete floor slabs located on grade.

3.2 NAMEPLATES

Provide laminated plastic nameplates for equipment, gages, thermometers, and valves; stop valves in supplies to fixtures will not require nameplates. Laminated plastic shall be 0.125-inch thick melamine plastic, black with white center core. Surface shall be a matte finish. Corners shall be square. Accurately align lettering and engrave into the white core. Minimum size of nameplates shall be 1.0 inch by 2.5 inches. Lettering shall be minimum of 0.25-inch high normal block lettering. Key nameplates to a chart and schedule for each system. Frame charts and schedules under glass and place where directed near each system. Furnish two copies of each chart and schedule. Each inscription shall identify its function. Equipment nameplates shall show the following information.

a. Manufacturer, type, and model number

b. Contact number and accepted date

c. Capacity or size

d. System in which installed

e. System which it controls

3.3 FIELD QUALITY CONTROL

3.3.1 Inspections

Prior to initial operation, inspect piping system for compliance with drawings, specifications, and manufacturer’s submittals.

3.3.2 Field Testing

Before final acceptance of the work, test each system as in service to demonstrate compliance with the contract requirements. Perform the following tests in addition to the test specified in the Plumbing Code, except as modified herein. Correct defects in the work provided by the Contractor, and repeat tests until work is in compliance with contract requirements. Furnish water, electricity, instruments, connecting devices, and personnel for performing tests.

3.3.2.1 Hydrostatic Testing Water and Process Piping

Before applying insulation, hydrostatically test each piping system at not less than 120 psig with no leakage or reduction in gage pressure for two hours.

3.3.2.3 Overflow Piping (Containment Drainage)

Before backfilling drain piping trenches, (whether before or after structural grade beams are poured) cap ends of each system, fill each section with water for test with not less than a 10 foot head of water. Allow to stand full until a thorough inspection has been made, but not less than two hours. Any leaks discovered shall be repaired, after which, the section shall be retested.

3.4 DISINFECTION

Disinfect new water piping in accordance with AWWA C651. Fill piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for a minimum of 24 hours. Flush solution from systems with clean water until maximum residual chlorine content is not greater than 0.2 parts per million or residual chlorine content of domestic water supply.

HAZARDOUS WASTE TSD FACILITY
STEEL TANKS WITH FIXED ROOFS

REF.: Specification section 13205

2.31. - Inlet and outlet piping

FMF will provide carbon steel pipe and flanges for all inlet and outlet pipes that weld to the carbon steel tank.

It is standard practice to separate dissimilar metals of this type, therefore the separation could be made at the first flange connection.

2.3.3 - Nozzle

Per our calculations submitted by a registered professional engineer. Nozzle reinforcing is not required.

Hazards Waste TSD Facility
Steel tanks with fixed roofs

Reference: Submittals section 13205 1.2.1

- Structural steel: FMF will use industry standard materials conforming to ASTM A-36 carbon steel.

- Pipe and fittings: FMF will use industry standard materials conforming to ASTM A-53B ERW, ASTM A234 WPE carbon steel.

- Flange bolting: FMF will use industry standard materials conforming to ASTM A105. Class 150, RFSO welding neck carbon steel. All boltholes to straddle natural vessel.

- Gaskets: FMF will use industry standard materials conforming to military spec MIL-R-6855.

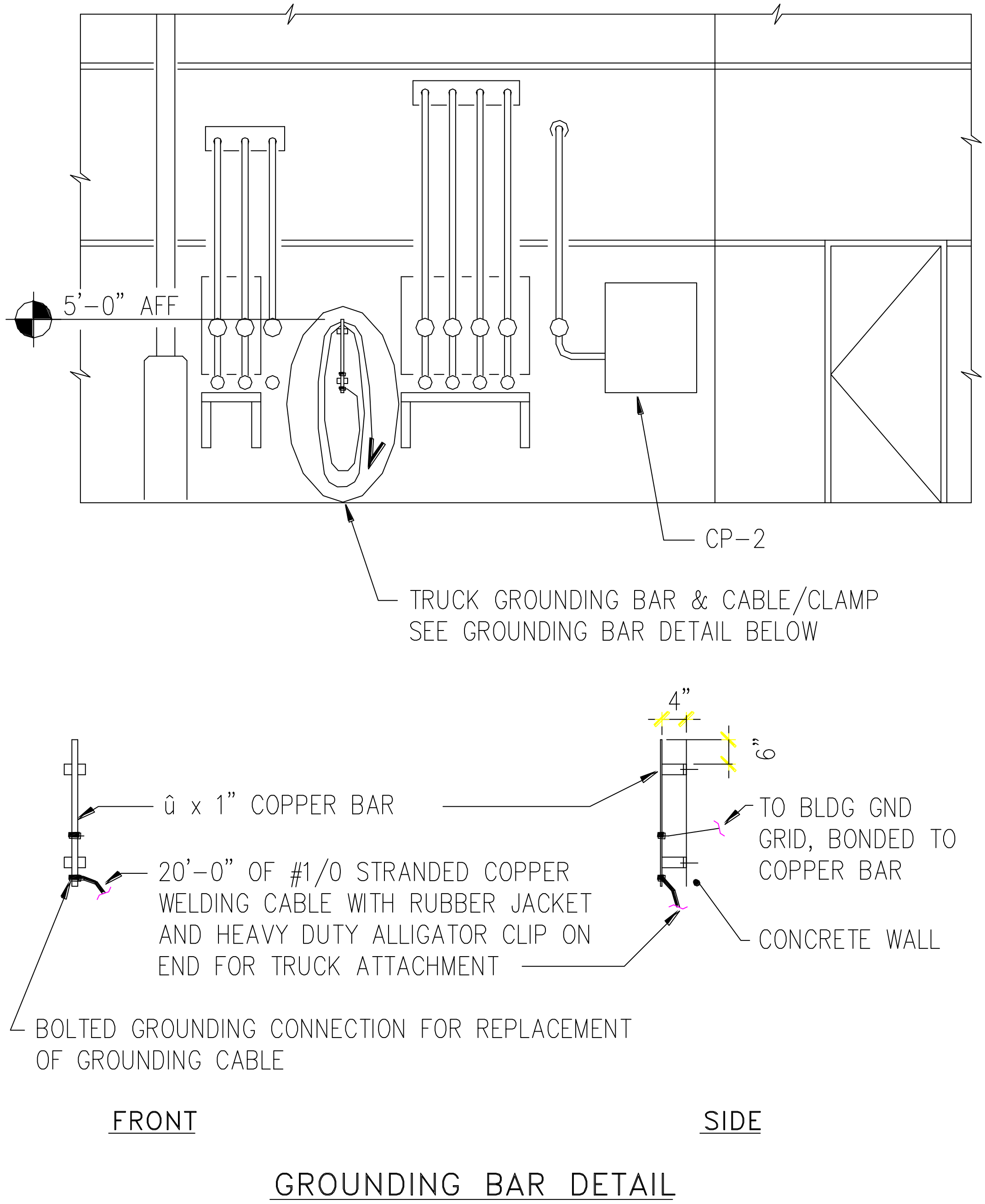
- Tank level: Gauge; by others.

- Venting: FMF has provided a nozzle to the first flange only.

- Roof manholes: See submittal drawing.

- Shell access holes: See submittal drawing.

- Oil – resistant coating system: attached.



9
E3 | E3

TRUCK GROUNDING DETAIL

SCALE: NONE

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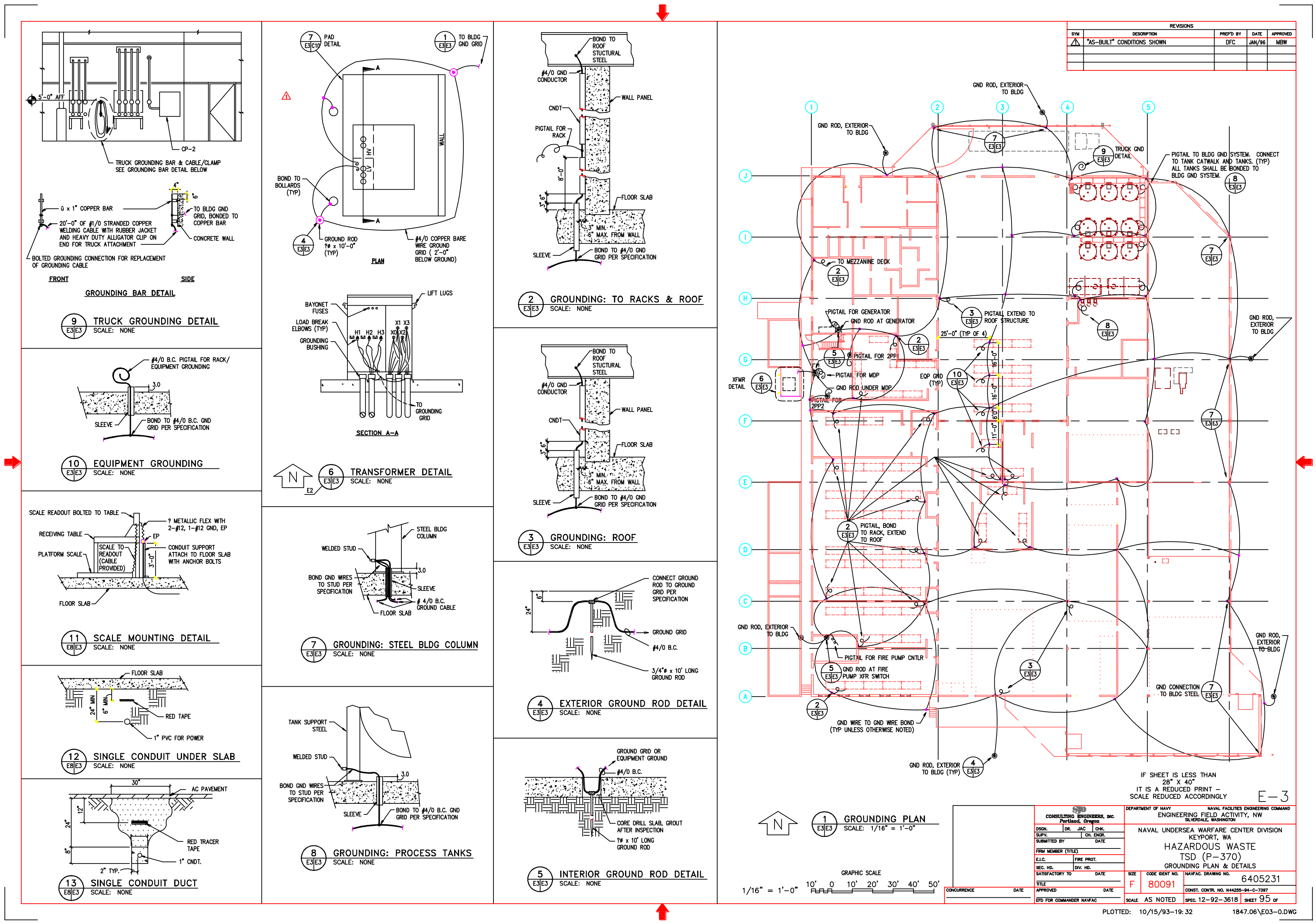
TRUCK GROUNDING BAR & CABLE/CLAMP SEE GROUNDING BAR DETAIL BELOW
CP-2
5'-0" AFF
TO BLDG GND GRID, BONDED TO COPPER BAR
CONCRETE WALL
20'-0" OF #1/0 STRANDED COPPER WELDING CABLE WITH RUBBER JACKET AND HEAVY DUTY ALLIGATOR CLIP ON END FOR TRUCK ATTACHMENT
BOLTED GROUNDING CONNECTION FOR REPLACEMENT OF GROUNDING CABLE
FRONT
SIDE
GROUNDING BAR DETAIL
9 TRUCK GROUNDING DETAIL
SCALE: NONE
#4/0 B.C. PIGTAIL FOR RACK/ EQUIPMENT GROUNDING
SLEEVE
BOND TO #4/0 B.C. GND GRID PER SPECIFICATION
10 EQUIPMENT GROUNDING
SCALE: NONE
SCALE READOUT BOLTED TO TABLE
RECEIVING TABLE
PLATFORM SCALE
SCALE TO READOUT (CABLE PROVIDED)
CONDUIT SUPPORT ATTACH TO FLOOR SLAB WITH ANCHOR BOLTS
FLOOR SLAB
11 SCALE MOUNTING DETAIL
SCALE: NONE
FLOOR SLAB
RED TAPE
1" PVC FOR POWER
12 SINGLE CONDUIT UNDER SLAB
SCALE: NONE
AC PAVEMENT
RED TRACER TAPE
1" CNDT.
2" TYP.
13 SINGLE CONDUIT DUCT
SCALE: NONE
PAD DETAIL
TO BLDG GND GRID
BOND TO BOLLARDS (TYP)
GND ROD 10'-0" (TYP)
#4/0 COPPER BARE WIRE GROUND GRID (2'-0" BELOW GROUND)
PLAN
BAYONET FUSES
LOAD BREAK ELBOWS (TYP)
GROUNDING BUSHING
LIFT LUGS
TO GROUNDING GRID
SECTION A-A
6 TRANSFORMER DETAIL
SCALE: NONE
STEEL BLDG COLUMN
WELDED STUD
BOND GND WIRES TO STUD PER SPECIFICATION
SLEEVE
4/0 B.C. GROUND CABLE
FLOOR SLAB
7 GROUNDING: STEEL BLDG COLUMN
SCALE: NONE
TANK SUPPORT STEEL
WELDED STUD
BOND GND WIRES TO STUD PER SPECIFICATION
SLEEVE
BOND TO #4/0 B.C. GND GRID PER SPECIFICATION
8 GROUNDING: PROCESS TANKS
SCALE: NONE
BOND TO ROOF STUCTURAL STEEL
#4/0 GND CONDUCTOR
WALL PANEL
CNDT
PIGTAIL FOR RACK
FLOOR SLAB
3" MIN. 6" MAX. FROM WALL
SLEEVE
BOND TO #4/0 GND GRID PER SPECIFICATION
2 GROUNDING: TO RACKS & ROOF
SCALE: NONE
3 GROUNDING: ROOF
SCALE: NONE
CONNECT GROUND ROD TO GROUND GRID PER SPECIFICATION
GROUND GRID
#4/0 B.C.
3/4"ø x 10' LONG GROUND ROD
4 EXTERIOR GROUND ROD DETAIL
SCALE: NONE
GROUND GRID OR EQUIPMENT GROUND
#4/0 B.C.
CORE DRILL SLAB, GROUT AFTER INSPECTION
?ø x 10' LONG GROUND ROD
5 INTERIOR GROUND ROD DETAIL
SCALE: NONE
REVISIONS
SYM | DESCRIPTION | PREP'D BY | DATE | APPROVED
"AS-BUILT" CONDITIONS SHOWN | DFC | JAN/96 | MBW
GND ROD, EXTERIOR TO BLDG
TRUCK GND DETAIL
PIGTAIL TO BLDG GND SYSTEM. CONNECT TO TANK CATWALK AND TANKS. (TYP) ALL TANKS SHALL BE BONDED TO BLDG GND SYSTEM.
TO MEZZANINE DECK
PIGTAIL FOR GENERATOR
GND ROD AT GENERATOR
PIGTAIL, EXTEND TO ROOF STRUCTURE
25'-0" (TYP OF 4)
PIGTAIL FOR 2PP1
PIGTAIL FOR MDP
GND ROD UNDER MDP
PIGTAIL FOR 2PP2
XFMR DETAIL
EQP GND (TYP)
PIGTAIL, BOND TO RACK, EXTEND TO ROOF
GND ROD, EXTERIOR TO BLDG
PIGTAIL FOR FIRE PUMP CNTLR
GND ROD AT FIRE PUMP XFR SWITCH
GND WIRE TO GND WIRE BOND (TYP UNLESS OTHERWISE NOTED)
GND CONNECTION TO BLDG STEEL
GND ROD, EXTERIOR TO BLDG (TYP)
1 GROUNDING PLAN
SCALE: 1/16" = 1'-0"
GRAPHIC SCALE
1/16" = 1'-0"
IF SHEET IS LESS THAN 28" X 40" IT IS A REDUCED PRINT - SCALE REDUCED ACCORDINGLY
E-3
CONSULTING ENGINEERS, INC. Portland, Oregon
DEPARTMENT OF NAVY
NAVAL FACILITIES ENGINEERING COMMAND
ENGINEERING FIELD ACTIVITY, NW
SILVERDALE, WASHINGTON
NAVAL UNDERSEA WARFARE CENTER DIVISION
KEYPORT, WA
HAZARDOUS WASTE
TSD (P-370)
GROUNDING PLAN & DETAILS
SIZE F
CODE IDENT NO. 80091
NAVFAC DRAWING NO. 6405231
CONST. CONTR. NO. N44255-94-C-7397
SCALE AS NOTED
SPEC. 12-92-3618
SHEET 95 OF
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1847.06\E03-0.DWG

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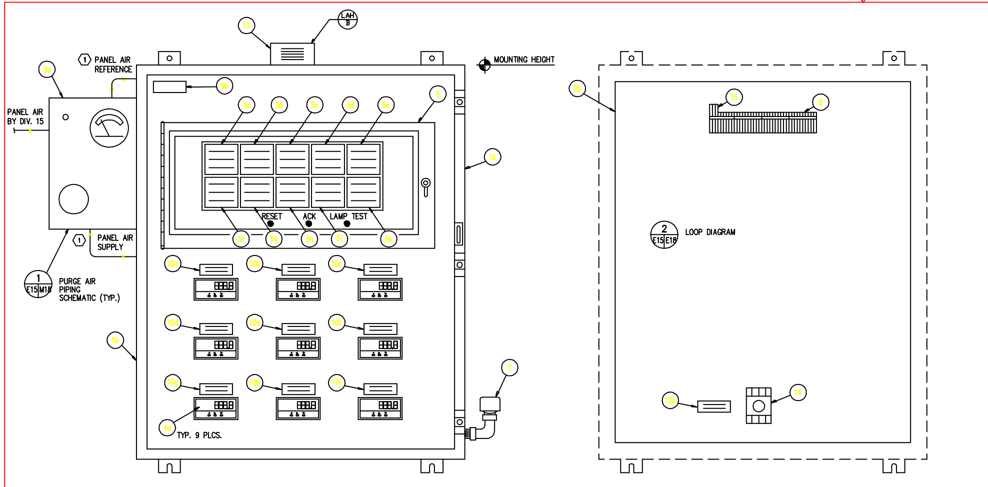
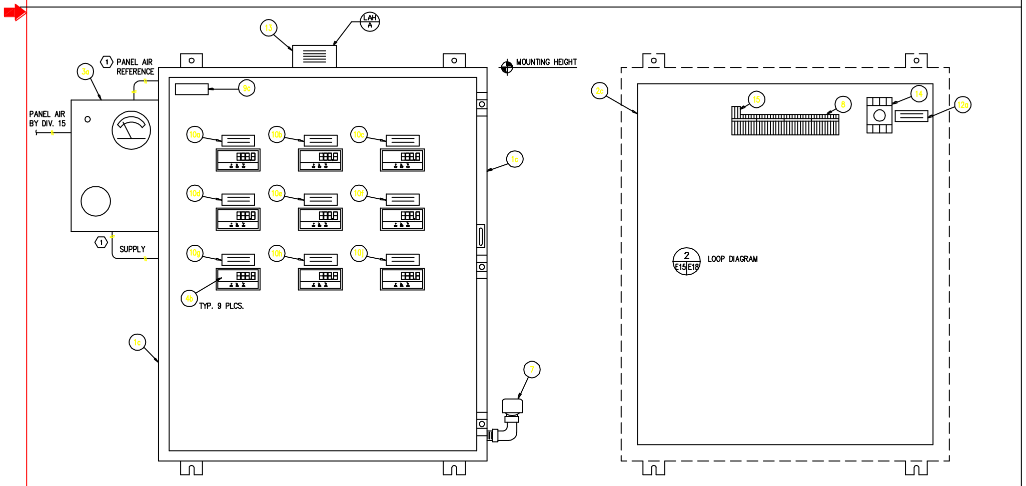
REVISIONS				
SYM	DESCRIPTION	PREP'D BY	DATE	APPROVED
1	"AS-BUILT"	DFC	JAN/96	MBW



PANEL FRONT

PANEL INTERIOR

2 TRUCK UNLOADING LEVEL PANEL (CP-2)
E8 E15 E18
SCALE: NONE



PANEL FRONT

PANEL INTERIOR

NOTE:

1. PROVIDE PANEL PRESSURIZATION AIR CONNECTIONS FROM PANEL PRESSURIZATION SYSTEM TO PROTECTED ENCLOSURE PER DWG M-18, DETAIL 1 AND MANUFACTURER'S RECOMENDATION. PANEL PIPING SHOWN IS SCHEMATIC.

3 TANK FARM LEVEL PANEL (CP-1)
E8 E15 E18
SCALE: NONE

GRAPHIC SCALES:
3" = 1'-0" 6" 3" 0 1'

1 NOT USED
E15
SCALE: NONE

PANEL COMPONENTS:

1a NOT USED

1b ENCLOSURE: 36"H x 30"W x 16"D; NEMA 12; SINGLE DOOR; PAINTED: OFF-WHITE ENAMEL.

1c ENCLOSURE: 24"H x 20"W x 10"D; NEMA 12; SINGLE DOOR; PAINTED: OFF-WHITE ENAMEL.

2a NOT USED

2b PANEL: 33"H x 27"W; PAINTED: WHITE ENAMEL.

2c PANEL: 21"H x 17"W; PAINTED: WHITE ENAMEL.

3a PANEL PRESSURIZATION SYSTEM (PCV): PANEL AUTOMATIC AIR PURGING AND PRESSURIZATION SYSTEM SUITABLE FOR TYPE "Z" PURGING. SYSTEM TO INCLUDE INTEGRAL AIR SUPPLY REGULATOR, ENCLOSURE PRESSURE INDICATOR, EXPLOSION PROOF PRESSURE LOSS ALARM SWITCH, AND RAPID EXCHANGE CONTROL VALVE, MOUNT TO LEFT HAND SIDE OF ENCLOSURE.

4a DIGITAL PANEL METER: PANEL MOUNTED WITH 3 1/2 DIGIT HIGH VISIBILITY, .56" HIGH RED LED DISPLAY; 4-20mA ANALOG INPUT; DUAL ALARM RELAY OUTPUTS; NEMA 4 SEALED METAL FRONT BEZEL; PROGRAMMABLE ALARM SET POINTS, ZERO VALUE, AND RANGE; 120 VOLT POWER.

4b SAME AS 4a ABOVE EXCEPT: WITH 4-20mA ANALOG RETRANSMISSION; WITHOUT DUAL ALARM RELAY OUTPUTS.

5 SOLID STATE ANNUNCIATOR: WITH GASKETED DOOR SUITABLE FOR PANEL PURGING. FLUSH PANEL MOUNTED TEN CHANNEL ANNUNCIATOR. 24 VOLT DC SIGNAL INPUT, RELAY CONTACT OUTPUT. 2 7/8" x 3 1/4" ENGRAVED WHITE LIGHTBOX WITH BACKLIGHTED LEGENDS PER TABLE 1. DRY CONTACT 5A@ 120VAC FOR ALARM HORN. ALARM HORN ACKNOWLEDGE, LAMP TEST, AND RESET PUSHBUTTONS. ANNUNCIATOR POWER 120VAC.

ALARM SEQUENCE "AF" AS FOLLOWS:

	CONDITION			
DEVICE	SIGNAL CONTACT NORMAL	SIGNAL CONTACT GOES OFF-NORMAL	SILENCE BY PUSHBUTTON	SIGNAL CONTACT RETURNS TO NORMAL
LAMPS	OFF	BRIGHT FLASH	STEADY BRIGHT	OFF
HORN	OFF	ON	OFF	OFF

7 ENCLOSURE PROTECTION VENT: GRAVITY OPERATED, PRESSURE RELIEF VALVE MATCHED TO ENCLOSURE PURGE SYSTEM.

8 TERMINAL BLOCKS: CHANNEL MOUNTING TYPE, TUBULAR SCREW TYPE TERMINALS. CAPABLE OF HANDLING #22-#12 AWG CONDUCTORS; 600VAC INSULATION CAPACITY; APPROXIMATELY 0.24" THICK x 1.31" HIGH x 1.6" WIDE.

9, 10, 12 NAMEPLATES: FLEXIBLE LAMINATED PLASTIC; THREE-PLY, WHITE SURFACE, BLACK CORE; ENGRAVED WITH ROUND TIP (V-BOTTOMS ARE NOT ACCEPTABLE); ENGRAVE AS SHOWN ON TABLES 2,3,4 AND 5. FASTEN TO PANEL FACES WITH FOAM TAPE.

13 ALARM HORN: VIBRATING HORN, 120VAC, SUITABLE FOR CLASS 1 DIV. 2, GROUP C & D ENVIRONMENT. 100 DECIBEL MINIMUM AT 10 FEET. MOUNT ON TOP OF ENCLOSURE UNLESS INDICATED OTHERWISE.

14 CONTROL RELAY: DPDT; 120VAC COIL; CONTACTS RATED MINIMUM 120VAC AT 10AMPS.

15 FUSED TERMINAL STRIPS: SAME AS 8 ABOVE, EXCEPT WITH SWITCH AND FUSE ARRANGEMENT; APPROXIMATELY 0.36" THICK x 2.3" HIGH x 3.1" WIDE. SUITABLE FOR FUSE SIZE 0 x 10.

TABLE 1, LIGHTBOX LEGENDS

5_	LINE 1	LINE 2	LINE 3	LINE 4
a	TANK #1	OTHER WASTE WATER	TANK FULL	LAH-1B
b	TANK #2	OTHER WASTE WATER	TANK FULL	LAH-2B
c	TANK #3	WASTE OIL	TANK FULL	LAH-3B
d	TANK #4	OIL/WATER	TANK FULL	LAH-4B
e	TANK #5	OIL/WATER	TANK FULL	LAH-5B
f	TANK #20	CYANIDE/OIL FEED	TANK FULL	LAH-20B
g	TANK #21	CYANIDE/OIL FEED	TANK FULL	LAH-21B
h	TANK #22	CYANIDE METAL WASTE	TANK FULL	LAH-22B
j	TANK #40	EFFLUENT COLLECTION	TANK FULL	LAH-40B
k	AIR	PRESSURE	FAILURE	

TABLE 2, PANEL NAMEPLATES

9_	LINE 1	LINE 2
b	TRUCK UNLOADING LEVEL PANEL	CP-2
c	TANK FARM LEVEL PANEL	CP-1

TABLE 3, DIGITAL PANEL METER LEGENDS

10_	LINE 1	LINE 2	LINE 3 (CP-1)	LINE 3 (CP-2)
a	TANK #1 - OTHER WASTE WATER	PERCENT (%) FULL	LI-1A	LI-1B
b	TANK #2 - OTHER WASTE WATER	PERCENT (%) FULL	LI-2A	LI-2B
c	TANK #3 - WASTE OIL	PERCENT (%) FULL	LI-3A	LI-3B
d	TANK #4 - OIL/WATER	PERCENT (%) FULL	LI-4A	LI-4B
e	TANK #5 - OIL/WATER	PERCENT (%) FULL	LI-5A	LI-5B
f	TANK #20 - CYANIDE/OIL FEED	PERCENT (%) FULL	LI-20A	LI-20B
g	TANK #21 - CYANIDE/OIL FEED	PERCENT (%) FULL	LI-21A	LI-21B
h	TANK #22 - CYANIDE METAL WASTE	PERCENT (%) FULL	LI-22A	LI-22B
j	TANK #40 - EFFLUENT COLLECTION	PERCENT (%) FULL	LI-40A	LI-40B

TABLE 5, CONTROL RELAY LEGENDS

12_	LINE 1
a	CONTROL RELAY CP-7
b	CONTROL RELAY CP-8

IF SHEET IS LESS THAN 28" X 40" IT IS A REDUCED PRINT - SCALE REDUCED ACCORDINGLY

E-15

SJO CONSULTING ENGINEERS, INC.
Portland, Oregon

DSGN.	DR. JAC	CHK.
SUPV.		CH. ENGR.
SUBMITTED BY		DATE
FIRM MEMBER (TITLE)		
E.I.C.		FIRE PROT.
SEC. HD.		DIV. HD.
SATISFACTORY TO		DATE
TITLE		
APPROVED		DATE
EFD FOR COMMANDER NAVFAC		

CONCURRENCE DATE

DEPARTMENT OF NAVY — NAVAL FACILITIES ENGINEERING COMMAND
ENGINEERING FIELD ACTIVITY, NW
SILVERDALE, WASHINGTON

NAVAL UNDERSEA WARFARE CENTER DIVISION
KEYPORT, WA
HAZARDOUS WASTE
TSD (P-370)
TANK LEVEL INDICATOR PANELS

SIZE	CODE IDENT NO.	NAVFAC. DRAWING NO.	
F	80091	6405243	
		CONST. CONTR. NO. N44255-94-C-7397	
SCALE AS NOTED		SPEC. 12-92-3618	SHEET 107 OF

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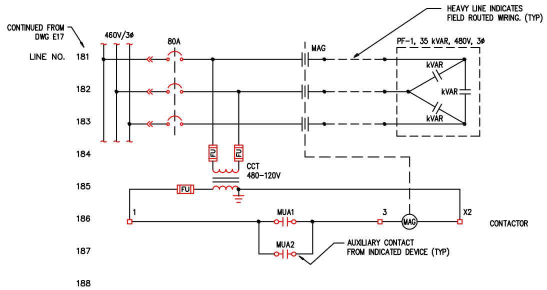
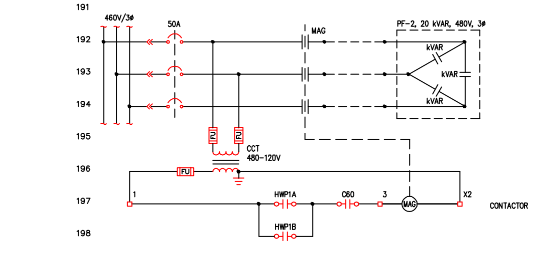
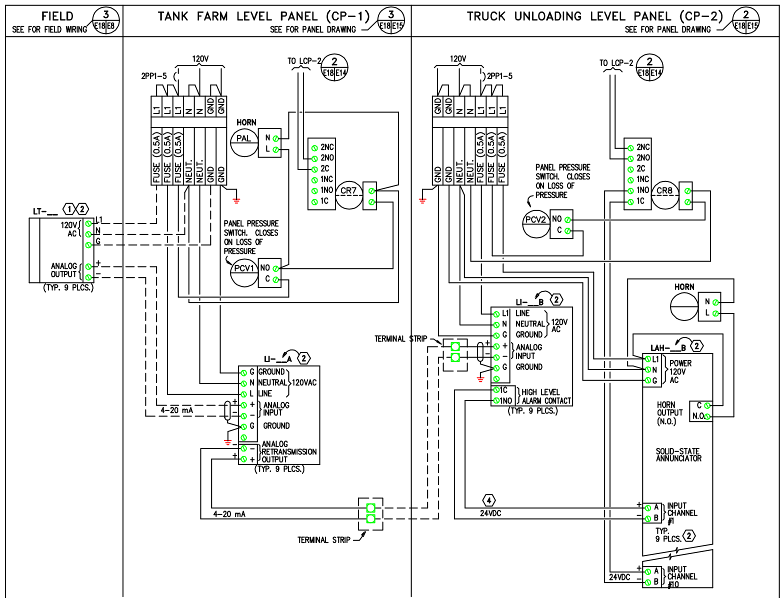


3 E20 E18 MCC1 POWER FACTOR CORRECTION
SCALE: NONE



4 E20 E18 MCC2 POWER FACTOR CORRECTION
SCALE: NONE

1 E18 NOT USED
SCALE: NONE



2 E15 E18 TANK LEVEL LOOP DIAGRAM
SCALE: NONE

REVISIONS

SYM	DESCRIPTION	PREP'D BY	DATE	APPROVED
1	"AS-BUILT"	DFC	JAN/96	MBW

NOTES:

1. ULTRASONIC LEVEL SENSOR: SELF CONTAINED; SUITABLE FOR CLASS 1, DIV. 2 ENVIRONMENT: SENSING RANGE: 1'–30'; ACCURACY: ANALOG OUTPUT – 1/4% OF FULL SCALE; ISOLATED 4–20mA ANALOG OUTPUT; 120VAC INPUT POWER.
2. TANK LEVEL LOOP DIAGRAM IS TYPICAL FOR NINE PLACES. TAG; LEVEL TRANSMITTERS (1 PER TANK); LEVEL INDICATORS (2 PER TANK); AND LEVEL ALARM ANNUNCIATION (1 INPUT CHANNEL PER TANK) AS SHOWN IN TABLE 1, THIS PAGE.
3. THIS NOTE NO LONGER USED.
4. DC INPUT VOLTAGE GENERATED INTERNALLY BY ANNUNCIATOR.

TABLE 1 – ULTRASONIC TANK LEVEL SENSOR INSTRUMENTS

TANK	INSTRUMENT NOS.			
	LEVEL TRANSMITTER (LOCAL)	LEVEL INDICATOR (CP-1)	LEVEL INDICATOR (CP-2)	LEVEL ALARM (HIGH) (CP-2)
T-1	LT-1	LI-1A	LI-1B	LAH-1B
T-2	LT-2	LI-2A	LI-2B	LAH-2B
T-3	LT-3	LI-3A	LI-3B	LAH-3B
T-4	LT-4	LI-4A	LI-4B	LAH-4B
T-5	LT-5	LI-5A	LI-5B	LAH-5B
T-20	LT-20	LI-20A	LI-20B	LAH-20B
T-21	LT-21	LI-21A	LI-21B	LAH-21B
T-22	LT-22	LI-22A	LI-22B	LAH-22B
T-40	LT-40	LI-40A	LI-40B	LAH-40B

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E–18

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SUPV. | CH. ENGR.
SUBMITTED BY | DATE
FIRM MEMBER (TITLE)
E.I.C. | FIRE PROT.
SEC. HD. | DIV. HD.
SATISFACTORY TO | DATE
TITLE
CONCURRENCE | DATE
APPROVED | DATE
EFD FOR COMMANDER NAVFAC

DEPARTMENT OF NAVY — NAVAL FACILITIES ENGINEERING COMMAND
ENGINEERING FIELD ACTIVITY, NW
SILVERDALE, WASHINGTON

NAVAL UNDERSEA WARFARE CENTER STATION
KEYPORT, WA
HAZARDOUS WASTE
TSD (P–370)
TANK LEVEL LOOP DIAGRAM

SIZE F | CODE IDENT NO. 80091 | NAVFAC. DRAWING NO. 6405246
CONST. CONTR. NO. N44255-94-C-7397
SCALE AS NOTED | SPEC. 12–92–3618 | SHEET 110 OF

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SECTION D

APPENDIX D8

TANK CALCULATIONS

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Rohr Metal Fabricators, Inc. 3920 6th Avenue NW Seattle Washington 98107 (206) 633-2222	HAZARDOUS WASTE TSD TANKS	BY TJW DATE 5/11/94	FILE F2323-C SHEET 1 OF ___

DESIGN PER API 620; 8^{th} Ed, 1990
8'-6" DIA × 12'-0 SM/SM
CONTENTS = OIL/WATER & CYANIDE METAL WASTE
S.G. = 1.2 (FOR DESIGN)
SEISMIC ZONE 3
CORROSION ALLOW = 1/16

TANK WEIGHT

SHELL - 2500
ROOF - 459
CONE - 766

CONTENTS - 52400

FULL WEIGHT = 56125
EMPTY WEIGHT = 3725

SEISMIC OVERTURNING

FROM UBC:

$$F_s = \frac{ZIC}{R_w} W$$

SEISMIC ZONE 3
I = 1.0 C = 2.75
Z = .30
R_w = 3

$$F_s = \frac{(.3)(1.0)(2.75)}{3} (56125)$$

F_s = 15434 LB (HORIZONTAL)

THOMAS J. WOLFE STATE OF WASHINGTON 25363 REGISTERED PROFESSIONAL ENGINEER

5-16-94
EXP 11-30-94

VERTICAL SEISMIC LOAD

MOMENT @ BOTTOM JOINT:

$$M = (F_S)(6) = (15434)(6) = 92604 \text{ FT·LB}$$

$$\text{VERT LOAD} = \frac{4M}{D} = \frac{(4)(92604)\text{ FT·LB}}{8.5 \text{ FT}}$$

$$= 43578 \text{ LB}$$

STATIC HEAD @ BOTTOM JOINT $= (.433)(12)(1.2) = 6.23$ P

FROM API 620 SECTION 3.10.2.4 :

FOR SHELL: $T_1 = \frac{R_c}{2}\left[P + \frac{W+F}{A_t}\right]$

WHERE $P = 6.23$ LB/IN²
$W = 56125$ LB
$F = 43578$ LB
$A_t = 8171$ IN²

$$T_1 = \frac{51}{2}\left[6.23 + \frac{-56125 - 43578}{8171}\right]$$

LEEWARD SIDE ⟹ $T_1 = -152.3$ LB/IN

$$T_1 = \frac{51}{2}\left[6.23 - \frac{56125 + 43578}{8171}\right]$$

WINDWARD SIDE ⟹ $T_1 = +120$ LB/IN

$T_2 = PR_c = (6.23)(51)$
$T_2 = 318$ LB/IN

MAX COMPRESSIVE LOAD = -152.3 LB/IN
MAX TENSILE LOAD = +318 LB/IN

FOR 3/16 PL A36:

ALLOWABLE TENSION = 16000 (TABLE 5-1)

$t_{corr} = 3/16 - 1/16 = 1/8"$

$\frac{t-c}{R} = .00245$

ALLOW COMPRESSION = $1,800,000 \left(\frac{t-c}{R}\right)$
= 4412 PSI

ACTUAL STRESS

TENSILE = $\frac{318}{.125}$ = 2544 PSI

FOR E = .85:
MAX ALLOW = (16000)(.85) = 1360C

COMPRESSION = $\frac{152.3}{.125}$ = 1219 PSI (< 4412)

$\therefore$ 3/16 SHELL IS O.K. FOR PRESSURE & SEISMIC LOADS

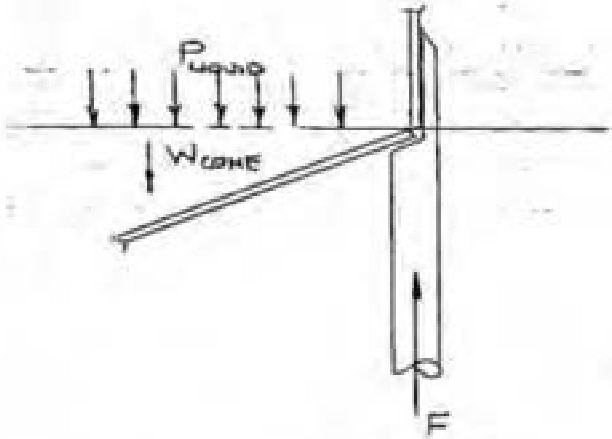
Rohr Metal Fabricators, Inc.
3920 6th Avenue N.W.
Seattle Washington 98107
(206) 633-2222

HAZARDOUS WASTE TSD TANKS

BY TW
DATE 5/11/94

FILE F2323-C
SHEET 4 OF __

BOTTOM CONE



FREE BODY
FOR BOTTOM CONE

$P_{LIQ.} = 6.23$ PSI

$W_{CONE} = 1946$ LB

SEISMIC, DEAD WT

$F = 43578 + 56175 = 99753$

(SUMMATION OF REACTION FOR SEISMIC LOAD)

$\alpha = 76.76°$ (½ APEX ANGLE)

$$T_1 = \left[\frac{R}{2\cos\alpha}\right]\left[P + \frac{W+F}{A_t}\right]$$

$$T_1 = \left[\frac{51}{2\cos 76.76}\right]\left[6.23 + \frac{1946 - 99753}{8171}\right]$$

$$\underline{\underline{T_1 = -639 \ \text{LB/IN}}}$$

IN STEADY STATE W/ NO SEISMIC LOAD :

$F = 56125$ (DEAD WT ONL

$W = 1946$

$P = 6.23$

$$\underline{\underline{T_1 = -44.6 \ \text{LB/IN}}}$$

$$\underline{T_2} = \frac{PR}{\cos\alpha} = \frac{(6.23)(51)}{\cos 76.76} = \underline{1387 \ \text{LB/IN}}$$

$$\text{MIN } t_{CONE} = \frac{T_2}{16000 \cdot .85} = .102 + 1/16 = .1645$$

$\boxed{\therefore \ 5/16 \text{ PL IS O.K. FOR CONE}}$

ROOF

USE API 650

$\alpha = \tan^{-1}(12/51) = 13.24°$ <> API MIN OF 9.46°

$t_{min} = \frac{D}{400 \sin\alpha} = \frac{8.5}{400 \sin\alpha} = .0927$

$t + C.A. = .09 + 1/16 = .155$

$\boxed{\therefore\ 3/16 \text{ PL IS SUFFICIENT FOR ROOF}}$

REINFORCEMENT AT BOTTOM CONE TO SHELL JOINT:

$R_2 = \frac{R}{\cos\theta}$ $\theta = \frac{1}{2}$ APEX ANGLE $= 76.76°$

$R_2 = 222.7$

$W_H = .6\sqrt{R_2(t_H - c)} = .6\sqrt{(222.7)(.25)} = 4.477$ in

$W_C = .6\sqrt{R(t_c - C)} = .6\sqrt{(51)(.125)} = 1.515$ in

$Q = T_2 W_H + T_{2S} W_C - T_1 R \sin\theta$

$T_2 = 1387$ (SHT 4)
$T_{2S} = 318$ (SHT 2)
$T_1 = -639$ (SHT 4)

$Q = (1387)(4.477) + (318)(1.515) - (-639)(51)(\sin 76.76)$

$Q = +38414$

$A_c = Q/16000 \cdot .85 = 2.825$

Rohr Metal Fabricators, Inc. 3920 6th Avenue NW Seattle Washington 98107 (206) 633-2222	HAZARDOUS WASTE TSD TANKS	BY TW DATE 5/11/94	FILE F2323-C SHEET 6 OF __

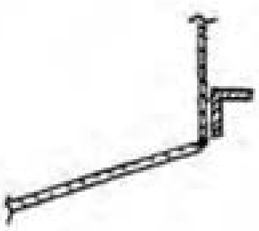
AVAILABLE AREA = $(W_H + W_C)(3/16 - 1/16) = .75\ IN^2$

REQ'D ADD'L REINF. = $2.825 - .75 = 2.075\ IN^2$

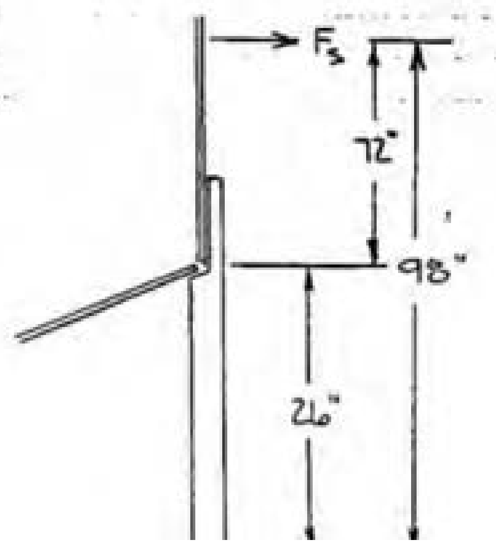
FOR $\angle\ 3 \times 3 \times 3/8$, $A_\angle = 2.11\ IN^2$

MIN. REQ'D PROJECTION = $.015\ R_c$
= .765

$\boxed{\therefore\ \angle\ 3\times3\times3/8 \text{ IS O.K.}}$



LEGS



MOMENT @ CONE JOINT = 92604 FT·LB
= 1111248 IN·LB

VERT LOAD PER LEG = $\frac{4M}{4D}$

= 10895 LB/LEG

LEG MOMENT @ BASE = $(F_3/4)(26)(.75)$ = 75241

SEE "BEDNAR"

FOR 4" SCH 40:

$$S_x = 3.21 \text{ IN}^3$$
$$A_x = 3.17 \text{ IN}^2$$
$$r_g = 1.51 \text{ IN}$$

BENDING STRESS = M/S_x = $100321/3.21$ = 23439 PSI

AXIAL COMP. = P/A = $10895/3.17$ = 3437

ALLOWABLE BENDING = 36000 × .60 × 1.33 = 28728

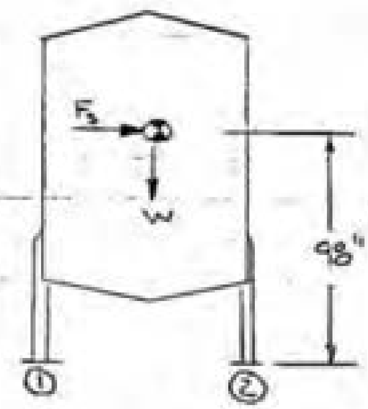
ALLOWABLE COMP = $\dfrac{18000}{1 + \dfrac{L^2}{18000\, r^2}}$ = 17708
(USE 15000)

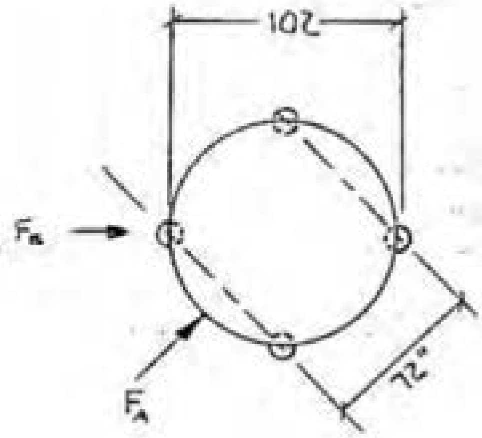
= 15000 × 1.33 = 19950

$$\frac{\sigma}{\sigma_a} + \frac{F}{F_A} = \frac{23439}{28728} + \frac{3437}{19950} = .988 \; (< 1.0)$$

$\boxed{\therefore \text{ 4" SCH 40 PIPE IS SUFFICIENT}}$

ANCHORAGE





SEISMIC LOAD FROM DIRECTION "A":

$\Sigma M_{②} = 0$:

$$(F_S)(98) - (W)(36) - (F_①)(72) = 0$$

W = 56125 (SHT 1

F_S = 15434 (SHT 1

$$F_① = \frac{(15434)(98) - (56125)(36)}{72}$$

$F_①$ = -7055 (COMPRESSION)

F = -7055/2 = -3527 (LB PER LEG) (NO UPLI

SEISMIC LOAD FROM DIRECTION "B"

$\Sigma M_2 = 0$:

$$(F_S)(98) - (W)(51) - (F_①)(102) = 0$$

$F_①$ = -13253.75 LB (NO UPLIFT)

WIND LOAD

ASSUME 18 PSF WIND LOAD (INCLUDING SHAPE FACTOR.

$$\text{WIND LOAD} = (18)\frac{LB}{FT^2}(8.5)\,FT\,(12)\,FT$$
$$= 1836\ LB$$

TANK EMPTY WEIGHT = 3725 (SHT 1)

WIND LOAD FROM DIRECTION "A" (SEE SHT 8)

$$(F_w)(98) - (W)(36) - (F_①)(72) = 0$$

$$F_① = 636.5$$
$$F_{ACTUAL} = 636.5/2 = \underline{318.25}\ \text{LB PER LEG}$$

WIND LOAD FROM DIRECTION "B" (SEE SHT 8)

$$(F_w)(98) - (w)(51) - (F_①)(102) = 0$$

$$F_① = -98.5 \quad \text{(NO UPLIFT)}$$

MAX UPLIFT = 318.25 LB

$\therefore$ (4) 5/8" BOLTS PER LEG, AS SHOWN ON DRAWING IS ADEQUATE

MANWAY REINFORCEMENT

24" MANWAY
d CORRODED = 24.125
t_{NECK} = 3/16" (CORRODED)
t_{SHELL} = 1/8" (CORRODED)

$$A_{REQ'D} = (d_{CORR})(t_{MIN})(E')$$

$$t_{MIN} = \frac{T_E}{SE} = \frac{318}{(16000)(1)} = .0199$$

E=1 SINCE NOZZ NOT IN WELD

$E' = 1.0$ (NOZZ NOT IN WELD

$$A_{REQ} = (24.125)(.0199)(1.0) = .480$$

AVAILABLE MATERIAL IN SHELL:

$$A_S = (d_{CORR})(t_{NOM} - t_{MIN})$$
$$= (24.125)(1/8 - .0199)$$
$$= 2.53$$

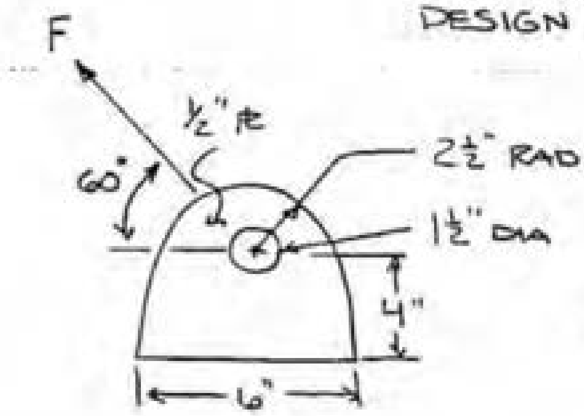
SINCE EXCESS AREA IN SHELL ($2.53\ IN^2$) IS GREATER THAN $A_{REQ'D}$ (.480) A REPAD IS NOT REQUIRED

LIFT LUG

EMPTY WT = 3725 (SHT 1)

LOAD PER LUG = $3725/3 = 1242$

DESIGN LOAD = $(1242)(2) = 2484$ LB



TENSION = $2484 / \sin 60 = 2868$

$\tau = P/A = 2868/(2.5-.75)(.5)$

$\tau = 3278$ PSI

HORIZ COMPONENT = $2868 \cos 60 = 1434$ LB

MOMENT = $(1434)(4) = 5736$ IN·LB

$I_{@\,BASE} = \frac{bh^3}{12} = (.5)(6)^3/12 = 9 \text{ IN}^4$

$S_{BASE} = I/c = 9/3 = 3.0 \text{ IN}^3$

BENDING STRESS = $\sigma = M/S = 5736/3 = $ **1912 PSI**

WELD STRESS = $P/A_w = 2868/(.707)(.1875)(12)$

$= 1803$ PSI

∴ 3 LUGS AS SHOWN

DESIGN BASIS

DESIGN PER API 650 IS NOT APPROPRIATE AS IT IS LIMITED TO FLAT BOTTOM TANKS RESTING ON GRADE, THEREFORE, DESIGN HAS BEEN PERFORMED IN ACCORDANCE WITH API 620. SEISMIC DESIGN IS IN ACCORDANCE WITH UBC, AS API 620 AND 650 PERTAIN TO FLAT BOTTOM TANKS IN THEIR DETAILED SEISMIC PROCEDURES.

TANK SYSTEM ASSESSMENT May 15, 1995

Prepared For:
Naval Undersea Warfare Center, Keyport Division
MCON P-370 Hazardous Waste TSD Facility

in accordance with WAC 173-303-640

Tanks numbered T-1 through T-5, T-20 through T-22 and T-40 on NAVFAC Drawing No. 6405150 and the piping systems attached thereto have been designed with sufficient structural integrity and are acceptable for the storing and treating of dangerous wastes.

(i) Design Standards

The tank systems have been designed to the following standards (among others) to insure their suitability:

API 650 - Welded steel storage tanks
ASTM A 312A/A 312M - Stainless steel pipe
MIL-P-24441 - Epoxy-polyamide coatings

See attached Specification Sections 09875, 13205, and 15400. The foundation and walls have been designed to adequately support the tank systems.

(ii) Dangerous Waste Characteristics

The tank systems have been designed to handle without significant corrosion a wide variety of waste oils and waste water contaminated with cyanides, heavy metals, salt water, solvents, alcohols, acids and/or bases. Materials which attack 304 stainless steel or epoxy - polyamide coatings should be handled in other systems.

Some of these wastes may be combustible, toxic, or corrosive as defined by WAC 173-303-090, WAC 173-303-101, or the Fire Code.

I certify under penalty of law that this assessment and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person(s) who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

5/15/95

SJO

SECTION D

APPENDIX D9

TANK INTEGRITY ASSESSMENTS AND CERTIFICATIONS

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Final Study Report

Naval Facilities Engineering Systems Command Northwest
Tank Integrity Testing
Naval Undersea Warfare Center, Naval Base Kitsap Keyport

Contract No.: N44255-15-D-0011
Delivery Order No.: N4425520F4167

Submitted to

Naval Facilities Engineering Systems Command Northwest
Naval Undersea Warfare Center
Naval Base Kitsap Keyport
Keyport, Washington

August 2021

Submitted by

WSP USA
33301 Ninth Avenue South, Suite 300
Federal Way, Washington 98003-2600

WA16.0094.49

TANK INTEGRITY TESTING STUDY REPORT
NAVAL FACILITIES ENGINEERING SYSTEMS COMMAND NORTHWEST
NAVAL UNDERSEA WARFARE CENTER, NAVAL BASE KITSAP KEYPORT
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LIST OF ACRONYMS AND ABBREVIATIONS

API	**American Petroleum Institute**
APP	**accident prevention plan**
Ecology	**Washington State Department of Ecology**
Mistras	**Mistras Group, Inc.**
NUWC	**Naval Undersea Warfare Center**
SSHO	**site safety and health officer**
STI	**Steel Tank Institute**
UT	**ultrasonic thickness**
WAC	**Washington Administrative Code**

EXECUTIVE SUMMARY

Underwater training exercises conducted by the Naval Undersea Warfare Center (NUWC) in Keyport, Washington, involve retrieving practice torpedoes that are propelled by Otto fuel monopropellant (propylene glycol dinitrate). Cleaning operations for the practice torpedoes result in the generation of a waste streams at NUWC consisting of spent cleaning solvents (alcohol) derived from torpedo engine compartment flushing (flushing operation), and Otto fuel/seawater mixtures derived from depressurization of the torpedo fuel compartment (ullage operation).

A byproduct of Otto fuel combustion is cyanide, and flushing wastes are treated on site using alkalinity adjustment and chlorination to reduce cyanide concentrations. Other waste streams generated at NUWC include acidic and plating wastewater, a result of metal finishing operations, including anodize stripping, acid pickling and passivation, and sodium bicarbonate surface blasting. These waste streams are designated as dangerous waste under Washington Administrative Code (WAC) 173-303, and the Building 1051 facility has obtained a dangerous waste treatment and storage permit from the Washington State Department of Ecology (Permit ID No. WA1170023419).

The waste storage tanks are required to be tested for structural integrity at five-year intervals pursuant to the existing permit. An assessment of the 12 tanks (11 tanks in dangerous waste facility plus one additional tank) was completed pursuant to the requirements of WAC 173-303-640(2) reference g and appropriate industry standards. The assessment found that 8 of the 12 tanks are suitable for continued service with no repairs recommended at this time. Two of the tanks were found suitable for continued service with optional repairs recommended. Two of the tanks, Tank K0825-105 and K0825-108, were found to be structurally suitable for service but require corrective action (cleaning and recoating) for compliance with WAC 173-303-640.

1.0 AUTHORIZATION

WSP USA was authorized on June 2, 2020 (Revision 01) by the Naval Facilities Engineering Systems Command Northwest, under Contract No. N44255-15-D-0011, Delivery Order N4425520F4167**,** to complete integrity testing of the 12 tanks listed below in Table 1.

2.0 OBJECTIVE

The purpose of the integrity assessment was to determine if the 12 tank systems located at the Naval Undersea Warfare Center (NUWC) dangerous waste treatment and storage facility are fit for continued use and/or the need for any repairs.

The assessment evaluated each tank for the presence of current leaks, the adequacy and integrity of secondary containment, and whether the tank systems were designed with sufficient structural strength to ensure that they will not collapse, rupture, or fail. Two of the 12 tanks required internal visual inspection. The following 12 tanks were evaluated.

Table 1. Tanks Designated for Inspection

Tank Designation	Capacity (gallons)	Material of Construction	Configuration	Hatches	Contents
K0514-105	1,350	Stainless Steel	Double Wall	Top	Otto Fuel/Alcohol
K0514-108 α	1,350	Stainless Steel	Double Wall	Top	Otto Fuel/Alcohol
K1051-101	5,000	Steel	Single Wall	Top and Side	Otto Fuel/Alcohol
K1051-102	5,000	Steel	Single Wall	Top and Side	Otto Fuel/Alcohol
K1051-103	5,000	Steel	Single Wall	Top and Side	Otto Fuel/Cyanide
K1051-104	5,000	Steel	Single Wall	Top and Side	Otto Fuel/Alcohol
K1051-105	5,000	Steel	Single Wall	Top and Side	Otto Fuel/Alcohol
K1051-106	5,000	Steel	Single Wall	Top and Side	Otto Fuel/Cyanide
K0825-105 *	40,000	Steel	Single Wall	Open Top and Side	Acidic Wastewater
K0825-108 *	40,000	Steel	Single Wall	Open Top and Side	Acidic Wastewater
K1058-101	1,000	Plastic	Double Wall	Top	Plating Wastewater
K1058-102	10,000	Fiberglass Reinforced Plastic	Double Wall	Top and Side	Plating Wastewater

Key:
* Tanks requiring internal inspection
α Not part of Dangerous Waste program

3.0 PROCEDURE

The tank assessment followed the requirements of WAC 173-303-640(2), reference g, and the relevant portions of Steel Tank Institute (STI) Standard SP001-05, *Standard for the Inspection of Aboveground Storage Tanks* (STI, 2011); American Petroleum Institute (API) Standard 653, *Tank Inspection, Repair, Alteration, and Reconstruction* (API, 2014); and Washington State Department of Ecology's Publication No. 94-114, reference (f), *Guidance for Assessing and Certifying Tank Systems that Store and Treat Dangerous Waste* (Ecology, 2014).

Subsequent to the in-service and out-of-service assessments, Mistras Group, Inc. (Mistras) performed calculations to validate the structural adequacy of the tank systems and calculated the size of secondary containment based on measurements made in the field for the three single-walled tanks (Tanks K1051-104 through -106).

On 14 August 2020 and 16 August 2020, an in-service assessment of 10 out of the 12 tanks was completed by Mistras. A representative of WSP was on site to perform as the site safety and health officer (SSHO). Prior to the on-site assessment, the SSHO prepared an accident prevention plan (APP) that incorporated Mistras' activity hazard analysis.

During the in-service assessment, the exterior of each of the tanks was inspected for indications of leaks. The condition of the shell and secondary containment coatings was noted and the general structural integrity of the tanks, foundations, bottoms, access structures, and tank appurtenances was examined. Ultrasonic thickness (UT) measurements were made of the shell and appropriate appurtenances at a frequency and location consistent with the API 653 and STI SP001 standards.

It should be noted that because 10 out of the 12 tanks are equipped with spill control and continuous release detection monitoring (i.e., they are elevated so leaks can be observed), they are classified as Class I tanks by the STI SP001 standard, and because their rate capacity is below 30,000 gallons, an internal inspection is not required. Similarly, Ecology regulation and guidance does not require out-of-service internal inspections when testing, such as UT, is performed, and industry standards, such as the STI SP001 standard, is followed.

On 16 December 2020 and 30 June 2021, an out-of-service assessment of the remaining two tanks, K0825-108 and K0825-105, was completed by Mistras. This involved confined space entry into the two tanks. A representative of WSP was on site to perform as the SSHO. Prior to the out-of-service assessment, the SSHO prepared an APP for submittal to NUWC that incorporated Mistras' activity hazard analysis.

During the out-of-service assessment, the interior and exterior of the tanks were inspected for indications of leaks. The condition of the internal and external shell coatings was noted and the general structural integrity of the tanks, foundations, bottoms, access structures, and tank appurtenances was also examined. UT measurements were made of the shell and appropriate appurtenances at a frequency and locations consistent with the API 653 and STI SP001 standards.

Following the completion of the in-service and out-of-service inspections, Mistras provided a suitability for service conclusion for each tank, tank drawings, and photographs, as well as certification by a registered professional engineer per WAC 173-303-810 as required by WAC 173-303-640(2). The certified assessment reports prepared by Mistras are provided in Appendices A to L.

4.0 COST ESTIMATES

In accordance with Mistras' results of the tank assessments, a cost estimate was prepared for recoating the concrete secondary containment for Tanks K0825-105 and K0825-108. The estimate was based on vendor quotes for epoxy coating meeting Specification MIL-P-14441, Epoxy-polyamide Coatings. Costs are based on the estimated area of concrete secondary containment (20 square feet) assuming the area of coating failure is in the floor area under the two tanks. The cost estimate and the Basis of Cost Estimate are provided in Appendix M.

5.0 SURVEY RESULTS AND RECOMMENDATIONS

As noted in Mistras' final reports detailing the survey results (Appendices A to L), 8 of the 12 tanks are suitable for continued service with no repairs recommended at this time. Two of the tanks were found suitable for continued service with optional repairs recommended. Two of the tanks, Tank K0825-105 and K0825-108, were found to be structurally suitable for service but require corrective action for compliance with WAC 173-303-640.

The inspection found that concrete coating within the curbed area of the tank is cracking and scaling in several areas and the bare concrete is beginning to erode to the east of Tank K0825-108. For compliance, the concrete containment area must be cleaned and recoated as needed and the coating applied to the concrete containment area must be repaired to eliminate all discontinuities per WAC 173-303-640(4)(c)(i). The areas that require repair were marked with orange paint by the inspector and can also be referenced in the inspection report of Tank K0825-105. Once this issue has been corrected and implemented, Mistras will need to return to verify the correction and upon verification, can issue a revised certification report.

WSP completed cost estimates for recoating the concrete secondary containment for Tanks K0825-105 and K0825-108. The cost estimate is provided in Appendix E. The estimate can assist in developing budgets and planning for future maintenance needs.

The tank systems should continue to be assessed at five-year intervals in accordance with WAC 173-303-640, and the Navy should continue with normal maintenance and facility-conducted visual inspections. A summary of all twelve tank inspection results are included in Table 2 below.

Table 2. Tank Inspection Summary

Tank Designation	Component	Recommendation	Recommendation Priority	Notes
K0514-105	NA	NA	NA	No work required
K0514-108	NA	NA	NA	No work required

Tank Designation	Component	Recommendation	Recommendation Priority	Notes
K1051-101	NA	NA	NA	No work required
K1051-102	NA	NA	NA	No work required
K1051-103	NA	NA	NA	No work required
K1051-104	NA	NA	NA	No work required
K1051-105	NA	NA	NA	No work required
K1051-106	NA	NA	NA	No work required
K0825-105*	Foundation	Clean and recoat the concrete containment area	Mandatory	Coating failure and early stages of erosion in concrete observed; refer to inspection report for locations
	Vegetation	Remove vegetation and debris from containment area	Optional	Vegetation removal will limit moisture retention and help prevent coating failure
	Tank Bottom	Recoat the bottom of the tank	Optional	Bottom coating is relatively aged and brittle
	Chime (External Bottom Plate Projection)	Replace sealant between chime and the concrete pad and clean and recoat the chime	Optional	Replacement and recoating can mitigate underside corrosion and maximize life of floor
	Repad	Perform particle testing on corner weld and repad welds	Optional	The current repad configuration is not typical design and should be checked for stress cracking
	Baffle	Clean and recoat baffles	Optional	Coating failure and delamination found
	I-Beams at Top of Tank	Clean and recoat I-beams	Optional	I-beam maintenance will assure sound structural reinforcement
K0825-108*	Foundation	Clean and recoat the concrete containment area	Mandatory	Areas marked with orange paint
	Vegetation	Remove vegetation from containment area	Optional	Moss near tank can accelerate corrosion
	Chime (External Bottom Plate Projection)	Replace sealant between chime and the concrete pad and recoat the chime	Optional	Replacement and recoating can mitigate underside corrosion and maximize life of floor
	Shell	Repair interior and external shell coating	Optional	Coat repair will maximize tank life
	Baffle	Clean and recoat baffles	Optional	Coating failure and delamination found

Tank Designation	Component	Recommendation	Recommendation Priority	Notes
	Shell Nozzle	Repair or replace the PVC fitting on 1-inch NPS nozzle on west side of tank if needed	Optional	The PVC piping is cracked directly above steel flange
	Manway and Transfer Line	Recoat inner neck	Optional	Major coating failure and corrosion observed
	I-Beams at Top of Tank	Clean and recoat I-beams	Optional	I-beam maintenance will assure sound structural reinforcement
K1058-101	Foundation	Clean and recoat tank steel support system	Optional	Coating failure observed in several areas of support system
	Plastic Tank Shell	Refer to manufacturer's manual for projected tank life	Optional	Age of the tank is unknown and thickness readings could not be obtained
K1058-102	Foundation	Clean and recoat concrete area	Optional	Coating is cracked and chipped in several areas
	Foundation	Remove all vegetation and debris from containment area	Optional	Moss could pose a slipping hazard and retains moisture near the tank
	Fiberglass Shell	Clean the tank and remove all mildew from shell	Optional	Mildew layer could visually obstruct tank defects
	Roof	Clean roof and remove all moss, vegetations, and debris	Optional	Moss and debris could pose safety hazard and accelerate degradation
	Ladder and Handrails	Clean and recoat the access structures	Optional	Coating failure and surface corrosion observed on ladder and handrails
	Shell and Roof	Consult manufacturer's manual on remedies for fiberglass degradation	Optional	There are minor areas where fibers are exposed in fiberglass

Key:
* = Tanks requiring internal inspection
NA = Not applicable, no repair recommendations provided
NPC = Nominal pipe size
PVC = Polyvinyl chloride

6.0 REFERENCES

American Petroleum Institute (API), 2014. Tank Inspection, Repair, Alteration, and Reconstruction, API Standard 653, 5th Edition. Washington, DC. November.

Steel Tank Institute (STI), 2011. Standard for the Inspection of Aboveground Storage Tanks, SP001, 5th Edition. Lake Zurich, Illinois. September.

Washington State Department of Ecology (Ecology), 2014. Guidance for Assessing and Certifying Tank Systems, Revised Publication 94-114. Olympia, Washington. November.

Washington State Department of Ecology (Ecology), 2009. Fact Sheet for State Waste Discharge Permit ST-7353 - Naval Undersea Warfare Center Division Keyport. Keyport, Washington.

APPENDIX C

INSPECTION REPORT TANK K1051-101

Above Ground Storage Tank Inspection Report

In accordance with
WAC 173-303-640
Dangerous Waste
Regulations

WSP

Tank K1051-101

In Service Inspection

Keyport, WA

October 14, 2020 to October 14, 2020

Report Number 40865710-3

Prepared By :
7820 South 212th St. St. 110
Kent, WA, 98032

www.mistrasgroup.com

Inspection Date
October 14, 2020

Table of Contents

1.0 Job Information

Job Location :	Naval Undersea Warfare Center
	610 Dowell Street
	Keyport, WA
	98345-7610
Customer Representative :	Grace Roberts
Customer Phone Number :	206-431-2295
Job Charge Number :	N44255-15-D-0011
Report Number :	40865710-3
Mistras Work Order Number :	T67726-40865710
Inspection Personnel Provided :	Alec Arpino
	API 653 Certified Inspector
	API 653 (77549)/UTT/MT
	Brandon Gonzalez
	Level II Technician
	MFL/UTT/PT

2.0 Tank Inspection Data Sheet

General :

Tank Number	K1051-101
Owner	U.S. Navy
Design Standard	Unknown
Tank Location	Keyport, WA
Product	Otto Fuel/ Alcohol
Specific Gravity	1.0
Manufacturer	Flohr Metal Fabrication
Manufacture Date	1994
Cathodic Protection	No
Data Plate Present	Yes
Data Plate Condition	Good Condition

Dimensions :

Diameter (ft)	8.75
Height (ft)	13.02
Capacity Nominal (Gallons)	5,551

Geometry :

Foundation	Concrete Pad with Steel Supports
Bottom	Cone Bottom
Shell	Butt Welded
Fixed Roof Type	Self-Supported Cone

Access :

Stairway	None
Roof Access	Yes

Coatings :

Bottom	Internal Thin Film Epoxy
Shell	External White
Roof	External White

3.0 Suitability for Service

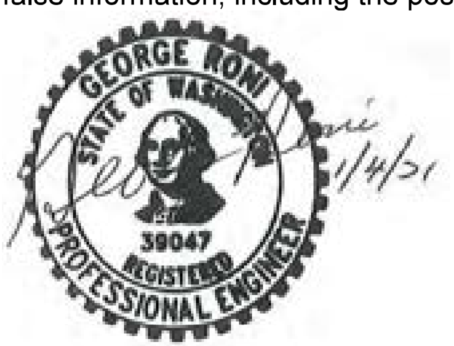
WSP on behalf of the U.S. Navy has contracted Mistras Group, Inc. to perform a in service inspection on Tank K1051-101 located in Building 1051 of the Naval Undersea Warfare Center located in Keyport, WA. This inspection was performed in accordance with the current criteria set forth in WAC 173-303-640 Dangerous Waste Regulations.

There were no issues found that would require repair at this time. The Navy should continue with routine maintenance and observation of the tank. The next formal WAC 173-303-640 inspection should be conducted per the established schedule which is 5 years per the current SPCC Plan for this site.

Tank K1051-101 can be considered suitable for continued service.

TANK CERTIFICATION

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”[1]



George Roni, P.E.

1) Per WAC 173-303-810 as required by WAC 173-303-640 (2)

Mistras Services has evaluated the condition of this tank based on the observations and measurements made by the tank Inspector. While our evaluation accurately describes the condition of the tank at the time of inspection, the tank owner/operator must independently assess the inspection information/report provided by Mistras Services and any conclusions reached by the tank owner/operator and any action taken or omitted to be taken are the sole responsibility of the owner/operator. With respect to inspection and testing, Mistras Services warrants only that the services have been performed in accordance with accepted industry practice. If any such services fail to meet the foregoing warranty, Mistras Services shall re-perform the service to the same extent and on the same conditions as the original service.

The preceding paragraph sets forth the exclusive remedy for claims based on failure or of defect in materials or services, whether such claim is made in contract or tort (including negligence) and however instituted, and, upon expiration of the warranty period, all such liability shall terminate. The foregoing warranty is exclusive and in lieu of all other warranties, whether written, oral, implied or statutory. NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE SHALL APPLY, nor shall Mistras Services be liable for any loss or damage whatsoever by reason of its failure to discover, report, repair or modify latent defects or defects inherent in the design of any tank inspected. In no event, whether a result of breach of contract, warranty or tort (including negligence) shall Mistras Services be liable for any consequential or incidental damages including, but not limited to, loss of profit or revenues, loss of use of equipment tested or services by Mistras Services or any associated damage to facilities, down-time costs or claims of other damages.

4.0 Inspection Findings

WSP on behalf of the U.S. Navy has contracted Mistras Group, Inc. to perform an in Service Inspection on Tank K1051-101 located in Keyport, WA. This inspection was performed in accordance Washington State Dangerous Waste Regulations WAC 173-303-640 (2).

Tank K1051-101 is a shop built, 2 course Above Ground Storage Tank in Otto Fuel/ Alcohol service. This tank is 8.75 feet in diameter, and 13.02 feet in height and is equipped with a Fixed Cone Roof. The following details all inspection findings.

Foundation

This tank was installed on a concrete pad. The tank is elevated above the concrete pad by (4) 4 inch steel pipe support legs. Each support leg has an 8” X 8” X 1/2” steel pad at the base that is anchored to the concrete foundation via (4) 1/2 inch anchor bolts.

The steel pipe support legs showed no evidence of dents, deformations, corrosion, pitting or other visible damage. The concrete at the base of each leg showed no evidence of cracking, spalling or broken concrete. The supports, footings, the anchor nuts and bolts are all coated. No coating failure or oxidation was noted.

The tank anchoring system was secure. There was no evidence of elongation, corrosion, pitting or damage to the steel pads or the anchor nuts and bolts.

The tank sits within a below grade epoxy lined concrete vault. The vault appeared to structurally sound and showed no evidence of cracking, spalling or broken concrete. It appears that epoxy coating had been previously repaired at various locations around the vault. The repaired areas and the rest of the epoxy coating appeared well adhered and fluid tight.

The volume of the containment is large enough to contain the contents of the tank in the event of leaks or catastrophic failure, which is also in compliance with WAC 173-303-640.

Cone Bottom

The cone bottom in Tank K1051-101 consists of 2 plates. The nominal floor plate thickness is 0.3125”. The lowest UT reading found was 0.300”.

The exterior surfaces of the tank showed no evidence of leaks from the plates, the plate to plate weld seams or the bottom to shell weld. There was no evidence of active corrosion, pitting or coating failure occurring on the plates or welds of the bottom. There was no evidence of dents, bulges or other deformations noted on the bottom plates.

At the apex of the bottom there is a 4 inch stainless steel nipple welded to the tank that reduces to a 2” line. There was no evidence of leaks from the attachment welds of the nozzle to the bottom. There was no evidence of leaks from the associated piping in the immediate area of the tank bottom attachment.

Shell

The shell on Tank K1051-101 consists of 2 courses and all joints are Butt Welded. A visual inspection and ultrasonic examination of the shell was conducted, the following details all findings.

The bottom of the shell to bottom transition has a reinforcement ring consisting of a 2-1/2 inch steel angle. The top of the reinforcement ring is fully fillet welded and the bottom is stitch welded. There was no evidence of weld failures or deformations noted to the reinforcement ring.

There was no evidence of bulges, dents or abnormal deformations noted to the tank shell. There was no evidence of leaks in the shell plates, shell to shell horizontal or vertical welds, the shell to cone weld or the shell to roof weld. There was no evidence of active corrosion or pitting noted on the shell exterior.

The shell coating appeared to be in very good condition.

The shell plates were ultrasonically inspected externally to verify the remaining thickness of the shell plates. Ultrasonic thickness readings were obtained on the shell in 4 equally spaced locations at approximately 6.87 feet. Each scan was conducted in one of the 4 cardinal directions. A total of 4 readings per course were obtained.

Section 6.1 of this report details all ultrasonic thickness (UT) readings obtained, detailing the low's to highs per course. There were no abnormally low readings noted on the shell. The lowest reading of 0.179” was located on the 1st course on the West drop.

Shell Nozzles

A visual inspection and ultrasonic examination of all accessible shell nozzles and manways was conducted to evaluate the current condition of each nozzle. Visual inspection of each nozzle included evaluation of the external neck, all attachment welds, and flange faces.

There was no evidence of leaks from the nozzle attachment welds, the flanges, the flange bolting and associated valves or nearby attached piping. There is no evidence of coating failure occurring on the nozzles or couplings.

The attached piping appears to be stainless steel and the nozzles are carbon steel. There is no evidence of galvanic reactions taking place due to the dissimilar metals. The flange faces appear to be raised and have Teflon type PTFE gasket material. The nozzle bolting appears tight and secure with proper thread engagements on the bolting.

All nozzles and manways were ultrasonically inspected (UT) by recording four readings on the top, bottom and both sides of each neck, one reading on each flange and the manway cover. There was no abnormally low thickness readings obtained. Section 6.5 details all data from UT exam.

Fixed Roof

The roof plates on Tank K1051-101 have a nominal thickness of 0.187 inches. The fixed roof plates were ultrasonically examined to determine the average remaining thickness. A total of 16 readings were obtained on the roof, four readings per each cardinal direction. There was no evidence of thinning or corrosion on the roof plates. Section 6.3 details all the data from the UT exam.

The fixed roof plates were visually inspected. All plates were evaluated to determine the condition of the external coating system. Aside from a coating of dust the roof coating is in good condition. There was no evidence of corrosion, pitting, dents, bulges or other deformations to the roof plates.

There was no evidence of leaks in the roof plates, the roof plate to plate welds or the shell to roof weld.

Fixed Roof Nozzles

All fixed roof nozzles were visually inspected. The following details the findings from this inspection.

All roof nozzles were ultrasonically inspected to verify remaining thickness. A total of 4 readings per nozzle were obtained. All fixed roof nozzles were visually inspected. The following details the findings from this inspection.

There was no evidence of leaks from the roof nozzles attachment welds, flanges, and flange bolting, associated valves or attached piping in the immediate area around the piping.

The roof top manway cover is securely attached to the roof with a hinge pin. There was no damage noted to the pin or the cover. There is a 3 inch nozzle attached to the manway cover for the liquid level float and tape gauge system. The system was not operated but appeared to be in satisfactory condition. There was no evident damage to the 3 inch nozzle or the flange face. The manway showed no evidence of coating failure, corrosion, pitting or other damage.

The 4 inch center roof vent piping runs to outside the building. The piping goes through the East wall and appears to have a pressure/vacuum style vent attached at the end of the piping run. The vent was unable to be inspected due to its location and inaccessibility. The pressure/vacuum vent appeared to be in acceptable condition from the ground with no obvious visual defects noted.

All roof nozzles were ultrasonically inspected to verify remaining thickness. A total of 4 readings per nozzle were obtained. There were no abnormally low readings noted on the roof nozzles. Section 6.6 details the data from the UT exam.

Access Ways & Handrails

The roof is accessible from a free standing ladder and catwalk system. This catwalk is used to access all the tanks inside the containment for visual inspections and gauging purposes.

The ladder and the catwalk are in acceptable condition. There was no damage noted to the ladder frame or rungs. The steps showed no signs of damage to the frame, the treads or the handrails. The catwalk showed no damage to the frame, the grating or the handrails. Much of the handrail was covered in black plastic during the inspection.

The catwalk supports are 3” X 3” square piping uprights that are anchored to the concrete by (2) 3/4 inch anchor bolts at each support location. There is 2-1/2 inch angle iron braces used as cross bracing. There were no evident weld failures, damage to the support structures, attachment hardware or the anchorage locations. The attachment hardware appears to be tight and secure. The catwalk grating is galvanized and in acceptable condition. The grating is tack welded into place. There were no signs of weld failure. There was no evidence of corrosion caused thinning or holes noted in the grating.

The 2 inch steel pipe handrails are 42 inches high at the top rail, 24 inches at the mid-rail with 4 inch toe boards. There were no signs of holes, corrosion or pitting noted in the top rail, the mid-rail or the uprights.

Miscellaneous Appurtenances

For product level gauging, this tank is equipped with a float and tape style gauging system. This unit was found to be in what appears to be visually acceptable condition with no apparent damage noted. The unit was not operated at the time of inspection.

The tank is equipped with a Delta Controls roof transponder. The unit model is an 872C-V-10-2NPT-6SE-IS-CC with a serial number of UGD9966-A2. The unit appeared in satisfactory condition with no apparent damage to the unit noted.

For electrical safety issues and lightning protection, this tank is equipped with (1) 1/2 inch braided grounding cable. The cable was found to be satisfactory condition. The cable is attached to the reinforcement ring on one end and attached to a grounding bar that is embedded into the concrete foundation.

Inspectors Signature: ______________________________

M. Alec Arpino
API 653
Certification No. 77549 Exp. 12/31/2023

Reviewed by:

____

George Roni, PE
API 653 Cert. No. 2042, Exp. 4/30/2023

Mistras Services has evaluated the condition of this tank based on the observations and measurements made by the tank Inspector. While our evaluation accurately describes the condition of the tank at the time of inspection, the tank owner/operator must independently assess the inspection information/report provided by Mistras Services and any conclusions reached by the tank owner/operator and any action taken or omitted to be taken are the sole responsibility of the owner/operator. With respect to inspection and testing, Mistras Services warrants only that the services have been performed in accordance with accepted industry practice. If any such services fail to meet the foregoing warranty, Mistras Services shall re-perform the service to the same extent and on the same conditions as the original service.

The preceding paragraph sets forth the exclusive remedy for claims based on failure or of defect in materials or services, whether such claim is made in contract or tort (including negligence) and however instituted, and, upon expiration of the warranty period, all such liability shall terminate. The foregoing warranty is exclusive and in lieu of all other warranties, whether written, oral, implied or statutory. NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE SHALL APPLY, nor shall Mistras Services be liable for any loss or damage whatsoever by reason of its failure to discover, report, repair or modify latent defects or defects inherent in the design of any tank inspected. In no event, whether a result of breach of contract, warranty or tort (including negligence) shall Mistras Services be liable for any consequential or incidental damages including, but not limited to,

5.0 Calculations

5.1 Thickness Calculations

Calculations for Shell & Cone-Shaped Tank Bottom - per API 620

Date of Inspection: 1014/20

Owner	NUWC			
Tank No.	K1051-101			
Diameter, D	8.750	ft	105.00	inches
Shell Height, H	12.000	ft	144.00	inches
Fill Height	12.000	ft	144.00	inches
Original Shell thickness	0.188	inches		
Measured Shell thickness, t_c	0.180	inches		
Original Cone thickness	0.313	inches		
Measured Cone thickness, t_h	0.301	inches		
Specific Gravity of contents of tank, SG	1.000			
Depth of Cone, d	12.25	inches	1.0208	ft
S, allowable tensile stress of shell & cone	15,200	psi		
Joint Efficiency cone-to-shell & long cone joints, E_1	0.70			
Joint Efficiency shell vertical joints, E_2	0.70			
Operating Pressure at top of tank, P_o	0.00	psi	0	psf

Note that per API 620 the max. operating pressure at top of tank is 15 psig.

O.D. of connection at bottom of cone (if none enter 0)	4.50	inches

1/2 Apex angle, alpha = a	1.331679	radians	76.2996	degrees		
Total Pressure, P at plane AA	748.80	psf (includes hydrostatic head + P_o)			5.20	psi

Plane AA is at the Spring Line.

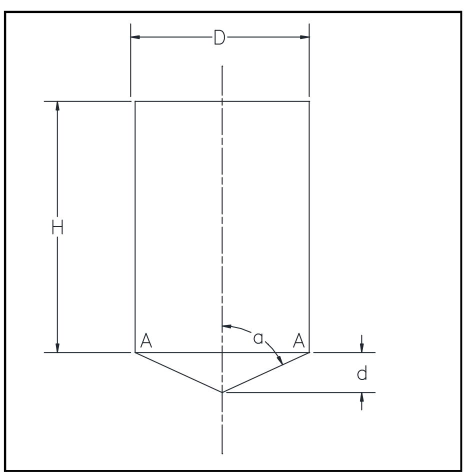


Figure No. A1

1) Shell Unit Forces @ Plane AA, See Figure No. A2

Sum F_x = 0

$2T_{2s}$ = PD

T_{2s} = PD/2

T_{2s} = 273 lb/in

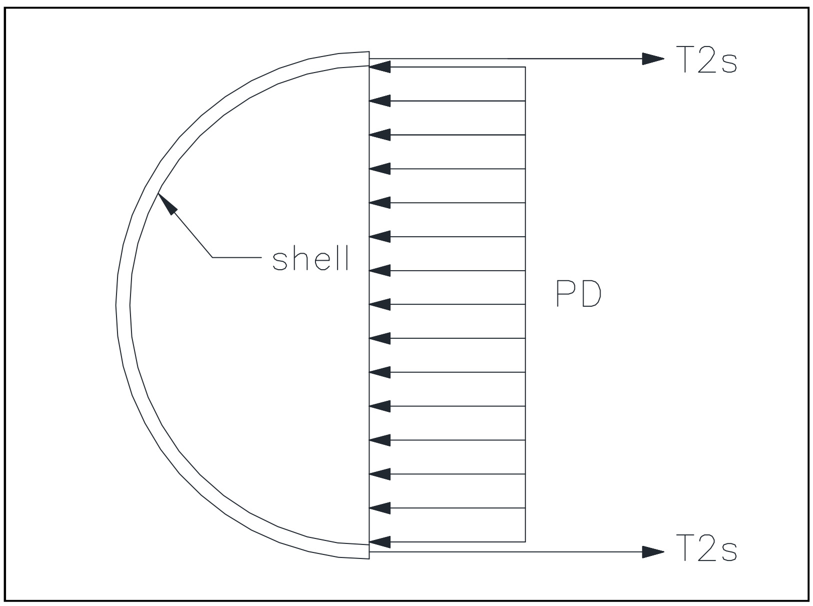


Figure No. A2

2) Cone unit force, T_2, the latitudinal unit force. Also known as the circumferential unit force. See Figure No. A3

R_2, radius of curvature of cone at A

R_2 = AB/cos(a)

R_2 = 221.664 inches

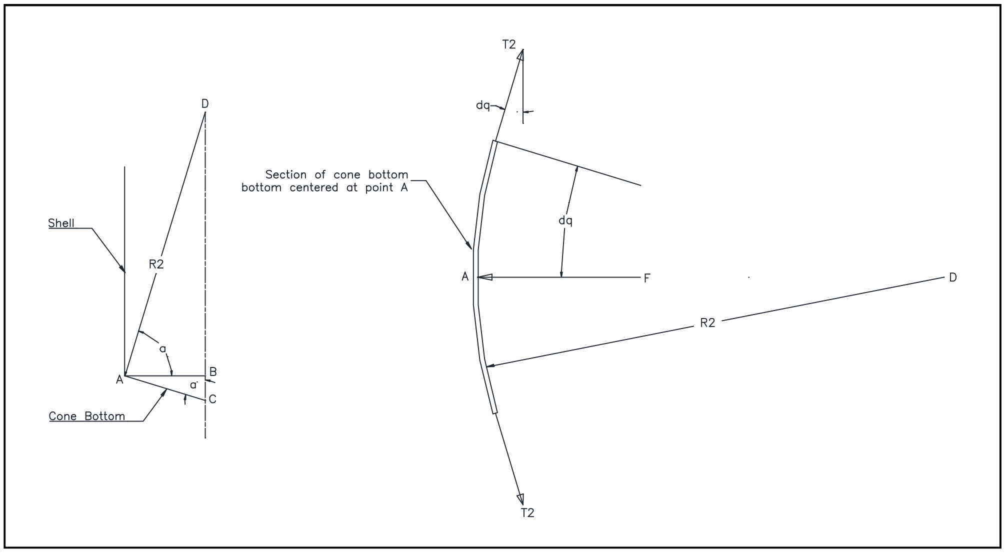


Figure No. A3

Sum of $F_x = 0$

F = the force on 1 inch wide section	$F - 2T_2 * \mathrm{Sin}(dq) = 0$
of cone at point A with an infinitesimal	$2PdqR_2 = 2T_2\mathrm{Sin}(dq)$ and for small dq, Sin(dq) = dq
arc length = 2 x dq	$PR_2 = T_2$
$F = P(1)(2)(dq)(R_2)$	$T_2 = PR_2$
$F = 2PdqR_2$	$T_2 =$ 1153 lb/in

3) Cone unit force, T_1, the Meridional unit force. See Figure No. A4

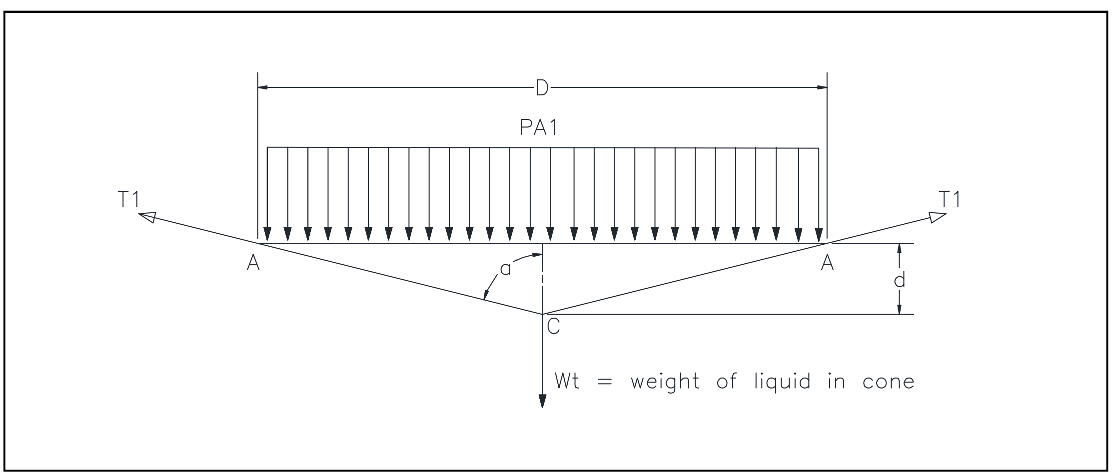


Figure No. A4

A_1 = PI/4 * D^2

A_1 =	8659.015	square inches	60.13205	square feet

V, Volume of Cone = (PI*D/2*D/2*d)/3

V = 20.461599 ft^3

W_t = SG* 62.4 lb/ft^3 * V

W_t = 1,277 lb

Sum F_y = 0

T_1Cos(a)PI*D - W_t -PA_1 =0

T_1 = (W_t + PA_1)/Cos(a)PI*D

T_1 = 593 lb/in

4) Knuckle Region Reinforcement Check per API 620 3.12

The measured cone bottom thickness is defined as t_h here, t_h =	0.301	inches
The measured shell thickness is defined as t_c here, t_c =	0.180	inches
R_2, radius of curvature of cone at A =	221.66	inches
R_c, radius of curvature shell =	52.5	inches

w_h = 0.6* sqrt(R_2 *t_h)

w_h = 4.900971 inches

w_c = 0.6* sqrt(R_c *t_c)

w_c = 1.844451 inches

Additional attached reinforcement area Ad

Ad = $\boxed{1.1875}$

Available reinforcing area, A_a = w_h*t_h + w_c*t_c+Ad

A_a = 2.994693 sq inches

T_1 =	593	lb/in
T_{2s} =	273	lb/in
T_2 =	1153	lb/in

Per API 620, the magnitude of the total circumferential force acting on any vertical cross section through the compression ring region shall be computed as follows:

Q = T_2w_h + $T_{2s}w_c$ -T_1R_cSin(a) Note that if Q is negative, compression is indicated.

Q = 5,649 + 504 - 30,230

Q = -24,077

A_c, the required compression ring reinforcing area = Q/15,000

A_c = 1.605145 sq. inches

A_a > Ac

2.994693	>	1.6051447	TRUE

and since Q is negative the following condition must be true also.

w_hSin(a)	>	0.015 * R_c	
4.761526	>	0.7875	TRUE

Since both conditions are true, knuckle region is adequately reinforced.

5) Check Measured Shell Thickness vs Required Shell Thickness

The required shell thickness is $t_{cr} = T_{2s}/SE_2$

0.025658 However, thickness must be at least 0.100" per API 653, so final required shell thickness is 0.100

t_c	>	t_{cr}	
0.180	>	0.100	TRUE

6) Check Measured Cone Bottom Thickness vs Required Cone Bottom Thickness at Plane A-A

The required cone thickness, t_{hr}, is the greater of the following 2 formulas

$t_{hr} = T_1/SE_1$ or $t_{hr} = T_2/SE_1$

t_{hr} = 0.055702 t_{hr} = 0.108332

t_{hr} = 0.108332 However, thickness must be at least 0.100" per API 653, so final required cone bottom thickness is: t_{hr} = 0.108 inches

t_h	>	t_{hr}	
0.301		0.108	TRUE

7) Tank Volume or Capacity Calculation

V_{total} = Volume of Cone + Volume of Shell

20.4616 ft^3 + (PI/4) *D^2*H

20.4616 + 721.5846

V_{total} = 742 ft^3 or 5,551 gallons

5.2 Seismic Calculations

SEISMIC ANALYSIS
For Tank Supported above grade on legs

1) Input Data

Tank Location			Keyport, WA		
Tank no.			K1051-101		
dia, D			8.75	ft	
shell height, Ht			12	ft	
fill height, H			12	ft. This is height from top liquid surface to bottom of tank.	
floor thk			0.295	in	
roof thk			0.187	in	
slope roof, ϑ	0.062418	radians	3.5763	degrees	This is standard slope of 3/4" in 12".
shell thk, t			0.189	in	
sg liquid, G			1.000		
density steel			490	lb/sq ft	
Proportion of roof supported by shell			1	1 indicates 100%.	
Seismic zone factor, Z			0.300	See fig E-1 & Table E-2	
Importance Factor			1.00	See E.3.1	
Site coefficient			1.5	See table E-3	
Lateral force coefficient, C1			0.6		
For cone bottom supported above the grade, the depth of cone, Xb			1.1666	feet	
Height, L that shell sup above grade			2.17	feet	
Height from bottom of tank to grade, m			1.0034	feet	
b, the width of the base			7.5	feet	
Slope floor, a	0.260588	radians	14.9306	degrees	
1/2 apex angle of cone floor =			1.310208	radians	75.0694 degrees
		Radius	4.375	ft	
		D/H	0.7292	The diameter/fill height ratio from above	

2) Weights

a) Shell

Plate Area	330	sq ft
plate weight/sq ft	7.718	lb/sq ft
weight shell plate	2,546	lb
misc shell weight	200	lb

Total shell weight	2,746	lb

b) Roof

no. Rafters	0	
length rafters	0	
Type of rafter (shape)		
lb/ft rafters	0	lb/ft
weight rafters	0	lb

Plate Area = PI*(r/cos(ϑ))^2

Plate Area	60.37	sq ft
plate weight/sq ft	7.636	lb/sq ft
Plate weight	461	lb
snow load	0	lb
misc weight	100	lb
Total Roof weight, Wr	561	lb

c) Cone Bottom

Plate Area = PI*(r/cos(gamma))^2

Plate Area	64.41	sq ft
plate weight/sq ft	12.046	lb/sq ft
Plate weight	776	lb
misc weight	100	lb
Bottom weight,Wb	876	lb

3) Determination of Additional Seismic Inputs

Natural period of 1st sloshing mode, T

T = k* sq root (D)		For D/H =	0.73	k =	0.58	from Figure E-4
T	1.716	seconds		S =	1.5	from table E-3

Is T < 4.5s? true, so C2=0.75S/T

C2 = 0.75S/T

C2 0.656

W1 & W2

D/H = 0.73

The weight of liquid, Wt

Wtshell = pi/4*D^2*62.4*sg*Ht

3,752 x Ht

Wtshell = 45,027 lb

Wtcone = ((pi*r^2*depth of cone)/3)*62.4*sg

Wtcone = 1,459 lb

Wt = Wtshell + Wtcone

Wt 46,486 lb

W1 = Wt*W1/Wt		W1/Wt =	0.820	from fig E-2
W1	38,119	lb		
W2		W2/Wt =	0.160	from fig E-2
W2	7,438	lb		

X1 & X2

X1/H =	0.42	from fig E-3
X1=	5.04	ft
X2/H =	0.76	from fig E-3
X2	9.12	

Xs = height from cg of shell to bottom of tank = 7.1666 feet

4) Calculation of Overturning Moment, M

M = Z*I*(C1*Ws*Xs'+C1*Wr*Ht'+C1*Wb*Xb'+C1*W1*X1'+C2*W2*X2') ft lb

m	1.0034	see above
Z	0.3	see above
I	1	see above
C1	0.6	see above
C2	0.656	see above
Ws	2,746	shell weight
Xs'	8.17	the height from grade to Fs
Wr	561	roof weight
Wb	876	bottom weight
Xb'	2	the height from the grade to Fb
Ht'	14.17	the height from grade to Fr
W1	38,119	effective weight of liquid responsible for impulse force
X1'	6.04	the height from the grade to F1
W2	7,438	effective weight of liquid responsible for sloshing or convective force of liquid.
X2'	10.12	the height from the grade to F2

Z*I =	0.3			
C1*Ws*Xs'=	13,460	Lateral Force, Fs =	494	Impulse force of tank shell
C1*Wr*Ht'=	4,769	Lateral Force, Fr =	101	Impulse force of tank roof
C1*W1*X1'=	138,219	Lateral Force, F1 =	6,861	Impulse force of liquid
C1*Wb*Xb' =	158	Lateral Force, Fb =	158	Impulse force of tank bottom
C2*W2*X2'=	49,373	Lateral Force, F2 =	1,463	Convective, or sloshing force

				of the liquid	
M=	61,794	ft lb	Total Lateral Force, Ft =	9,077	lb

5) Check Stability of Tank:

The resisting Moment is Mr = (weight of tank + the weight of fluid) x 1/2 of the base width

weight of tank =	4,183	lb
weight of liquid =	46,486	lb
width of base =	7.5	ft

Mr = 190,007 ft-lb

Safety Factor for overturning =	Mr/M		
Safety Factor for overturning =	**3.07**	**> 1.5**	**O.K., Tank is stable**

Note that if a tank is found to be unstable that indicates that tank anchors are needed to resist the uplift forces at the base plate to grade interface that will occur during an earthquake. An unstable tank is susceptible to tipping during an earthquake.

6) Check Need for Anchors Due Solely to Lateral Loads

Total weight of liquid	46,486	lb	
Total weight of tank	4,183	lb	
Total weight, W	50,669	lb	
Coefficient of friction =	0.030	Between steel & ice, the worst possible case.	

Frictional Force resisting the total lateral force = W*coefficient of static friction between base plates & grade

Ff = 1,520

Is Ff > Ft * 1.5 **Not true, therefore anchors are needed for lateral seismic forces**

The shear force on each bolt, assuming 4 anchor bolts are used is = 2,269 lb

The anchors should be sized and designed to provide at least this much strength plus a safety margin and a corrosion allowance for the bolts.

7) Check Vertical Forces at Anchor Points
Both Seismic and Dead Load.

Vertical Load, P =	W =	-50,669	lb, this force is given a negative sign to indicate a downward
N, number of anchor locations =		4	direction.
For 4 anchor points, I =4*(b/2)^2 =		56.250	sq ft.
c =		3.750	ft

Max anchor forces, F = P/N + - Mc/I

Mc/I =	4,120	lb		
F =	-8,548	lb	If negative that indicates a downward force and	
and F =	-16,787	lb	no tension in anchor bolt.	

Foot print size of 1 base plate = 100 sq inches

Bearing stress = F/footprint area = 167.9 psi

Allowable compressive strength of
the foundation under the base plates = 1,500 psi, the foundation is concrete, and the concrete is assumed to have at least this strength.

Safety factor
= 1,500 divided by 167.9 = 8.94

Safety Factor = 8.94 > 1.5 O.K., Foundation strength is acceptable

6.0 Ultrasonic Thickness Data

6.1 Shell Plates UT

The following table details all readings (in) from the shell UT survey.

Data and Statistics		1	2	3	4	*Readings Line Average*
Course 2	4	0.180	0.181	0.180	0.179	0.180
	3	0.182	0.181	0.181	0.180	0.181
	2	0.180	0.180	0.182	0.181	0.181
	1	0.182	0.181	0.180	0.179	0.181
Course 1	4	0.184	0.184	0.184	0.184	0.184
	3	0.184	0.182	0.185	0.181	0.183
	2	0.183	0.184	0.185	0.181	0.183
	1	0.184	0.183	0.182	0.180	0.182
Scan Line Average		0.182	0.182	0.182	0.182	0.182

The tables below presents the statistics of the thickness readings (in) obtained on the Shell plates.

Course #	Min	Avg	Max
2	0.179	0.181	0.182
1	0.180	0.182	0.185
Global	0.179	0.182	0.185

6.2 Cone Bottom Plates UT

The following table details all readings (in) obtained on the Fixed Roof plates.

Plate ID \ Reading ID	1	2	3	4	*Avg*
North	0.302	0.302	0.304	0.303	0.303
South	0.305	0.304	0.305	0.305	0.305
West	0.302	0.302	0.302	0.302	0.302
East	0.302	0.302	0.302	0.302	0.302
Avg	0.303	0.303	0.303	0.303	0.303

The table below presents the statistics of the thickness readings obtained on the roof plates.

UT Summary	
Maximum	0.305
Average	0.303
Minimum	0.302

6.3 Fixed Roof Plate UT

The following table details all readings (in) obtained on the Fixed Roof plates.

Plate ID \ Reading ID	1	2	3	4	*Avg*
North	0.183	0.183	0.185	0.184	0.183
South	0.183	0.183	0.184	0.184	0.184
West	0.186	0.185	0.184	0.185	0.185
East	0.185	0.183	0.183	0.183	0.184
Avg	0.184	0.184	0.183	0.184	0.184

The table below presents the statistics of the thickness readings obtained on the roof plates.

UT Summary	
Maximum	0.186
Average	0.184
Minimum	0.183

6.4 Shell Nozzle and Appurtenance Table

Item	Type	Service	Pipe Size (in)	Station (ft)	Center Line Elevation (ft)	Distance From Shell to Flange Face (in)
A	Manway	Access	24.0	0	20.5	5.875
B	Nozzle	Transfer	3.0	9.1	135.0	7.0
C	Nozzle	Transfer	2.0	18.2	129.0	6.75
D	Nozzle	Transfer	2.0	23.0	129.0	7.0
E	Nozzle	Bottom Draw	2.0	--	--	N/A

Note: The data represented in the weld spacing column is the minimum spacing measured. H, V, or N indicates which is the minimum distance from the nozzle measured. (H=Horizontal Weld, V=Vertical Weld, N=Nozzle Weld)

6.5 Shell Nozzle UT

Item	Type	Service	Pipe Size (in)	Top (in)	Bottom (in)	Right (in)	Left (in)	Repad Thickness (in)	Flange Thickness (in)	Cover Thickness (in)	Comments
A	Manway	Access	24.0	0.244	0.240	0.242	0.242	--	0.444	0.486	
B	Nozzle	Transfer	3.0	0.220	0.219	0.212	0.211	--	0.950	--	
C	Nozzle	Transfer	2.0	--	--	--	--	--	--	--	
D	Nozzle	Transfer	2.0	0.149	0.151	0.150	0.154	--	0.749	--	
E	Nozzle	Bottom Draw	2.0	0.285	0.254	0.252	0.247	--	--	--	SS

6.6 Fixed Roof Nozzle UT

Item	Type	Service	Pipe Size (in)	North (in)	South (in)	East (in)	West (in)	Comments
AA	Hatch	Access	22.0 x 22.0	0.243	0.241	0.243	0.243	
AB	Nozzle	Vent	4.0	0.207	0.210	0.210	0.208	
AC	Nozzle	HLA	4.0	0.210	0.210	0.210	0.208	

7.0 Shell Corrosion Rates

Course	$t_{previous}$ Previous Thickness (in)	Year Obtained	t_{actual} Actual Thickness (in)	Year Obtained	C_r Corrosion Rate (in/yr.)	t_{min} Minimum Allowable Thickness (in)	R_L Remaining Life (yr.)
2	0.188	1994	0.179	2020	0.00033	0.100	239.69
1	0.188	1994	0.180	2020	0.00031	0.100	257.89

8.0 Photographs

Dike area standoff

Tank label

Data Plate

Manway A

Nozzle B

Ground

Nozzle C	Nozzle D
	
Bottom Drain E	Tank Support (Typ.)
	
Tank Roof	Tank Roof
	

Area Standoff	Roof Standoff
	

9.0 NDE Equipment Used

The equipment utilized for the inspection of the tank included of the following :

Pit Gauge

Manufacturer	Model	Serial No
W.R. Thorpe	1	1.979.912

Ultrasonic Transducers

Manufacturer	Model	Serial No	MHz	Diameter
Olympus	D790-SM	865199	5	0.375

UT Equipment

Manufacturer	Model	Serial No
Olympus	38DL Plus	130573601
Olympus	304 SS	0743-07

10.0 Inspector Certifications

AMERICAN PETROLEUM INSTITUTE
Individual Certification Programs: ICP™

API Individual Certification Programs

verifies that

Michael Alec Arpino

has met the requirements for API certification

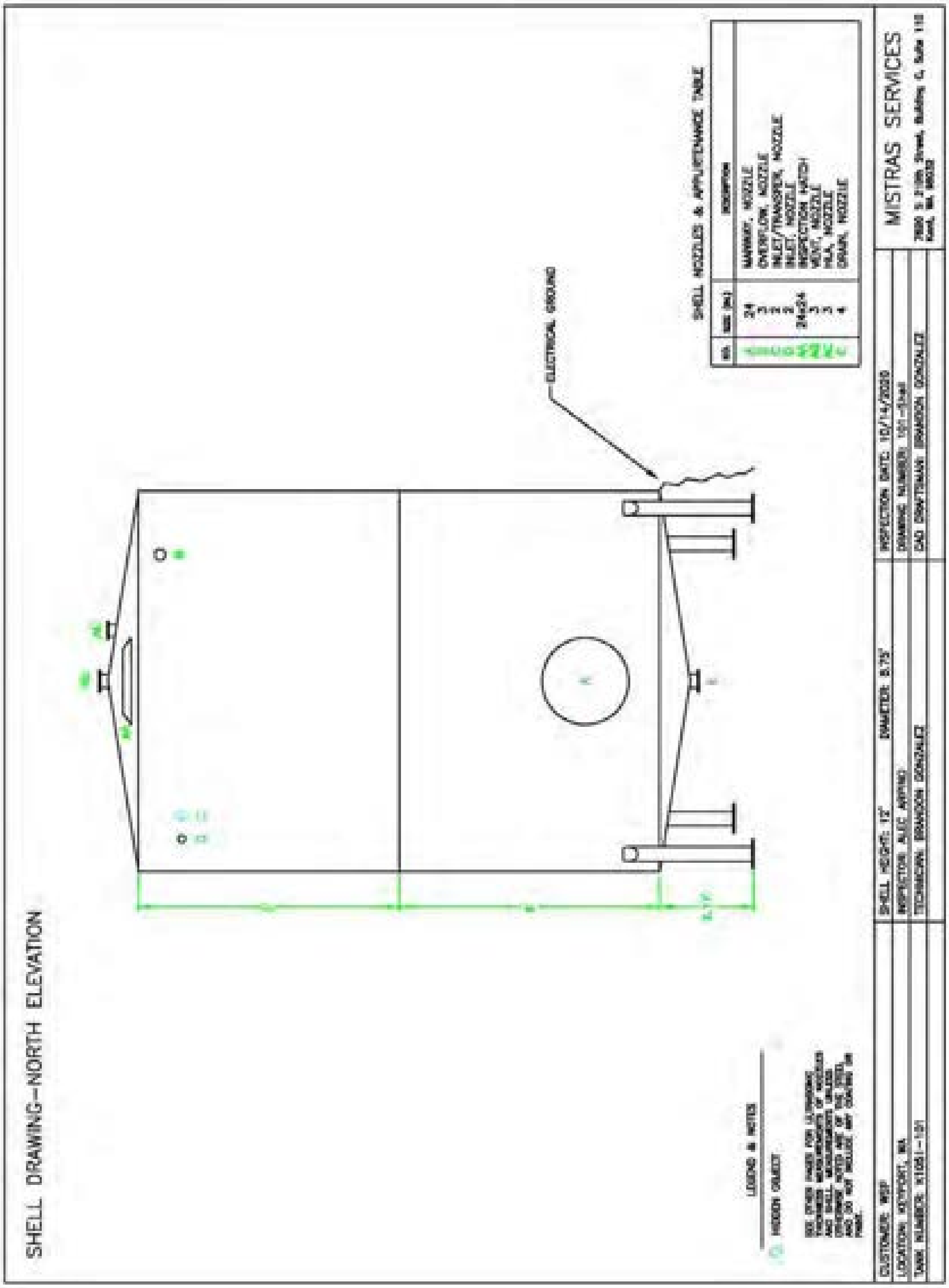
API-653 Aboveground Storage Tank Inspector

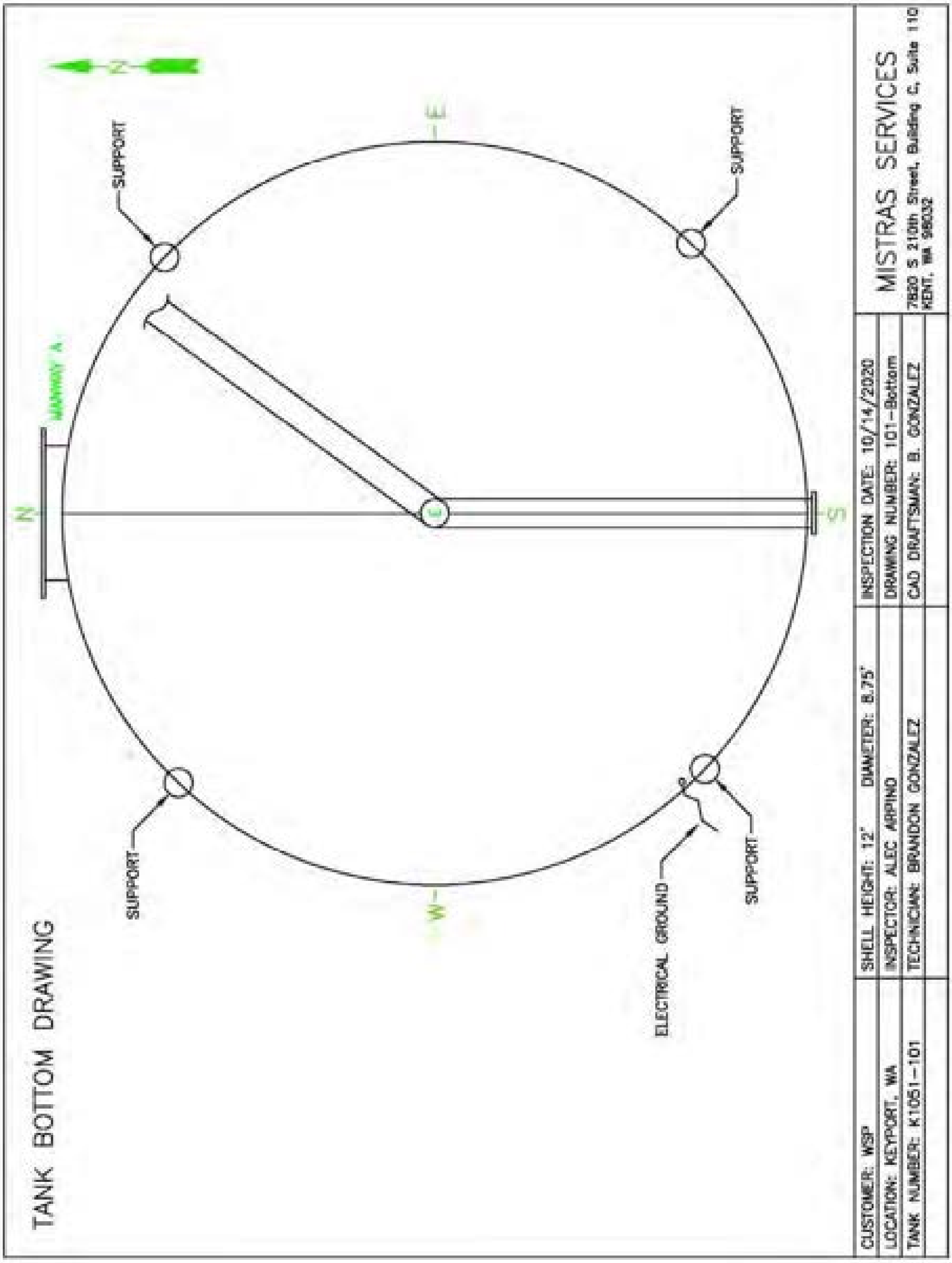
Certification Number	77549
Original Certification Date	December 31, 2017
Current Certification Date	December 31, 2017
Expiration Date	December 31, 2020

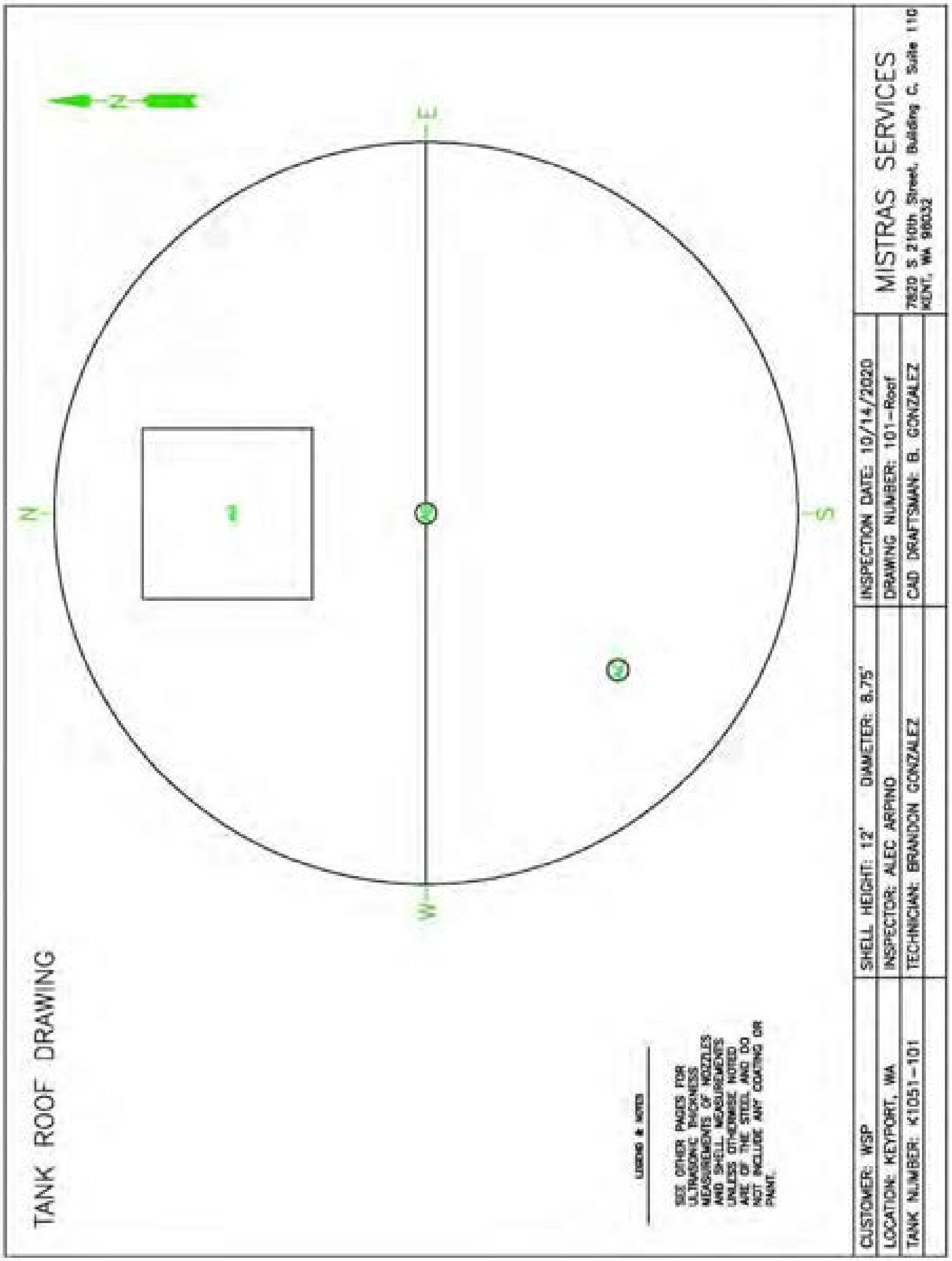
Manager, Individual Certification Programs

ICP

11.0 Drawings




TANK BOTTOM DRAWING
N
E
S
W
SUPPORT
SUPPORT
SUPPORT
SUPPORT
MANWAY A
E
ELECTRICAL GROUND
CUSTOMER: WSP
LOCATION: KEYPORT, WA
TANK NUMBER: K1051-101
SHELL HEIGHT: 12'
DIAMETER: 8.75'
INSPECTOR: ALEC ARPINO
TECHNICIAN: BRANDON GONZALEZ
INSPECTION DATE: 10/14/2020
DRAWING NUMBER: 101-Bottom
CAD DRAFTSMAN: B. GONZALEZ
MISTRAS SERVICES
7620 S 210th Street, Building C, Suite 110
KENT, WA 98032


TANK ROOF DRAWING
N
E
S
W
1
LEGEND & NOTES
SEE OTHER PAGES FOR ULTRASONIC THICKNESS MEASUREMENTS OF NOZZLES AND SHELL. MEASUREMENTS UNLESS OTHERWISE NOTED ARE OF THE STEEL AND DO NOT INCLUDE ANY COATING OR PAINT.
CUSTOMER: WSP
LOCATION: KEYPORT, WA
TANK NUMBER: K1051-101
SHELL HEIGHT: 12' DIAMETER: 8.75'
INSPECTOR: ALEC ARPINO
TECHNICIAN: BRANDON GONZALEZ
INSPECTION DATE: 10/14/2020
DRAWING NUMBER: 101-Roof
CAD DRAFTSMAN: B. GONZALEZ
MISTRAS SERVICES
7820 S 210th Street, Building C, Suite 110
KENT, WA 98032

12.0 Appendix A – References

References:

1) Washington State Department of Ecology, Dangerous Waste Regulations, Chapter 173-303 WAC
2) Conversations with the client
3) API RP 652, Lining of Above Ground Petroleum Storage Tanks
4) API RP 651, Cathodic Protection of Above Ground Storage Tanks
5) API Guide for the Inspection of Refinery Equipment – Chapter 13, Atmospheric and Low Pressure Tanks
6) API Standard 650, Welded Steel Tanks for Oil Storage
7) API Standard 653, Tank Inspection, Repair, Alteration, and Reconstruction
8) API Standard 620, Design and Construction of Large, Welded, Low Pressure Storage Tanks

APPENDIX D

INSPECTION REPORT TANK K1051-102

WSP

Naval Undersea Warfare Center

Tank K1051-102

In Service Inspection

Above Ground Storage Tank Inspection Report

In accordance with
WAC 173-303-640
Dangerous Waste
Regulations

WSP

Tank K1051-102

In Service Inspection

Keyport, WA

October 14, 2020 to October 14, 2020

Report Number 40865710-4

Prepared By :
7820 South 212th St. St. 110
Kent, WA, 98032

www.mistrasgroup.com

MISTRAS A World of NDT Solutions Services Division

Inspection Date
October 14, 2020

Table of Contents

1.0 Job Information

Job Location :	**Naval Undersea Warfare Center**
	610 Dowell Street
	Keyport, WA
	98345-7610
Customer Representative :	Grace Roberts
Customer Phone Number :	206-431-2295
Job Charge Number :	N44255-15-D-0011
Report Number :	40865710-4
Mistras Work Order Number :	T67726-40865710
Inspection Personnel Provided :	Alec Arpino
	API 653 Certified Inspector
	API 653 (77549)/UTT/MT
	Brandon Gonzalez
	Level II Technician
	MFL/UTT/PT

2.0 Tank Inspection Data Sheet

General :

Tank Number	K1051-102
Owner	U.S. Navy
Design Standard	Unknown
Tank Location	Keyport, WA
Product	Otto Fuel/ Alcohol
Specific Gravity	1.0
Manufacturer	Flohr Metal Fabrication
Manufacture Date	1994
Cathodic Protection	No
Data Plate Present	Yes
Data Plate Condition	Good Condition

Dimensions :

Diameter (ft)	8.75
Height (ft)	13.02
Capacity Nominal (Gallons)	5,551

Geometry :

Foundation	Concrete Pad with Steel Support Legs
Bottom	Cone Down
Shell	Butt Welded
Fixed Roof Type	Self-Supported Cone

Access :

Stairway	None
Roof Access	Yes

Coatings :

Bottom	Internal Thin Film Epoxy
Shell	External White
Roof	External White

3.0 Suitability for Service

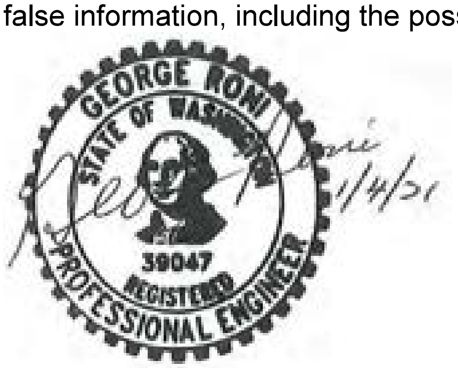
WSP on behalf of the U.S. Navy has contracted Mistras Group, Inc. to perform a in service inspection on Tank K1051-102 located in Building 1051 of the Naval Undersea Warfare Center located in Keyport, WA. This inspection was performed in accordance with the current criteria set forth in WAC 173-303-640 Dangerous Waste Regulations.

There were no issues found that would require repair at this time. The Navy should continue with routine maintenance and observation of the tank. The next formal WAC 173-303-640 inspection should be conducted per the established schedule which is 5 years per the current SPCC Plan for this site.

Tank K1051-102 can be considered suitable for continued service.

<u>TANK CERTIFICATION</u>

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."[1]



George Roni, P.E.

1) Per WAC 173-303-810 as required by WAC 173-303-640 (2)

4.0 Inspection Findings

WSP on behalf of the U.S. Navy has contracted Mistras Group, Inc. to perform an in Service Inspection on Tank K1051-102 located in Keyport, WA. This inspection was performed in accordance Washington State Dangerous Waste Regulations WAC 173-303-640 (2).

Tank K1051-102 is a shop built 2 course Above Ground Storage Tank in Otto Fuel/ Alcohol service. This tank is 8.75 feet in diameter, and 13.02 feet in height and is equipped with a Fixed Cone Roof. The following details all inspection findings.

Foundation

This tank was installed on a concrete pad. The tank is elevated above the concrete pad by (4) 4 inch steel pipe support legs. Each support leg has an 8” X 8” X 1/2” steel pad at the base that is anchored to the concrete foundation via (4) 1/2 inch anchor bolts. The anchor bolts are embedded into the concrete foundation and secured at the top of the plate.

The steel pipe support legs showed no evidence of dents, deformations, corrosion, pitting or other visible damage. The concrete at the base of each leg showed no evidence of cracking, spalling or broken concrete. The supports, footings, the anchor nuts and bolts are all coated. No coating failure or oxidation was noted.

The anchor system was found to be secure and in serviceable condition. There was no evidence of elongation, corrosion, pitting or damage to the steel pads or the anchor nuts and bolts.

The tank sits within a below grade epoxy lined concrete vault. The vault appeared to structurally sound and showed no evidence of cracking, spalling or broken concrete. It appears that epoxy coating had been previously repaired at various locations around the vault. The repaired areas and the rest of the epoxy coating appeared well adhered and fluid tight.

The volume of the containment is large enough to contain the entire volume of the tank in the event of leaks or catastrophic failure, which is also in compliance with WAC 173-303-640.

Cone Bottom

The cone bottom in Tank K1051-102 is made up of 2 plates. The nominal floor plate thickness is 0.3125 inches. The lowest UT reading found was 0.309.

The exterior surfaces of the tank showed no evidence of leaks from the plates, the plate to plate weld seams or the bottom to shell weld. There was no evidence of active corrosion, pitting or coating failure occurring on the plates or welds of the bottom. There was no evidence of dents, bulges or other deformations noted on the bottom plates.

At the apex of the bottom there is a 4 inch stainless steel nipple welded to the tank that reduces to a 2” line. There was no evidence of leaks from the attachment welds of the nozzle to the bottom. There was no evidence of leaks from the associated piping in the immediate area of the tank bottom attachment.

Shell

The shell on Tank K1051-102 consists of 2 courses and all joints are Butt Welded. A visual inspection and ultrasonic examination of the shell was conducted, the following details all findings.

The bottom of the shell to bottom transition has a reinforcement ring consisting of a 2-1/2 inch steel angle. The top of the reinforcement ring is fully fillet welded and the bottom is stitch welded. There is caulking in between the stitch welds along the bottom. There was no evidence of weld failures or deformations noted to the reinforcement ring.

There was no evidence of bulges, dents or abnormal deformations noted to the tank shell. There was no evidence of leaks in the shell plates, shell to shell horizontal or vertical welds, the shell to cone weld or the shell to roof weld. There was no evidence of active corrosion or pitting noted on the shell exterior.

The shell coating appeared to be in very good condition.

The shell plates were ultrasonically inspected externally to verify the remaining thickness of the shell plates. Ultrasonic thickness readings were obtained on the shell in 4 equally spaced locations at approximately 6.87 feet. Each scan was conducted in one of the 4 cardinal directions. A total of 4 readings per course were obtained.

Section 6.1 of this report details all ultrasonic thickness (UT) readings obtained, detailing the low's to highs per course. There were no abnormally low readings noted on the shell. The lowest reading of 0.183” was located on the 2nd course on the North drop.

Shell Nozzles

A visual inspection and ultrasonic examination of all accessible shell nozzles and manways was conducted to evaluate the current condition of each nozzle. Visual inspection of each nozzle included evaluation of the external neck, all attachment welds, and flange faces.

There was no evidence of leaks from the nozzle attachment welds, the flanges, the flange bolting and associated valves or nearby attached piping. There is no evidence of coating failure occurring on the nozzles or couplings.

The attached piping appears to be stainless steel and the nozzles are carbon steel. There is no evidence of galvanic reactions taking place due to the dissimilar metals. The flange faces appear to be raised and have Teflon type PTFE gasket material. The nozzle bolting appears tight and secure with proper thread engagements on the bolting.

All nozzles and manways were ultrasonically inspected (UT) by recording four readings on the top, bottom and both sides of each neck, one reading on each flange and the manway cover. There was no abnormally low thickness readings obtained. Section 6.5 details all data from UT exam.

Fixed Roof

The roof plates on Tank K1051-102 have a nominal thickness of 0.187 inches. The fixed roof plates were ultrasonically examined to determine the average remaining thickness. A total of 16 readings were obtained on the roof, four readings per each cardinal direction. There was no evidence of thinning or corrosion on the roof plates. Section 6.3 details all the data from the UT exam.

The fixed roof plates were visually inspected. All plates were evaluated to determine the condition of the external coating system. Aside from a coating of dust, the roof coating is in good condition. There was no evidence of corrosion, pitting, dents, bulges or other deformations to the roof plates.

There was no evidence of leaks in the roof plates, the roof plate to plate welds or the shell to roof weld.

Fixed Roof Nozzles

All fixed roof nozzles were visually inspected. The following details the findings from this inspection.

All roof nozzles were ultrasonically inspected to verify remaining thickness. A total of 4 readings per nozzle were obtained. All fixed roof nozzles were visually inspected.

There was no evidence of leaks from the roof nozzles attachment welds, flanges, and flange bolting, associated valves or attached piping in the immediate area around the piping.

The roof top manway cover is securely attached to the roof with a hinge pin. There was no damage noted to the pin or the cover. There is a 3 inch nozzle attached to the manway cover for the liquid level float and tape gauge system. The system was not operated but appeared to be in satisfactory condition. There was no evident damage to the 3 inch nozzle or the flange face. The manway showed no evidence of coating failure, corrosion, pitting or other damage.

The 4 inch center roof vent piping runs to outside the building. The piping goes through the East wall and appears to have a pressure/vacuum style vent attached at the end of the piping run. The vent was unable to be inspected at the time of inspection due to its location and inaccessibility. The pressure/vacuum vent appeared to be in acceptable condition from the ground with no obvious visual damage noted.

All roof nozzles were ultrasonically inspected to verify remaining thickness. A total of 4 readings per nozzle were obtained. There were no abnormally low readings noted on the roof nozzles. Section 6.6 details the data from the UT exam.

Access Ways & Handrails

The roof is accessible from a free standing ladder and catwalk system. This catwalk is used to access all the tanks inside the containment for visual inspections and gauging purposes.

The ladder and the catwalk are in acceptable condition. There was no damage noted to the ladder frame or rungs. The steps showed no signs of damage to the frame, the treads or the handrails. The catwalk showed no damage to the frame, the grating or the handrails. Much of the handrail was covered in black plastic during the inspection.

The catwalk supports are 3” X 3” square piping uprights that are anchored to the concrete by (2) 3/4 inch anchor bolts at each support location. There is 2-1/2 inch angle iron braces used as cross bracing. There were no evident weld failures, damage to the support structures, attachment hardware or the anchorage locations. The attachment hardware appears to be tight and secure. The catwalk grating is galvanized and in acceptable condition. The grating is tack welded into place. There were no signs of weld failure. There was no evidence of corrosion caused thinning or holes noted in the grating.

The 2 inch steel pipe handrails are 42 inches high at the top rail, 24 inches at the mid-rail with 4 inch toe boards. There were no signs of holes, corrosion or pitting noted in the top rail, the mid-rail or the uprights.

Miscellaneous Appurtenances

For product level gauging, this tank is equipped with a float and tape style gauging system. This unit was found to be in what appears to be visually acceptable condition with no apparent damage noted. The unit was not operated at the time of inspection.

The tank is equipped with a Delta Controls roof transponder. The unit model is an 872C-V-10-2NPT-6SE-IS-CC with a serial number of UGD9966-A2. The unit appeared in satisfactory condition with no apparent damage to the unit noted.

For electrical safety issues and lightning protection, this tank is equipped with (1) 1/2 inch braided grounding cable. The cable was found to be satisfactory condition. The cable is attached to the reinforcement ring on one end and attached to a grounding bar that is embedded into the concrete foundation.

Inspectors Signature:

M. Alec Arpino
API 653
Certification No. 77549 Exp. 12/31/2023

Reviewed by:

George Roni

George Roni, PE
API 653 Cert. No. 2042, Exp. 4/30/2023

Mistras Services has evaluated the condition of this tank based on the observations and measurements made by the tank Inspector. While our evaluation accurately describes the condition of the tank at the time of inspection, the tank owner/operator must independently assess the inspection information/report provided by Mistras Services and any conclusions reached by the tank owner/operator and any action taken or omitted to be taken are the sole responsibility of the owner/operator. With respect to inspection and testing, Mistras Services warrants only that the services have been performed in accordance with accepted industry practice. If any such services fail to meet the foregoing warranty, Mistras Services shall re-perform the service to the same extent and on the same conditions as the original service.

The preceding paragraph sets forth the exclusive remedy for claims based on failure or of defect in materials or services, whether such claim is made in contract or tort (including negligence) and however instituted, and, upon expiration of the warranty period, all such liability shall terminate. The foregoing warranty is exclusive and in lieu of all other warranties, whether written, oral, implied or statutory. NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE SHALL APPLY, nor shall Mistras Services be liable for any loss or damage whatsoever by reason of its failure to discover, report, repair or modify latent defects or defects inherent in the design of any tank inspected. In no event, whether a result of breach of contract, warranty or tort (including negligence) shall Mistras Services be liable for any consequential or incidental damages including, but not limited to,

5.0 Calculations
5.1 Thickness Calculations

Calculations for Shell & Cone-Shaped Tank Bottom - per API 620

Date of Inspection:	10/14/2020				
Owner		NUWC			
Tank No.		K1051-102			
Diameter, D		8.750	ft	105.00	inches
Shell Height, H		12.000	ft	144.00	inches
Fill Height		12.000	ft	144.00	inches
Original Shell thickness		0.188	inches		
Measured Shell thickness, t_c		0.184	inches		
Original Cone thickness		0.313	inches		
Measured Cone thickness, t_h		0.309	inches		
Specific Gravity of contents of tank, SG		1.000			
Depth of Cone, d		12.25	inches	1.0208	ft
S, allowable tensile stress of shell & cone		15,200	psi		
Joint Efficiency cone-to-shell & long cone joints, E_1		0.70			
Joint Efficiency shell vertical joints, E_2		0.70			
Operating Pressure at top of tank, P_o		0.00	psi	0	psf

Note that per API 620 the max. operating pressure at top of tank is 15 psig.

O.D. of connection at bottom of cone (if none enter 0)		4.50	inches			
1/2 Apex angle, alpha = a	1.331679	radians	76.2996	degrees		
Total Pressure, P at plane AA	748.80	psf (includes hydrostatic head + P_o)			5.20	psi

Plane AA is at the Spring Line.

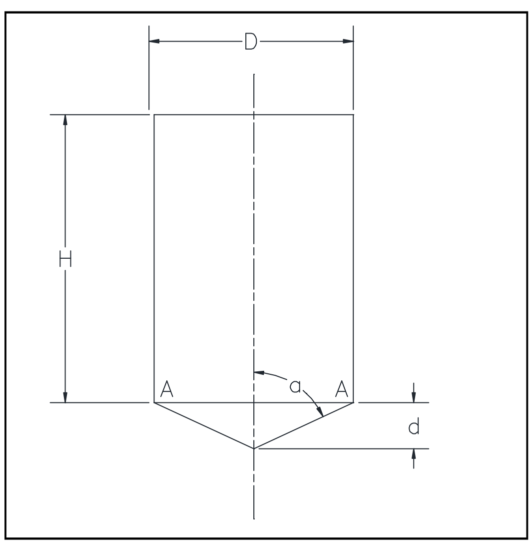


Figure No. A1

1) Shell Unit Forces @ Plane AA, See Figure No. A2

Sum $F_x = 0$

$2T_{2s} = PD$

$T_{2s} = PD/2$

$T_{2s} =$ 273 lb/in

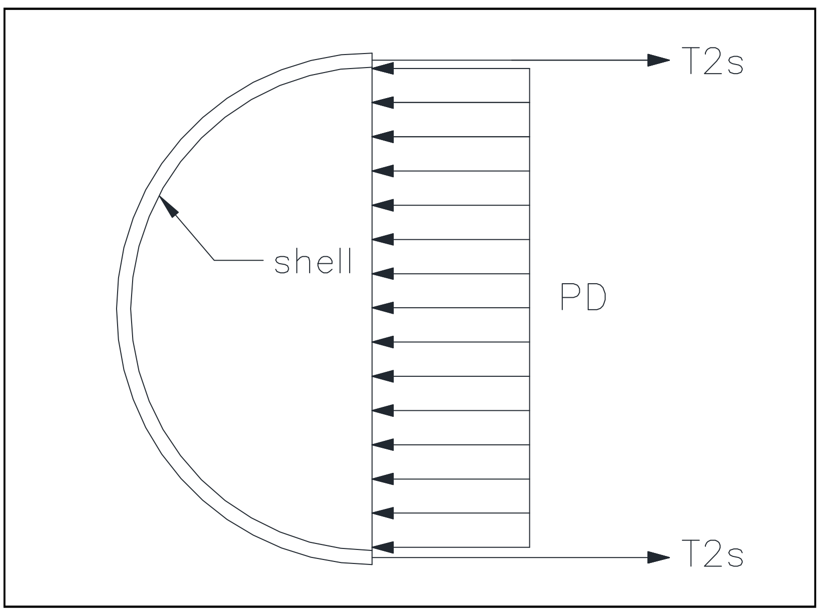


Figure No. A2

2) Cone unit force, T_2, the latitudinal unit force. Also known as the circumferential unit force.
See Figure No. A3

R_2, radius of curvature of cone at A

$R_2 = AB/\cos(a)$

$R_2 =$ 221.664 inches

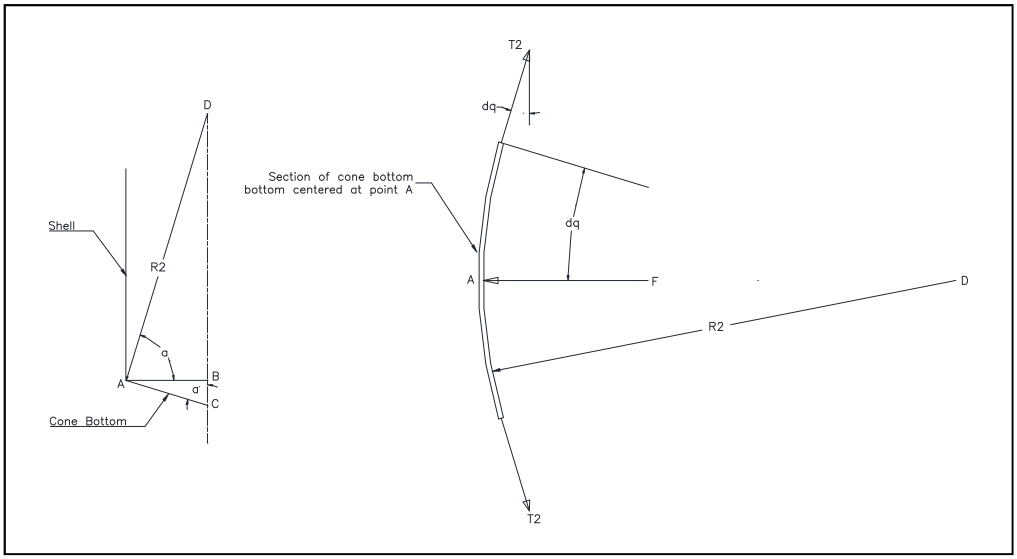


Figure No. A3

Sum of $F_x = 0$

F = the force on 1 inch wide section	$F - 2T_2 \cdot Sin(dq) = 0$
of cone at point A with an infinitesimal	$2PdqR_2 = 2T_2Sin(dq)$ and for small dq, Sin(dq) = dq
arc length = 2 x dq	$PR_2 = T_2$
$F = P(1)(2)(dq)(R_2)$	$T_2 = PR_2$
$F = 2PdqR_2$	$T_2 =$ 1153 lb/in

3) Cone unit force, T_1, the Meridional unit force. See Figure No. A4

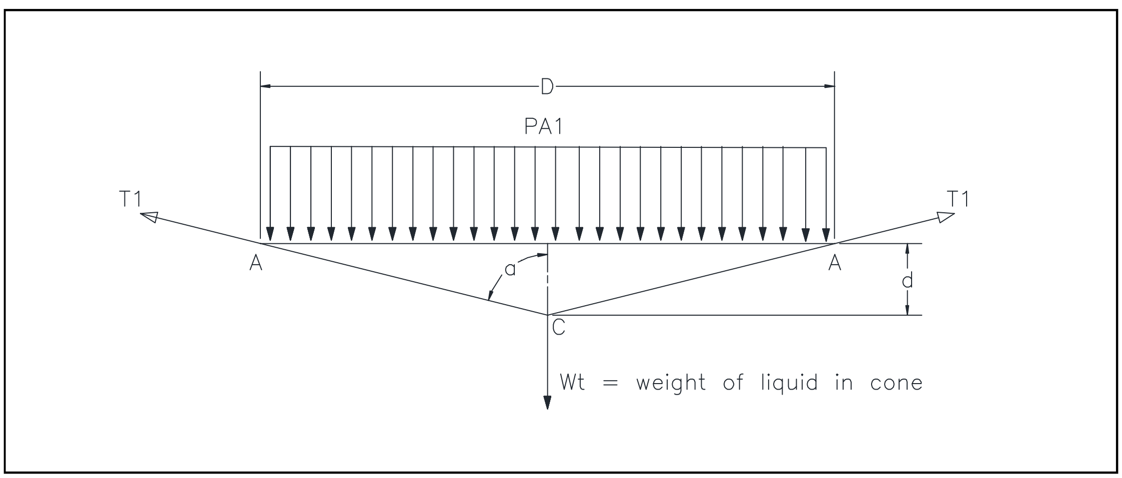


Figure No. A4

A_1 = PI/4 * D^2

A_1 = 8659.015 square inches 60.13205 square feet

V, Volume of Cone = (PI*D/2*D/2*d)/3

V = 20.461599 ft^3

W_t = SG* 62.4 lb/ft^3 * V

W_t = 1,277 lb

Sum F_y = 0

T_1Cos(a)PI*D - W_t -PA_1 =0

T_1 = (W_t + PA_1)/Cos(a)PI*D

T_1 = 593 lb/in

4) Knuckle Region Reinforcement Check per API 620 3.12

The measured cone bottom thickness is defined as t_h here, t_h = 0.309 inches

The measured shell thickness is defined as t_c here, t_c = 0.184 inches

R_2, radius of curvature of cone at A = 221.66 inches

R_c, radius of curvature shell = 52.5 inches

w_h = 0.6* sqrt(R_2 *t_h) w_c = 0.6* sqrt(R_c *t_c) Additional attached

w_h = 4.965673 inches w_c = 1.864832 inches reinforcement area Ad

Ad = $\boxed{1.1875}$

Available reinforcing area, A_a = w_h*t_h + w_c*t_c+Ad

A_a = 3.065022 sq inches

T_1 = 593 lb/in

T_{2s} = 273 lb/in

T_2 = 1153 lb/in

Per API 620, the magnitude of the total circumferential force acting on any vertical cross section through the compression ring region shall be computed as follows:

Q = T_2w_h + $T_{2s}w_c$ -T_1R_cSin(a) Note that if Q is negative, compression is indicated.

Q = 5,724 + 509 - 30,230

Q = -23,997

A_c, the required compression ring reinforcing area = Q/15,000

A_c = 1.599802 sq. inches

A_a > Ac

3.065022	>	1.5998018	TRUE

and since Q is negative the following condition must be true also.

w_hSin(a)	>	0.015 * R_c	
4.824387	>	0.7875	TRUE

Since both conditions are true, knuckle region is adequately reinforced.

5) Check Measured Shell Thickness vs Required Shell Thickness

The required shell thickness is $t_{cr} = T_{2s}/SE_2$

0.025658 However, thickness must be at least 0.100" per API 653, so final required shell thickness is 0.100

t_c	>	t_{cr}	
0.184	>	0.100	TRUE

6) Check Measured Cone Bottom Thickness vs Required Cone Bottom Thickness at Plane A-A

The required cone thickness, t_{hr}, is the greater of the following 2 formulas

$t_{hr} = T_1/SE_1$ or $t_{hr} = T_2/SE_1$

t_{hr} = 0.055702 t_{hr} = 0.108332

t_{hr} = 0.108332 However, thickness must be at least 0.100" per API 653, so final required cone bottom thickness is: t_{hr} = 0.108 inches

t_h	>	t_{hr}	
0.309		0.108	TRUE

7) Tank Volume or Capacity Calculation

V_{total} = Volume of Cone + Volume of Shell

20.4616 ft^3 + (PI/4) *D^2*H

20.4616 + 721.5846

V_{total} = 742 ft^3 or 5,551 gallons

5.2 Seismic Calculations

For Tank Supported above grade on legs

1) Input Data

Tank Location			Keyport, WA			
Tank no.			K1051-102			
dia, D			8.75	ft		
shell height, Ht			12	ft		
fill height, H			12	ft. This is height from top liquid surface to bottom of tank.		
floor thk			0.312	in		
roof thk			0.190	in		
slope roof, ϑ	0.062418	radians	3.5763	degrees	This is standard slope of 3/4" in 12".	
shell thk, t			0.187	in		
sg liquid, G			1.000			
density steel			490	lb/sq ft		
Proportion of roof supported by shell			1	1 indicates 100%.		
Seismic zone factor, Z			0.300	See fig E-1 & Table E-2		
Importance Factor			1.00	See E.3.1		
Site coefficient			1.5	See table E-3		
Lateral force coefficient, C1			0.6			
For cone bottom supported above the grade, the depth of cone, Xb			1.1666	feet		
Height, L that shell sup above grade			2.17	feet		
Height from bottom of tank to grade, m			1.0034	feet		
b, the width of the base			7.5	feet		
Slope floor, a	0.260588	radians	14.9306	degrees		
1/2 apex angle of cone floor =			1.310208	radians	75.0694	degrees
		Radius	4.375	ft		
		D/H	0.7292	The diameter/fill height ratio from above		

2) Weights

a) Shell

Plate Area	330	sq ft
plate weight/sq ft	7.636	lb/sq ft
weight shell plate	2,519	lb
misc shell weight	200	lb
Total shell weight	2,719	lb

b) Roof

no. Rafters	0	
length rafters	0	
Type of rafter (shape)		
lb/ft rafters	0	lb/ft
weight rafters	0	lb

Plate Area = PI*(r/cos(ϑ))^2

Plate Area	60.37	sq ft
plate weight/sq ft	7.758	lb/sq ft
Plate weight	468	lb
snow load	0	lb
misc weight	100	lb
Total Roof weight, Wr	568	lb

c) Cone Bottom

Plate Area = PI*(r/cos(gamma))^2

Plate Area	64.41	sq ft
plate weight/sq ft	12.740	lb/sq ft
Plate weight	821	lb
misc weight	100	lb
Bottom weight,Wb	921	lb

3) Determination of Additional Seismic Inputs

Natural period of 1st sloshing mode, T

T = k* sq root (D)		For D/H =	0.73	k =	0.58	from Figure E-4
T	1.716	seconds		S =	1.5	from table E-3

Is T < 4.5s? true, so C2=0.75S/T

C2 = 0.75S/T

C2 0.656

W1 & W2

D/H = 0.73

The weight of liquid, Wt

Wtshell = pi/4*D^2*62.4*sg*Ht — 3,752 x Ht

Wtcone = ((pi*r^2*depth of cone)/3)*62.4*sg

Wtshell = 45,027 lb

Wtcone = 1,459 lb

Wt = Wtshell + Wtcone

Wt 46,486 lb

W1 = Wt*W1/Wt W1/Wt = 0.820 from fig E-2

W1	38,119	lb	
W2		W2/Wt =	0.160 from fig E-2
W2	7,438	lb	

X1 & X2

X1/H =	0.42	from fig E-3
X1=	5.04	ft
X2/H =	0.76	from fig E-3
X2	9.12	

Xs = height from cg of shell to bottom of tank = 7.1666 feet

4) Calculation of Overturning Moment, M

M = Z*I*(C1*Ws*Xs'+C1*Wr*Ht'+C1*Wb*Xb'+C1*W1*X1'+C2*W2*X2') ft lb

m	1.0034	see above
Z	0.3	see above
I	1	see above
C1	0.6	see above
C2	0.656	see above
Ws	2,719	shell weight
Xs'	8.17	the height from grade to Fs
Wr	568	roof weight
Wb	921	bottom weight
Xb'	2	the height from the grade to Fb
Ht'	14.17	the height from grade to Fr
W1	38,119	effective weight of liquid responsible for impulse force
X1'	6.04	the height from the grade to F1
W2	7,438	effective weight of liquid responsible for sloshing or convective force of liquid.
X2'	10.12	the height from the grade to F2

Z*I =	0.3			
C1*Ws*Xs'=	13,328	Lateral Force, Fs =	489	Impulse force of tank shell
C1*Wr*Ht'=	4,832	Lateral Force, Fr =	102	Impulse force of tank roof
C1*W1*X1'=	138,219	Lateral Force, F1 =	6,861	Impulse force of liquid
C1*Wb*Xb' =	166	Lateral Force, Fb =	166	Impulse force of tank bottom

C2*W2*X2'=	49,373		Lateral Force, F2 =	1,463	Convective, or sloshing force of the liquid
M=	61,775	ft lb	Total Lateral Force, Ft =	9,082	lb

5) Check Stability of Tank:

The resisting Moment is Mr = (weight of tank + the weight of fluid) x 1/2 of the base width

weight of tank =	4,208	lb
weight of liquid =	46,486	lb
width of base =	7.5	ft

Mr = 190,101 ft-lb

Safety Factor for overturning = Mr/M

Safety Factor for overturning = **3.08** **> 1.5** **O.K., Tank is stable**

Note that if a tank is found to be unstable that indicates that tank anchors are needed to resist the uplift forces at the base plate to grade interface that will occur during an earthquake. An unstable tank is susceptible to tipping during an earthquake.

6) Check Need for Anchors Due Solely to Lateral Loads

Total weight of liquid	46,486	lb	
Total weight of tank	4,208	lb	
Total weight, W	50,694	lb	
Coefficient of friction =	0.030	Between steel & ice, the worst possible case.	

Frictional Force resisting the total lateral force = W*coefficient of static friction between base plates & grade

Ff = 1,521

Is Ff > Ft * 1.5 **Not true, therefore anchors are needed for lateral seismic forces**

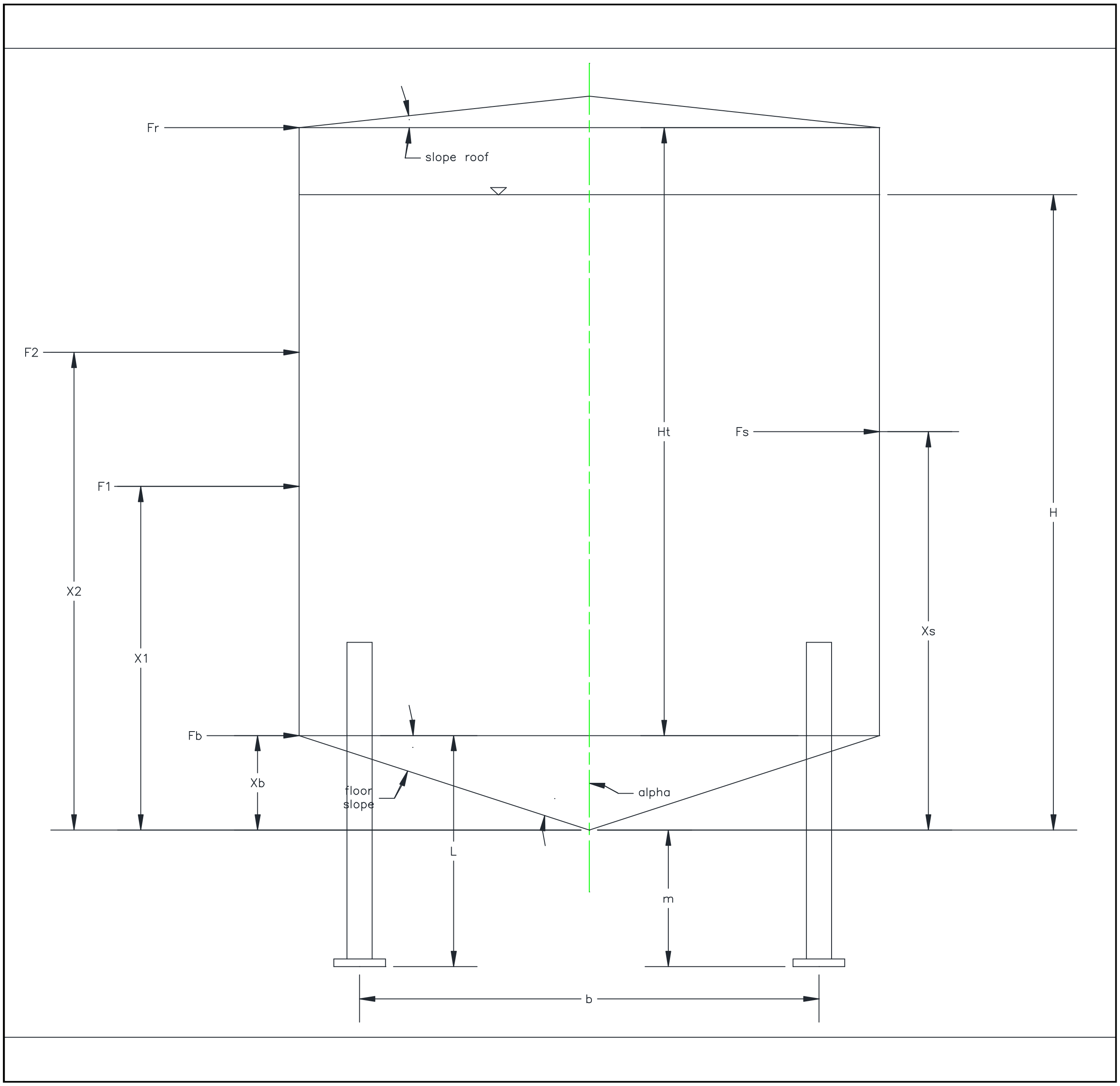
The shear force on each bolt, assuming 4 anchor bolts are used is = 2,270 lb

The anchors should be sized and designed to provide at least this much strength plus a safety margin and a corrosion allowance for the bolts.

7) Check Vertical Forces at Anchor Points
Both Seismic and Dead Load.

Vertical Load, P =	W =	-50,694	lb, this force is given a negative sign to indicate a downward
N, number of anchor locations =		4	direction.
For 4 anchor points, I =4*(b/2)^2 =		56.250	sq ft.

c =			3.750	ft	
Max anchor forces, F = P/N + - Mc/I					
		Mc/I =	4,118	lb	
		F =	-8,555	lb	If negative that indicates a downward force and
		and F =	-16,792	lb	no tension in anchor bolt.
Foot print size of 1 base plate =			100	sq inches	
Bearing stress = F/footprint area =			167.9	psi	
Allowable compressive strength of the foundation under the base plates =			1,500	psi, the foundation is concrete, and the concrete is assumed to have at least this strength.	
Safety factor =	1,500	divided by	167.9	=	8.93
	Safety Factor	**=**	**8.93**	**> 1.5**	**O.K., Foundation strength is acceptable**


Fr
slope roof
F2
Ht
Fs
F1
H
X2
X1
Xs
Fb
Xb
floor slope
alpha
L
m
b

6.0 Ultrasonic Thickness Data

6.1 Shell Plates UT

The following table details all readings (in) from the shell UT survey. All scan drops were equally spaced at 6.87 ft.

Data and Statistics		North	East	South	West	*Readings Line Average*
Course 2	4	0.185	0.184	0.184	0.185	0.185
	3	0.184	0.185	0.184	0.184	0.184
	2	0.183	0.184	0.185	0.184	0.184
	1	0.183	0.184	0.186	0.185	0.185
Course 1	4	0.185	0.184	0.184	0.186	0.185
	3	0.186	0.185	0.185	0.184	0.185
	2	0.186	0.184	0.184	0.185	0.185
	1	0.185	0.184	0.184	0.185	0.185
Scan Line Average		0.187	0.185	0.184	0.185	0.185

The tables below presents the statistics of the thickness readings (in) obtained on the Shell plates.

Course #	Min	Avg	Max
2	0.183	0.184	0.186
1	0.184	0.185	0.186
Global	0.183	0.184	0.186

6.2 Cone Bottom Plates UT

The following table details all readings (in) obtained on the cone bottom plates.

Plate ID \ Reading ID	1	2	3	4	*Avg*
North	0.310	0.311	0.311	0.312	0.311
South	0.310	0.310	0.311	0.312	0.311
West	0.309	0.309	0.310	0.311	0.310
East	0.310	0.309	0.310	0.311	0.310
Avg	0.310	0.310	0.311	0.312	0.310

The table below presents the statistics of the thickness readings obtained on the cone plates.

UT Summary	
Maximum	0.312
Average	0.310
Minimum	0.309

6.3 Fixed Roof Plates UT

The following table details all readings (in) obtained on the Fixed Roof plates.

Plate ID \ Reading ID	1	2	3	4	*Avg*
North	0.186	0.187	0.185	0.185	0.186
South	0.183	0.19	0.188	0.185	0.187
West	0.189	0.191	0.186	0.19	0.189
East	0.185	0.185	0.186	0.185	0.185
Avg	0.186	0.188	0.186	0.186	0.187

The table below presents the statistics of the thickness readings obtained on the roof plates.

UT Summary	
Maximum	0.191
Average	0.187
Minimum	0.183

6.4 Shell Nozzle and Appurtenance Table

Item	Type	Service	Pipe Size (in)	Station (ft)	Center Line Elevation (ft)	Distance from Shell to Flange Face (in)
A	Manway	Access	24.0	0	20.5	5.875
B	Nozzle	Transfer	3.0	9.1	135.0	7.0
C	Nozzle	Transfer	2.0	18.2	129.0	6.75
D	Nozzle	Transfer	2.0	23.0	129.0	7.0
E	Nozzle	Bottom Draw	2.0	–	–	–

Note: The data represented in the weld spacing column is the minimum spacing measured. H, V, or N indicates which is the minimum distance from the nozzle measured. (H=Horizontal Weld, V=Vertical Weld, N=Nozzle Weld)

6.5 Shell Nozzle UT

Item	Type	Service	Pipe Size (in)	Top (in)	Bottom (in)	Right (in)	Left (in)	Repad Thickness (in)	Flange Thickness (in)	Cover Thickness (in)	Comments
A	Manway	Access	24.0	0.242	0.242	0.243	0.243	–	0.423	0.508	
B	Nozzle	Transfer	3.0	0.207	0.209	0.217	0.208	–	0.945	–	
C	Nozzle	Transfer	2.0	0.148	0.145	0.147	0.147	–	0.719	–	
D	Nozzle	Transfer	2.0	0.147	0.148	0.145	0.147	–	0.742	–	
E	Nozzle	Bottom Draw	2.0	0.248	0.241	0.243	0.243	–	–	–	

6.6 Fixed Roof Nozzle UT

Item	Type	Service	Pipe Size (in)	North (in)	South (in)	East (in)	West (in)	Comments
AA	Hatch	Access	22.0 x 22.0	0.243	0.242	0.245	0.239	
AB	Nozzle	Vent	4.0	0.208	0.211	0.209	0.211	
AC	Nozzle	HLA	4.0	0.209	0.210	0.212	0.209	

7.0 Shell Corrosion Rates

Course	$t_{previous}$ Previous Thickness (in)	Year Obtained	t_{actual} Actual Thickness (in)	Year Obtained	C_r Corrosion Rate (in/yr.)	t_{min} Minimum Allowable Thickness (in)	R_L Remaining Life (yr.)
2	0.188	1994	0.183	2020	0.00019	0.100	431.19
1	0.188	1994	0.184	2020	0.00015	0.100	545.49

8.0 Photographs

Tank Labeling

Data Plate

Manway

Nozzle B

Nozzle B Piping

Nozzle C

Nozzle D	Bottom Nozzle E
	
Bottom Nozzle E	**Support Leg**
	
Support Anchor	**Ground Cable**
	

Standoff	Roof
	
Roof Manway	Roof
	
Containment Area	Walkway
	

Walkway	Standoff
	

9.0 NDE Equipment Used

The equipment utilized for the inspection of the tank included of the following :

Pit Gauge

Manufacturer	Model	Serial No
W.R. Thorpe	1	1.979.912

Ultrasonic Transducers

Manufacturer	Model	Serial No	MHz	Diameter
Olympus	D790-SM	865199	5	0.375

UT Equipment

Manufacturer	Model	Serial No
Olympus	38DL Plus	130573601

10.0 Inspector Certifications

AMERICAN PETROLEUM INSTITUTE
Individual Certification Programs: ICP™

API Individual Certification Programs

verifies that

Michael Alec Arpino

has met the requirements for API certification

API-653 Aboveground Storage Tank Inspector

Certification Number *77549*

Original Certification Date *December 31, 2017*

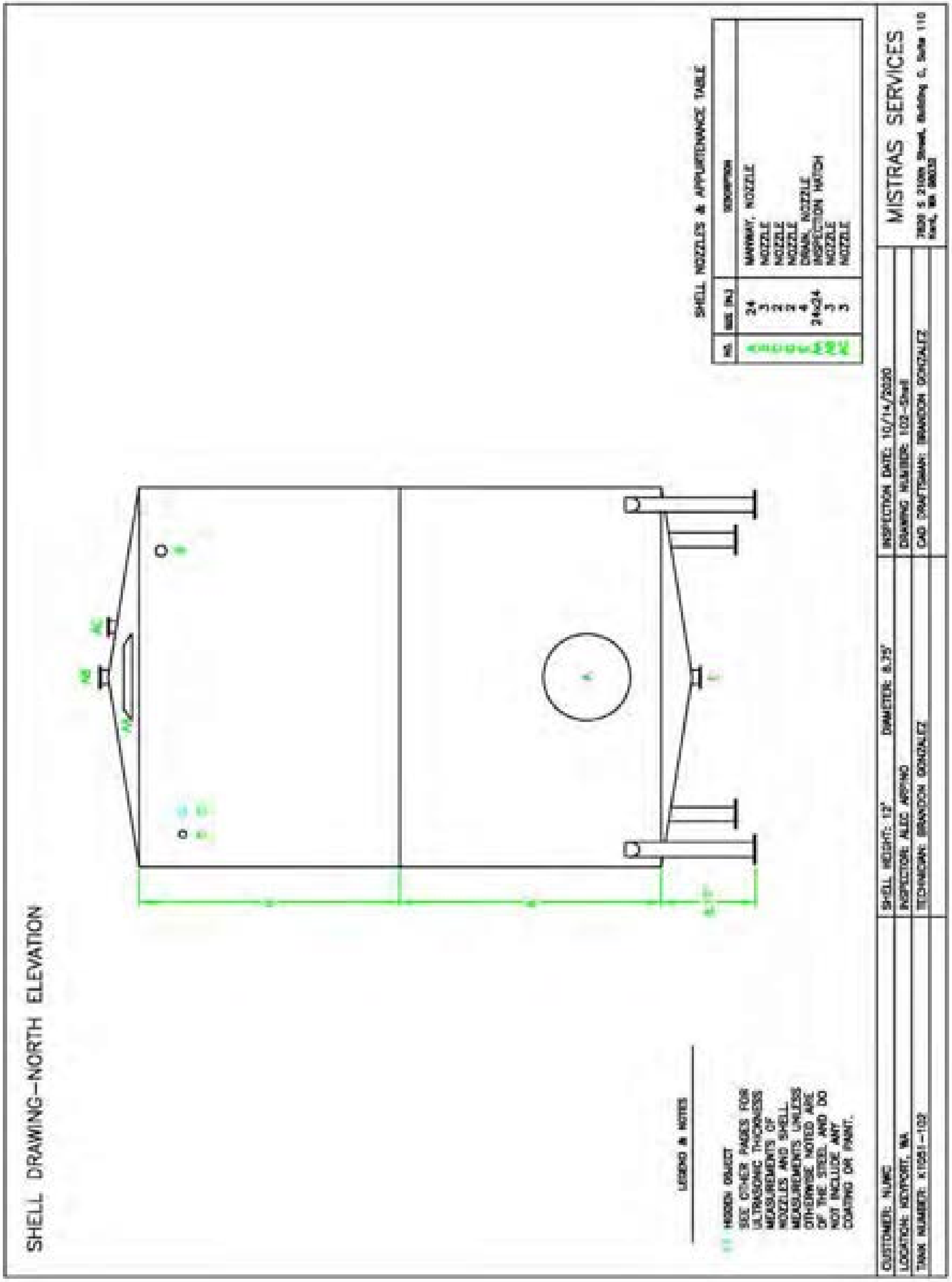
Current Certification Date *December 31, 2017*

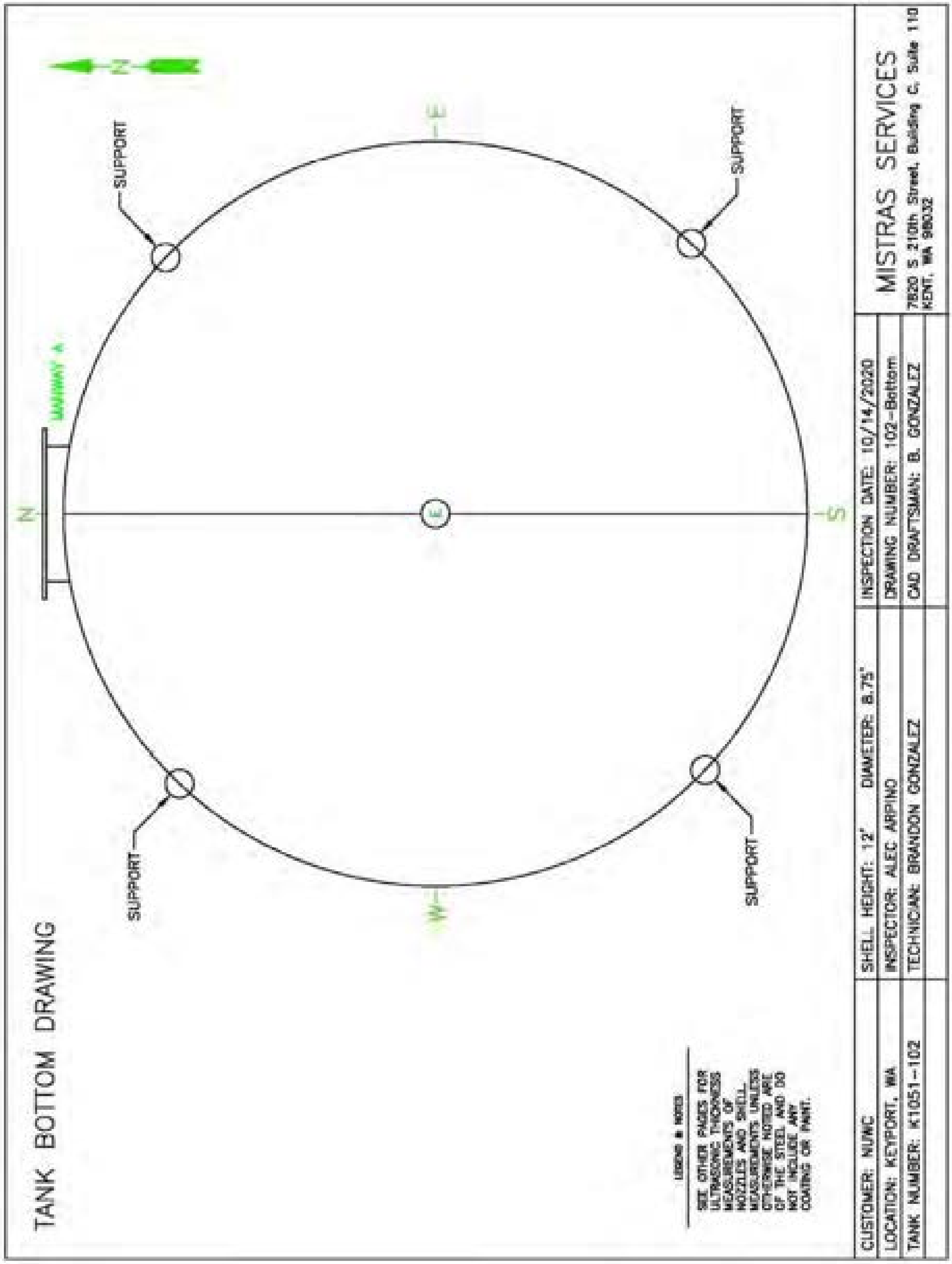
Expiration Date *December 31, 2020*

Manager, Individual Certification Programs

ICP

11.0 Drawings




TANK BOTTOM DRAWING
N
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SUPPORT
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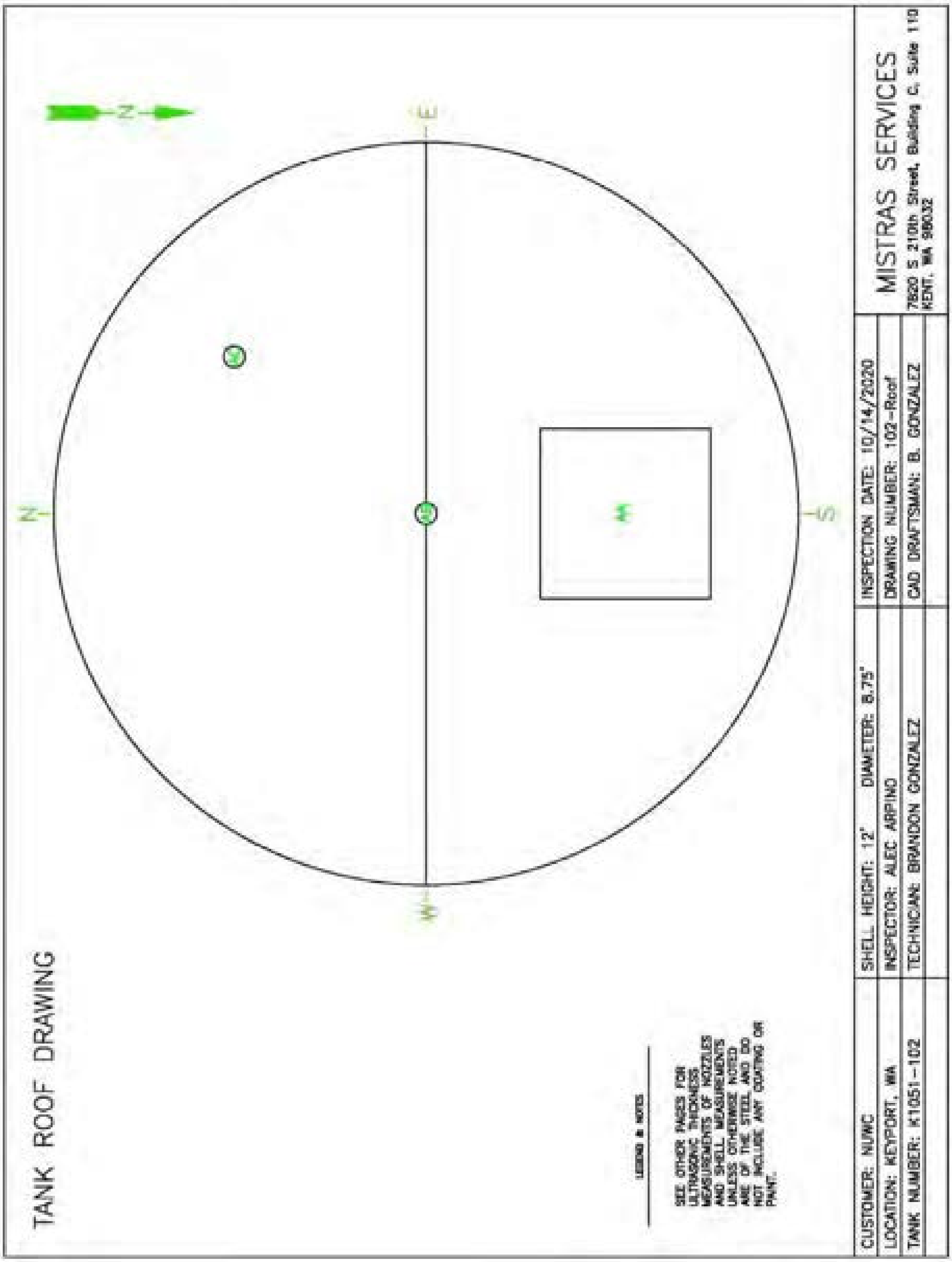
MANWAY A
LEGEND & NOTES
SEE OTHER PAGES FOR ULTRASONIC THICKNESS MEASUREMENTS OF NOZZLES AND SHELL. MEASUREMENTS UNLESS OTHERWISE NOTED ARE OF THE STEEL AND DO NOT INCLUDE ANY COATING OR PAINT.
CUSTOMER: NUWC
LOCATION: KEYPORT, WA
TANK NUMBER: K1051-102
SHELL HEIGHT: 12' DIAMETER: 8.75'
INSPECTOR: ALEC ARPINO
TECHNICIAN: BRANDON GONZALEZ
INSPECTION DATE: 10/14/2020
DRAWING NUMBER: 102-Bottom
CAD DRAFTSMAN: B. GONZALEZ
MISTRAS SERVICES
7820 S. 210th Street, Building C, Suite 110
KENT, WA 98032


TANK ROOF DRAWING
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LEGEND & NOTES
SEE OTHER PAGES FOR ULTRASONIC THICKNESS MEASUREMENTS OF NOZZLES AND SHELL. MEASUREMENTS UNLESS OTHERWISE NOTED ARE OF THE STEEL AND DO NOT INCLUDE ANY COATING OR PAINT.
CUSTOMER: NUWC
LOCATION: KEYPORT, WA
TANK NUMBER: K1051-102
SHELL HEIGHT: 12' DIAMETER: 8.75'
INSPECTOR: ALEC ARPINO
TECHNICIAN: BRANDON GONZALEZ
INSPECTION DATE: 10/14/2020
DRAWING NUMBER: 102-Roof
CAD DRAFTSMAN: B. GONZALEZ
MISTRAS SERVICES
7820 S 210th Street, Building C, Suite 110
KENT, WA 98032

12.0 Appendix A – References

References:

1) Washington State Department of Ecology, Dangerous Waste Regulations, Chapter 173-303 WAC
2) Conversations with the client
3) API RP 652, Lining of Above Ground Petroleum Storage Tanks
4) API RP 651, Cathodic Protection of Above Ground Storage Tanks
5) API Guide for the Inspection of Refinery Equipment – Chapter 13, Atmospheric and Low Pressure Tanks
6) API Standard 650, Welded Steel Tanks for Oil Storage
7) API Standard 653, Tank Inspection, Repair, Alteration, and Reconstruction
8) API Standard 620, Design and Construction of Large, Welded, Low Pressure Storage Tanks

APPENDIX E

INSPECTION REPORT TANK K1051-103

WSP

Naval Undersea Warfare Center

Tank K1051-103

In Service Inspection

Above Ground Storage Tank Inspection Report

In accordance with
WAC 173-303-640
Dangerous Waste
Regulations

WSP

Tank K1051-103

In Service Inspection

Keyport, WA

October 14, 2020 to October 14, 2020

Report Number 40865710-5

Prepared By :
7820 South 212th St. St. 110
Kent, WA, 98032

www.mistrasgroup.com

Inspection Date
October 14, 2020

Table of Contents

1.0 Job Information

Job Location :	**Naval Undersea Warfare Center**
	610 Dowell Street
	Keyport, WA
	98345-7610
Customer Representative :	Grace Roberts
Customer Phone Number :	206-431-2295
Job Charge Number :	N442555-15-D-0011-00
Report Number :	40875710-5
Mistras Work Order Number :	T67726-40865710
Inspection Personnel Provided :	Alec Arpino
	API 653 Certified Inspector
	API 653 (77549)/UTT/MT
	Brandon Gonzalez
	Level II Technician
	MFL/UTT/PT

2.0 Tank Inspection Data Sheet

General :

Tank Number	K1051-103
Owner	U.S. Navy
Design Standard	Unknown
Tank Location	Keyport, WA
Product	Otto Fuel/ Cyanide
Specific Gravity	1.23
Manufacturer	Flohr Metal Fabrication
Manufacture Date	1994
Cathodic Protection	No
Data Plate Present	Yes
Data Plate Condition	Good Condition

Dimensions :

Diameter (ft)	8.75
Height (ft)	13.02
Capacity Nominal (Gallons)	5,551.0

Geometry :

Foundation	Concrete Pad with Steel Support Legs
Bottom	Cone Down Butt Welded
Shell	Butt Welded
Fixed Roof Type	Self-Supported Fixed Cone

Access :

Stairway	None
Roof Access	Yes

Coatings :

Bottom	Internal Thin Film Epoxy
Shell	External White
Roof	External White

3.0 Suitability for Service

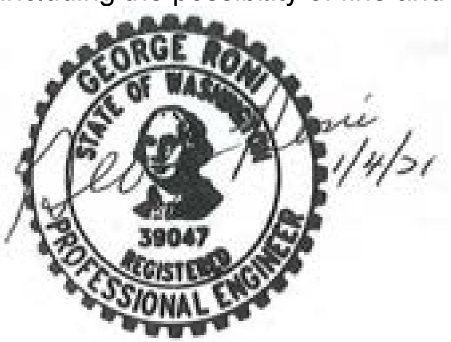
WSP on behalf of the U.S. Navy has contracted Mistras Group, Inc. to perform a in service inspection on Tank K1051-103 located in Building 1051 of the Naval Undersea Warfare Center located in Keyport, WA. This inspection was performed in accordance with the current criteria set forth in WAC 173-303-640 Dangerous Waste Regulations.

There were no issues found that would require repair at this time. The Navy should continue with routine maintenance and observation of the tank. The next formal WAC 173-303-640 inspection should be conducted per the established schedule which is 5 years per the current SPCC Plan for this site.

Tank K1051-103 can be considered suitable for continued service.

TANK CERTIFICATION

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."[1]



George Roni, P.E.

1) Per WAC 173-303-810 as required by WAC 173-303-640 (2)

Mistras Services has evaluated the condition of this tank based on the observations and measurements made by the tank Inspector. While our evaluation accurately describes the condition of the tank at the time of inspection, the tank owner/operator must independently assess the inspection information/report provided by Mistras Services and any conclusions reached by the tank owner/operator and any action taken or omitted to be taken are the sole responsibility of the owner/operator. With respect to inspection and testing, Mistras Services warrants only that the services have been performed in accordance with accepted industry practice. If any such services fail to meet the foregoing warranty, Mistras Services shall re-perform the service to the same extent and on the same conditions as the original service.

The preceding paragraph sets forth the exclusive remedy for claims based on failure or of defect in materials or services, whether such claim is made in contract or tort (including negligence) and however instituted, and, upon expiration of the warranty period, all such liability shall terminate. The foregoing warranty is exclusive and in lieu of all other warranties, whether written, oral, implied or statutory. NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE SHALL APPLY, nor shall Mistras Services be liable for any loss or damage whatsoever by reason of its failure to discover, report, repair or modify latent defects or defects inherent in the design of any tank inspected. In no event, whether a result of breach of contract, warranty or tort (including negligence) shall Mistras Services be liable for any consequential or incidental damages including, but not limited to, loss of profit or revenues, loss of use of equipment tested or services by Mistras Services or any associated damage to facilities, down-time costs or claims of other damages.

4.0 Inspection Findings

WSP on behalf of the U.S. Navy has contracted Mistras Group, Inc. to perform an in Service Inspection on Tank K1051-103 located in Keyport, WA. This inspection was performed in accordance Washington State Dangerous Waste Regulations WAC 173-303-640 (2).

Tank K1051-103 is a shop built, 2 course Above Ground Storage Tank in Otto Fuel/Cyanide Waste service. This tank is 8.75 feet in diameter, and 13.02 feet in height and is equipped with a Fixed Cone Roof. The following details all inspection findings.

Foundation

This tank was installed on a concrete pad. The tank is elevated above the concrete pad by (4) 4 inch steel pipe support legs. Each support leg has an 8” X 8” X 1/2” steel pad at the base that is anchored to the concrete foundation via (4) 1/2 inch anchor nuts and bolts. The anchor bolts are embedded into the concrete foundation and secured at the top of the plate.

The steel pipe support legs showed no evidence of dents, deformations, corrosion, pitting or other visible damage. The concrete at the base of each leg showed no evidence of cracking, spalling or broken concrete. The supports, footings, the anchor nuts and bolts are all coated. No coating failure or oxidation was noted.

The anchor nuts and bolts were found to be tight and secure. There was no evidence of elongation, corrosion, pitting or damage to the steel pads or the anchor nuts and bolts.

The tank sits within a below grade epoxy lined concrete vault. The vault appeared to structurally sound and showed no evidence of cracking, spalling or broken concrete. It appears that epoxy coating had been previously repaired at various locations around the vault. The repaired areas and the rest of the epoxy coating appeared well adhered and fluid tight.

The volume of the containment is large enough to contain the contents of the tank in the event of leaks or catastrophic failure, which is also in compliance with WAC 173-303-640.

Cone Bottom

The cone bottom in Tank K1051-103 is made up of 2 plates. The nominal floor plate thickness is 0.3125 inches. The lowest UT reading found was 0.303”.

The exterior surfaces of the tank showed no evidence of leaks from the plates, the plate to plate weld seams or the bottom to shell weld. There was no evidence of active corrosion, pitting or coating failure occurring on the plates or welds of the bottom. There was no evidence of dents, bulges or other deformations noted on the bottom plates.

At the apex of the bottom there is a 4 inch stainless steel nipple welded to the tank that reduces to a 2” line. There was no evidence of leaks from the attachment welds of the nozzle to the bottom. There was no evidence of leaks from the associated piping in the immediate area of the tank bottom attachment.

Shell

The shell on Tank K1051-103 consists of 2 courses and all joints are Butt Welded. A visual inspection and ultrasonic examination of the shell was conducted, the following details all findings.

The bottom of the shell to bottom transition has a reinforcement ring consisting of a 2-1/2 inch steel angle. The top of the reinforcement ring is fully fillet welded and the bottom is stitch welded. There is caulking in between the stitch welds along the bottom. There was no evidence of weld failures or deformations noted to the reinforcement ring.

There was no evidence of bulges, dents or abnormal deformations noted to the tank shell. There was no evidence of leaks in the shell plates, shell to shell horizontal or vertical welds, the shell to cone weld or the shell to roof weld. There was no evidence of active corrosion however there is 0.040” mechanical pit located on the South 2nd course just above the horizontal weld line. It would appear that the pit is part of a shell repair which was not properly filled in. The pit is coated therefore not corroding and the pit does not violate t-min therefor no repairs are required.

The shell coating appeared to be in very good condition.

The shell plates were ultrasonically inspected externally to verify the remaining thickness of the shell plates. Ultrasonic thickness readings were obtained on the shell in 4 equally spaced locations at approximately 6.87 feet. Each scan was conducted in one of the 4 cardinal directions. A total of 4 readings per course were obtained.

Section 6.1 of this report details all ultrasonic thickness (UT) readings obtained, detailing the low's to highs per course. There were no abnormally low readings noted on the shell. The lowest reading of 0.181” was located on the North drop.

Shell Nozzles

A visual inspection and ultrasonic examination of all accessible shell nozzles and manways was conducted to evaluate the current condition of each nozzle. Visual inspection of each nozzle included evaluation of the external neck, all attachment welds, and flange faces.

There was no evidence of leaks from the nozzle attachment welds, the flanges, the flange bolting and associated valves or nearby attached piping. There is no evidence of coating failure occurring on the nozzles or couplings.

The attached piping appears to be stainless steel and the nozzles are carbon steel. There is no evidence of galvanic reactions taking place due to the dissimilar metals. The flange faces appear to be raised and have Teflon type PTFE gasket material. The nozzle bolting appears tight and secure with proper thread engagements on the bolting.

All nozzles and manways were ultrasonically inspected (UT) by recording four readings on the top, bottom and both sides of each neck, one reading on each flange and the manway cover. There was no abnormally low thickness readings obtained. Section 6.5 details all data from UT exam.

Fixed Roof

The roof plates on Tank K1051-103 have a nominal thickness of 0.187 inches. The fixed roof plates were ultrasonically examined to determine the average remaining thickness. A total of 16 readings were obtained on the roof, four readings per each cardinal direction. There was no evidence of thinning or corrosion on the roof plates. Section 6.3 details all the data from the UT exam.

The fixed roof plates were visually inspected. All plates were evaluated to determine the condition of the external coating system. Aside from a coating of dust the roof coating is in good condition. There was no evidence of corrosion, pitting, dents, bulges or other deformations to the roof plates.

There was no evidence of leaks in the roof plates, the roof plate to plate welds or the shell to roof weld.

Fixed Roof Nozzles

All fixed roof nozzles were visually inspected. The following details the findings from this inspection.

All roof nozzles were ultrasonically inspected to verify remaining thickness. A total of 4 readings per nozzle were obtained. All fixed roof nozzles were visually inspected. The following details the findings from this inspection.

There was no evidence of leaks from the roof nozzles attachment welds, flanges, and flange bolting, associated valves or attached piping in the immediate area around the piping.

The roof top manway cover is securely attached to the roof with a hinge pin. There was no damage noted to the pin or the cover. There is a 3 inch nozzle attached to the manway cover for the liquid level float and tape gauge system. The system was not operated but appeared to be in satisfactory condition. There was no evident damage to the 3 inch nozzle or the flange face. The manway showed no evidence of coating failure, corrosion, pitting or other damage.

The 4 inch center roof vent piping runs to outside the building. The piping goes through the East wall and appears to have a pressure/vacuum style vent attached at the end of the piping run. The vent was unable to be inspected at the time of inspection due to its location and inaccessibility. The pressure/vacuum vent appeared to be in acceptable condition from the ground with no obvious visual damage noted.

All roof nozzles were ultrasonically inspected to verify remaining thickness. A total of 4 readings per nozzle were obtained. There were no abnormally low readings noted on the roof nozzles. Section 6.6 details the data from the UT exam.

Access Ways & Handrails

The roof is accessible from a free standing ladder and catwalk system. This catwalk is used to access all the tanks inside the containment for visual inspections and gauging purposes.

The ladder and the catwalk are in acceptable condition. There was no damage noted to the ladder frame or rungs. The steps showed no signs of damage to the frame, the treads or the handrails. The catwalk showed no damage to the frame, the grating or the handrails. Much of the handrail was covered in black plastic during the inspection.

The catwalk supports are 3" X 3" square piping uprights that are anchored to the concrete by (2) 3/4 inch anchor bolts at each support location. There is 2-1/2 inch angle iron braces used as cross bracing. There were no evident weld failures, damage to the support structures, attachment hardware or the anchorage locations. The attachment hardware appears to be tight and secure. The catwalk grating is galvanized and in acceptable condition. The grating is tack welded into place. There were no signs of weld failure. There was no evidence of corrosion caused thinning or holes noted in the grating.

The 2 inch steel pipe handrails are 42 inches high at the top rail, 24 inches at the mid-rail with 4 inch toe boards. There were no signs of holes, corrosion or pitting noted in the top rail, the mid-rail or the uprights.

Miscellaneous Appurtenances

For product level gauging, this tank is equipped with a float and tape style gauging system. This unit was found to be in what appears to be visually acceptable condition with no apparent damage noted. The unit was not operated at the time of inspection.

The tank is equipped with a Delta Controls roof transponder. The unit model is an 872C-V-10-2NPT-6SE-IS-CC with a serial number of UGD9966-A2. The unit appeared in satisfactory condition with no apparent damage to the unit noted.

For electrical safety issues and lightning protection, this tank is equipped with (1) 1/2 inch braided grounding cable. The cable was found to be satisfactory condition. The cable is attached to the reinforcement ring on one end and attached to a grounding bar that is embedded into the concrete foundation.

Inspectors Signature: ______________________________

M. Alec Arpino
API 653
Certification No. 77549 Exp. 12/31/2023

Reviewed by:

____
George Roni, PE
API 653 Cert. No. 2042, Exp. 4/30/2023

Mistras Services has evaluated the condition of this tank based on the observations and measurements made by the tank Inspector. While our evaluation accurately describes the condition of the tank at the time of inspection, the tank owner/operator must independently assess the inspection information/report provided by Mistras Services and any conclusions reached by the tank owner/operator and any action taken or omitted to be taken are the sole responsibility of the owner/operator. With respect to inspection and testing, Mistras Services warrants only that the services have been performed in accordance with accepted industry practice. If any such services fail to meet the foregoing warranty, Mistras Services shall re-perform the service to the same extent and on the same conditions as the original service.

The preceding paragraph sets forth the exclusive remedy for claims based on failure or of defect in materials or services, whether such claim is made in contract or tort (including negligence) and however instituted, and, upon expiration of the warranty period, all such liability shall terminate. The foregoing warranty is exclusive and in lieu of all other warranties, whether written, oral, implied or statutory. NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE SHALL APPLY, nor shall Mistras Services be liable for any loss or damage whatsoever by reason of its failure to discover, report, repair or modify latent defects or defects inherent in the design of any tank inspected. In no event, whether a result of breach of contract, warranty or tort (including negligence) shall Mistras Services be liable for any consequential or incidental damages including, but not limited to,

5.0 Calculations

Calculations for Shell & Cone-Shaped Tank Bottom - per API 620

Date of Inspection: 10/14/2020

Owner	NUWC			
Tank No.	K1051-103			
Diameter, D	8.750	ft	105.00	inches
Shell Height, H	12.000	ft	144.00	inches
Fill Height	12.000	ft	144.00	inches
Original Shell thickness	0.188	inches		
Measured Shell thickness, t_c	0.181	inches		
Original Cone thickness	0.313	inches		
Measured Cone thickness, t_h	0.303	inches		
Specific Gravity of contents of tank, SG	1.230			
Depth of Cone, d	12.25	inches	1.0208	ft
S, allowable tensile stress of shell & cone	15,200	psi		
Joint Efficiency cone-to-shell & long cone joints, E_1	0.70			
Joint Efficiency shell vertical joints, E_2	0.70			
Operating Pressure at top of tank, P_o	0.00	psi	0	psf

Note that per API 620 the max. operating pressure at top of tank is 15 psig.

O.D. of connection at bottom of cone (if none enter 0)		4.50	inches			
1/2 Apex angle, alpha = a	1.331679	radians	76.2996	degrees		
Total Pressure, P at plane AA	921.02	psf (includes hydrostatic head + P_o)			6.40	psi

Plane AA is at the Spring Line.

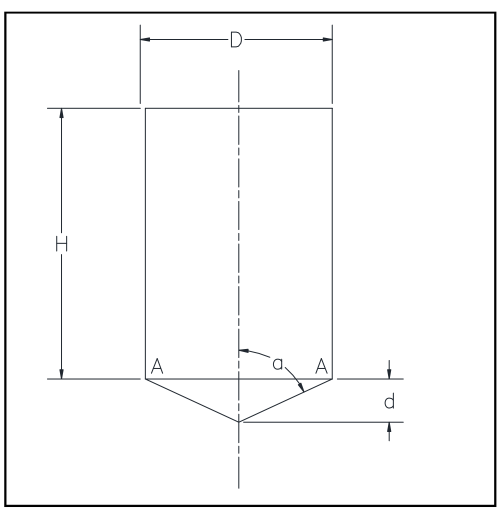


Figure No. A1

1) Shell Unit Forces @ Plane AA, See Figure No. A2

Sum $F_x = 0$

$2T_{2s} = PD$

$T_{2s} = PD/2$

$T_{2s} =$ 336 lb/in

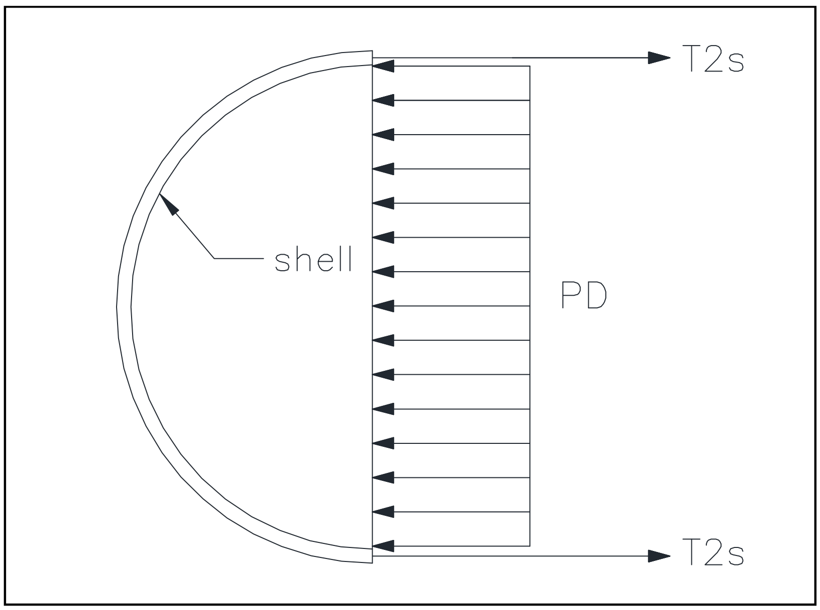


Figure No. A2

2) Cone unit force, T_2, the latitudinal unit force. Also known as the circumferential unit force.
See Figure No. A3

R_2, radius of curvature of cone at A

$R_2 = AB/\cos(a)$

$R_2 =$ 221.664 inches

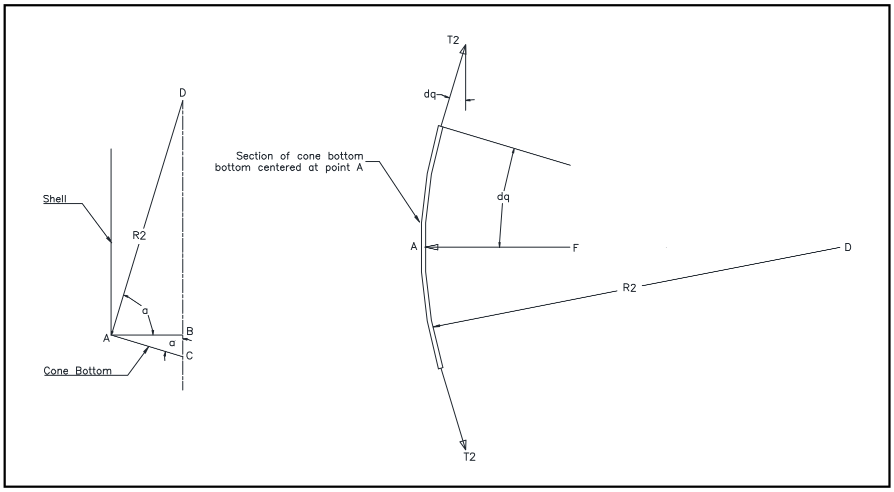


Figure No. A3

F = the force on 1 inch wide section of cone at point A with an infinitesimal arc length = 2 x dq

$F = P(1)(2)(dq)(R_2)$

$F = 2PdqR_2$

Sum of $F_x = 0$

$F - 2T_2 * Sin(dq) = 0$

$2PdqR_2 = 2T_2Sin(dq)$ and for small dq, $Sin(dq) = dq$

$PR_2 = T_2$

$T_2 = PR_2$

$T_2 =$ 1418 lb/in

3) Cone unit force, T_1, the Meridional unit force. See Figure No. A4

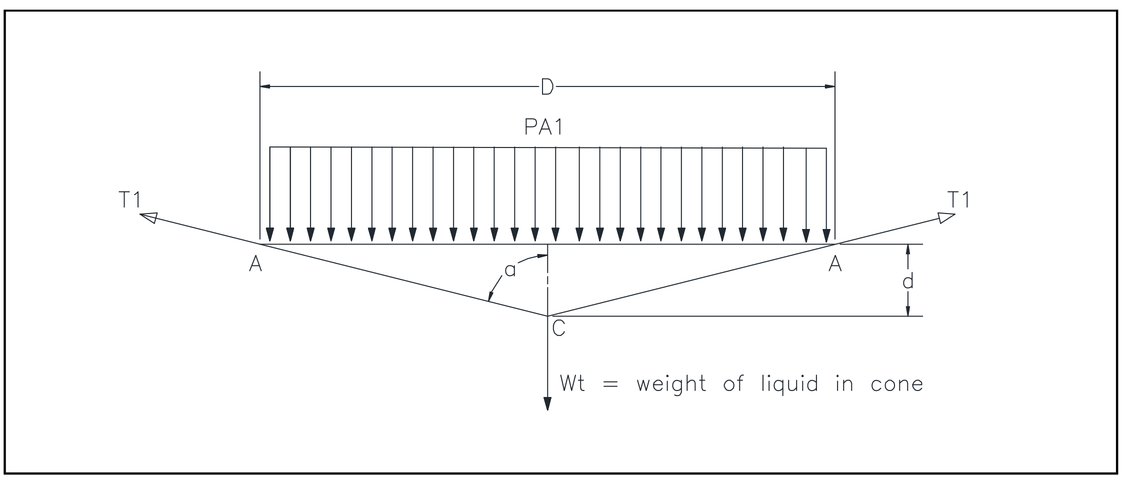


Figure No. A4

$A_1 = PI/4 * D^2$

A_1 = 8659.015 square inches 60.13205 square feet

V, Volume of Cone = (PI*D/2*D/2*d)/3
V = 20.461599 ft^3

W_t = SG* 62.4 lb/ft^3 * V
W_t = 1,570 lb

Sum F_y = 0
$T_1Cos(a)PI*D - W_t - PA_1 = 0$
T_1 = $(W_t + PA_1)/Cos(a)PI*D$
T_1 = 729 lb/in

4) Knuckle Region Reinforcement Check per API 620 3.12

The measured cone bottom thickness is defined as t_h here, t_h =	0.303	inches
The measured shell thickness is defined as t_c here, t_c =	0.181	inches
R_2, radius of curvature of cone at A =	221.66	inches
R_c, radius of curvature shell =	52.5	inches

$w_h = 0.6* sqrt(R_2 *t_h)$
w_h = 4.917226 inches

$w_c = 0.6* sqrt(R_c *t_c)$
w_c = 1.849568 inches

Additional attached reinforcement area Ad
Ad = $\boxed{1.1875}$

Available reinforcing area, A_a = $w_h*t_h + w_c*t_c+Ad$
A_a = 3.012191 sq inches

T_1 = 729 lb/in
T_{2s} = 336 lb/in
T_2 = 1418 lb/in

Per API 620, the magnitude of the total circumferential force acting on any vertical cross section through the compression ring region shall be computed as follows:

$Q = T_2w_h + T_{2s}w_c - T_1R_cSin(a)$ Note that if Q is negative, compression is indicated.
Q = 6,971 + 621 - 37,183
Q = -29,590

A_c, the required compression ring reinforcing area = Q/15,000
A_c = 1.972677 sq. inches

A_a	>	Ac	
3.012191	>	1.972677	TRUE

and since Q is negative the following condition must be true also.

$w_h Sin(a)$	>	$0.015 * R_c$	
4.777319	>	0.7875	TRUE

<u>Since both conditions are true, knuckle region is adequately reinforced.</u>

5) Check Measured Shell Thickness vs Required Shell Thickness

The required shell thickness is $t_{cr} = T_{2s}/SE_2$

0.031559 However, thickness must be at least 0.100" per API 653, so final required shell thickness is 0.100

t_c	>	t_{cr}	
0.181	>	0.100	TRUE

6) Check Measured Cone Bottom Thickness vs Required Cone Bottom Thickness at Plane A-A

The required cone thickness, t_{hr}, is the greater of the following 2 formulas

$t_{hr} = T_1/SE_1$ or $t_{hr} = T_2/SE_1$

$t_{hr} =$ 0.068513 $t_{hr} =$ 0.133248

$t_{hr} =$ 0.133248 However, thickness must be at least 0.100" per API 653, so final required cone bottom thickness is: $t_{hr} =$ 0.133 inches

t_h	>	t_{hr}	
0.303		0.133	TRUE

7) Tank Volume or Capacity Calculation

V_{total} = Volume of Cone + Volume of Shell

20.4616 ft^3 + $(PI/4) * D^2 * H$

20.4616 + 721.5846

$V_{total} =$ 742 ft^3 or 5,551 gallons

5.2 Seismic Calculations

SEISMIC ANALYSIS
For Tank Supported above grade on legs

1) Input Data

Tank Location			Keyport, WA	
Tank no.			K1051-103	
dia, D			8.75	ft
shell height, Ht			12	ft
fill height, H			12	ft. This is height from top liquid surface to bottom of tank.
floor thk			0.296	in
roof thk			0.186	in
slope roof, ϑ	0.062418	radians	3.5763	degrees This is standard slope of 3/4" in 12".
shell thk, t			0.187	in
sg liquid, G			1.230	
density steel			490	lb/sq ft
Proportion of roof supported by shell			1	1 indicates 100%.
Seismic zone factor, Z			0.300	See fig E-1 & Table E-2
Importance Factor			1.00	See E.3.1
Site coefficient			1.5	See table E-3
Lateral force coefficient, C1			0.6	
For cone bottom supported above the grade, the depth of cone, Xb			1.1666	feet
Height, L that shell sup above grade			2.17	feet
Height from bottom of tank to grade, m			1.0034	feet
b, the width of the base			7.5	feet
Slope floor, a	0.260588	radians	14.9306	degrees
1/2 apex angle of cone floor =			1.310208	radians 75.0694 degrees
		Radius	4.375	ft
		D/H	0.7292	The diameter/fill height ratio from above

2) Weights

a) Shell

Plate Area	330	sq ft
plate weight/sq ft	7.636	lb/sq ft
weight shell plate	2,519	lb
misc shell weight	200	lb

Total shell weight	2,719	lb

b) Roof

no. Rafters	0	
length rafters	0	
Type of rafter (shape)		
lb/ft rafters	0	lb/ft
weight rafters	0	lb
Plate Area = PI*(r/cos(ϑ))^2		
Plate Area	60.37	sq ft
plate weight/sq ft	7.595	lb/sq ft
Plate weight	458	lb
snow load	0	lb
misc weight	100	lb
Total Roof weight, Wr	558	lb

c) Cone Bottom

Plate Area = PI*(r/cos(gamma))^2		
Plate Area	64.41	sq ft
plate weight/sq ft	12.087	lb/sq ft
Plate weight	778	lb
misc weight	100	lb
Bottom weight,Wb	878	lb

3) Determination of Additional Seismic Inputs

Natural period of 1st sloshing mode, T

T = k* sq root (D)		For D/H =	0.73	k =	0.58	from Figure E-4
T	1.716	seconds		S =	1.5	from table E-3
Is T < 4.5s?	true, so C2=0.75S/T					

C2 = 0.75S/T
C2 0.656

W1 & W2
D/H = 0.73

The weight of liquid, Wt

Wtshell = pi/4*D^2*62.4*sg*Ht			Wtcone = ((pi*r^2*depth of cone)/3)*62.4*sg		
	4,615	x Ht			
Wtshell =	55,383	lb	Wtcone =	1,459	lb

Wt = Wtshell + Wtcone
Wt 56,842 lb

W1 = Wt*W1/Wt		W1/Wt =	0.820	from fig E-2
W1	46,611	lb		
W2		W2/Wt =	0.160	from fig E-2
W2	9,095	lb		

X1 & X2

X1/H =	0.42	from fig E-3
X1=	5.04	ft
X2/H =	0.76	from fig E-3
X2	9.12	

Xs = height from cg of shell to bottom of tank = 7.1666 feet

4) Calculation of Overturning Moment, M

M = Z*I*(C1*Ws*Xs'+C1*Wr*Ht'+C1*Wb*Xb'+C1*W1*X1'+C2*W2*X2') ft lb

m	1.0034	see above
Z	0.3	see above
I	1	see above
C1	0.6	see above
C2	0.656	see above
Ws	2,719	shell weight
Xs'	8.17	the height from grade to Fs
Wr	558	roof weight
Wb	878	bottom weight
Xb'	2	the height from the grade to Fb
Ht'	14.17	the height from grade to Fr
W1	46,611	effective weight of liquid responsible for impulse force
X1'	6.04	the height from the grade to F1
W2	9,095	effective weight of liquid responsible for sloshing or convective force of liquid.
X2'	10.12	the height from the grade to F2

Z*I =	0.3			
C1*Ws*Xs'=	13,328	Lateral Force, Fs =	489	Impulse force of tank shell
C1*Wr*Ht'=	4,748	Lateral Force, Fr =	101	Impulse force of tank roof
C1*W1*X1'=	169,012	Lateral Force, F1 =	8,390	Impulse force of liquid
C1*Wb*Xb' =	158	Lateral Force, Fb =	158	Impulse force of tank bottom
C2*W2*X2'=	60,372	Lateral Force, F2 =	1,789	Convective, or sloshing force

			of the liquid	
M=	74,285 ft lb	Total Lateral Force, Ft =	10,927	lb

5) Check Stability of Tank:

The resisting Moment is Mr = (weight of tank + the weight of fluid) x 1/2 of the base width

weight of tank =	4,156	lb
weight of liquid =	56,842	lb
width of base =	7.5	ft

Mr = 228,742 ft-lb

Safety Factor for overturning = Mr/M

Safety Factor for overturning = **3.08** **> 1.5** **O.K., Tank is stable**

Note that if a tank is found to be unstable that indicates that tank anchors are needed to resist the uplift forces at the base plate to grade interface that will occur during an earthquake. An unstable tank is susceptible to tipping during an earthquake.

6) Check Need for Anchors Due Solely to Lateral Loads

Total weight of liquid	56,842	lb	
Total weight of tank	4,156	lb	
Total weight, W	60,998	lb	
Coefficient of friction =	0.030	Between steel & ice, the worst possible case.	

Frictional Force resisting the total lateral force = W*coefficient of static friction between base plates & grade

Ff = 1,830

Is Ff > Ft * 1.5 **Not true, therefore anchors are needed for lateral seismic forces**

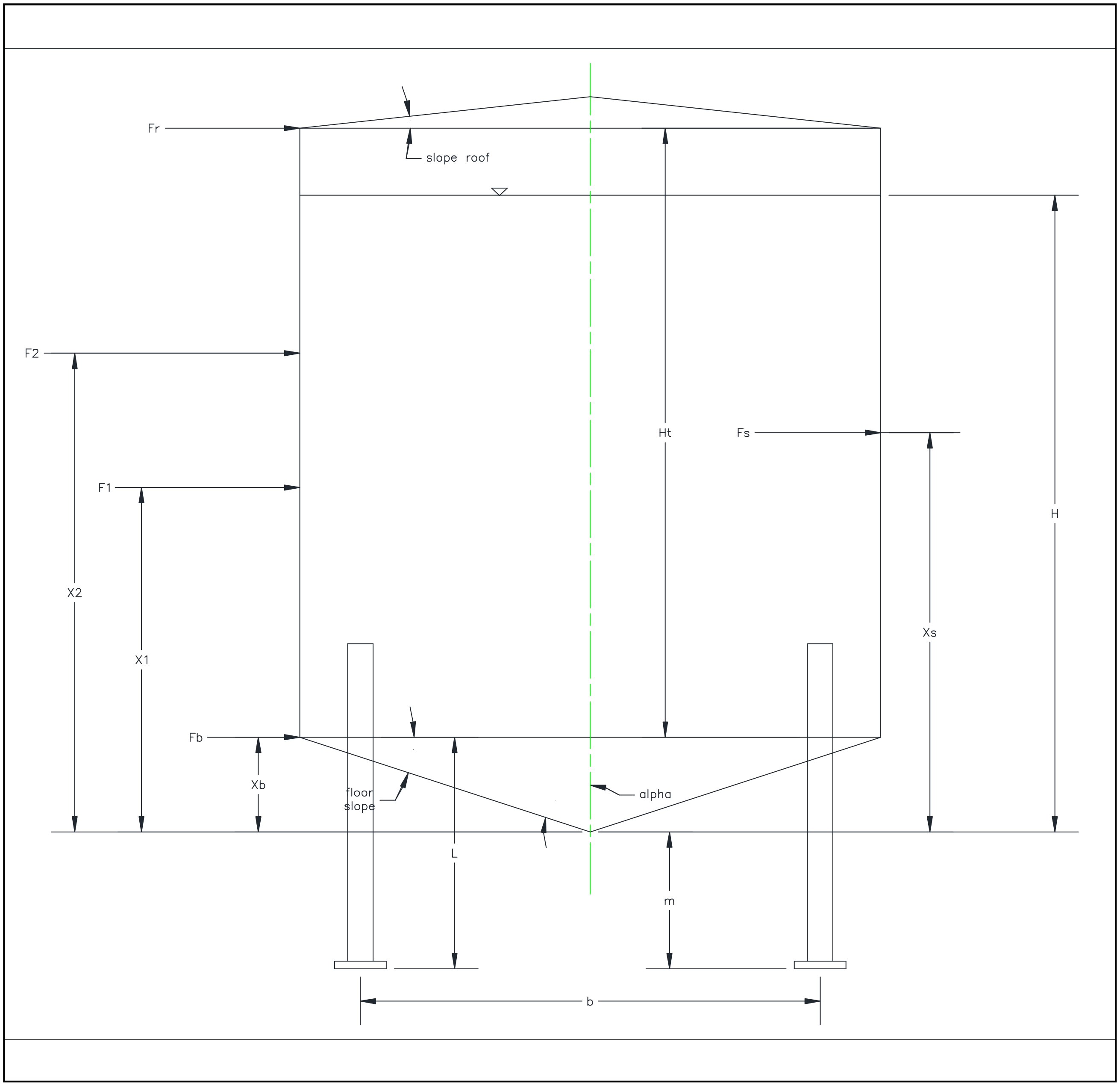
The shear force on each bolt, assuming 4 anchor bolts are used is = 2,732 lb

The anchors should be sized and designed to provide at least this much strength plus a safety margin and a corrosion allowance for the bolts.

7) Check Vertical Forces at Anchor Points
Both Seismic and Dead Load.

Vertical Load, P =	W =	-60,998	lb, this force is given a neagtive sign to indicate a downward
N, number of anchor locations =		4	direction.
For 4 anchor points, I =4*(b/2)^2 =		56.250	sq ft.
c =		3.750	ft

Max anchor forces, F = P/N + - Mc/I				
	Mc/I =	4,952	lb	
	F =	-10,297	lb	If negative that indicates a downward force and
	and F =	-20,202	lb	no tension in anchor bolt.
Foot print size of 1 base plate =		100	sq inches	
Bearing stress = F/footprint area =		202.0	psi	
Allowable compressive strength of the foundation under the base plates =		1,500	psi, the foundation is concrete, and the concrete is assumed to have at least this strength.	
Safety factor = 1,500	divided by	202.0	=	7.43
Safety Factor	**=**	**7.43**	**> 1.5**	**O.K., Foundation strength is acceptable**


Fr
slope roof
F2
Ht
Fs
H
F1
X2
X1
Xs
Fb
Xb
floor slope
alpha
L
m
b

6.0 Ultrasonic Thickness Data

6.1 Shell Plates UT

The following table details all readings (in) from the shell UT survey. All scan drops were equally spaced at 6.87 ft.

Data and Statistics		North	East	South	West	*Readings Line Average*
Course 2	4	0.181	0.182	0.182	0.185	*0.183*
	3	0.181	0.182	0.182	0.186	*0.183*
	2	0.182	0.183	0.182	0.187	*0.184*
	1	0.181	0.182	0.184	0.187	*0.184*
Course 1	4	0.181	0.182	0.182	0.189	*0.184*
	3	0.181	0.184	0.183	0.188	*0.184*
	2	0.181	0.182	0.183	0.189	*0.184*
	1	0.181	0.182	0.182	0.188	*0.183*
Scan Line Average		*0.181*	*0.182*	*0.183*	*0.187*	*0.183*

The tables below presents the statistics of the thickness readings (in) obtained on the Shell plates.

Course #	Min	Avg	Max
2	0.181	0.183	0.187
1	0.181	0.183	0.189
Global	0.181	0.183	0.189

6.2 Cone Bottom Plates UT

The following table details all readings (in) obtained on the cone bottom plates.

Plate ID \ Reading ID	1	2	3	4	*Avg*
North	0.303	0.304	0.303	0.303	*0.303*
South	0.303	0.303	0.304	0.304	*0.303*
West	0.305	0.305	0.305	0.305	*0.305*
East	0.303	0.303	0.303	0.304	*0.303*
Avg	*0.304*	*0303.*	*0.303*	*0.303*	*0.304*

The table below presents the statistics of the thickness readings obtained on the cone plates.

UT Summary	
Maximum	0.305
Average	0.304
Minimum	0.303

6.3 Fixed Roof Plates UT

The following table details all readings (in) obtained on the Fixed Roof plates.

Plate ID \ Reading ID	1	2	3	4	*Avg*
North	0.187	0.189	0.189	0.188	*0.188*
South	0.186	0.185	0.185	0.186	*0.186*
West	0.186	0.186	0.185	0.186	*0.186*
East	0.186	0.188	0.187	0.189	*0.188*
Avg	*0.186*	*0.187*	*0.187*	*0.187*	*0.187*

The table below presents the statistics of the thickness readings obtained on the roof plates.

UT Summary	
Maximum	0.189
Average	0.187
Minimum	0.185

6.4 Shell Nozzle and Appurtenance Table

Item	Type	Service	Pipe Size (in)	Station (ft)	Center Line Elevation (ft)	Distance From Shell to Flange Face (in)
A	Manway	Access	24.0	0	20.5	5.875
B	Nozzle	Transfer	3.0	9.1	135.0	7.0
C	Nozzle	Transfer	2.0	18.2	129.0	6.75
D	Nozzle	Transfer	2.0	23.0	129.0	7.0
E	Nozzle	Bottom Draw	2.0	N/A	N/A	N/A

Note: The data represented in the weld spacing column is the minimum spacing measured. H, V, or N indicates which is the minimum distance from the nozzle measured. (H=Horizontal Weld, V=Vertical Weld, N=Nozzle Weld)

6.5 Shell Nozzle UT

Item	Type	Service	Pipe Size (in)	Top (in)	Bottom (in)	Right (in)	Left (in)	Flange Thickness (in)	Cover Thickness (in)	Comments
A	Manway	Access	24.0	0.244	0.243	0.242	0.243	0.426	0.493	
B	Nozzle	Transfer	3.0	0.209	0.209	0.210	0.208	0.914	–	
C	Nozzle	Transfer	2.0	0.147	0.148	0.146	0.148	0.698	–	
D	Nozzle	Transfer	2.0	0.145	0.148	0.146	0.148	0.686	–	
E	Nozzle	Bottom Draw	2.0	0.290	0.274	0.267	0278	–	–	

6.6 Fixed Roof Nozzle UT

Item	Type	Service	Pipe Size (in)	North (in)	South (in)	East (in)	West (in)	Comments
AA	Hatch	Access	22.0 x 22.0	0.243	0.241	0.240	0.241	
AB	Nozzle	Vent	4.0	0.209	0.210	0.210	0.208	
AC	Nozzle	HLA	4.0	0.208	0.209	0.211	0.210	

7.0 Shell Corrosion Rates

Course	$t_{previous}$ Previous Thickness (in)	Year Obtained	t_{actual} Actual Thickness (in)	Year Obtained	C_r Corrosion Rate (in/yr.)	t_{min} Minimum Allowable Thickness (in)	R_L Remaining Life (yr.)
2	0.188	1994	0.181	2020	0.00027	0.100	300.57
1	0.188	1994	0.181	2020	0.00027	0.100	300.57

8.0 Photographs

Tank Labeling

Data Plate

Nozzle B

Nozzle B Piping

Ground	Nozzle C
	
Nozzle D	Tank Support
	
Tank Support Anchor	Bottom Draw
	

Bottom Draw Reducer	Roof
	
Roof	**Roof**
	
Containment Area Overview	**Containment Area Overview**
	

Containment Area Overview	Containment Area Overview
	
Walkway	Walkway
	
Walkway	Area Overview
	

Ladder


9.0 NDE Equipment Used

The equipment utilized for the inspection of the tank included of the following :

Pit Gauge

Manufacturer	Model	Serial No
W.R. Thorpe	1	1.979.912

Ultrasonic Transducers

Manufacturer	Model	Serial No	MHz	Diameter
Olympus	D790-SM	865199	5	0.375

UT Equipment

Manufacturer	Model	Serial No
Olympus	38DL Plus	130573601
UTT Pole Crawler	MC-2258	1103095

10.0 Inspector Certifications

AMERICAN PETROLEUM INSTITUTE
Individual Certification Programs: ICP™

API Individual Certification Programs

verifies that

Michael Alec Arpino

has met the requirements for API certification

API-653 Aboveground Storage Tank Inspector

Certification Number *77549*

Original Certification Date *December 31, 2017*

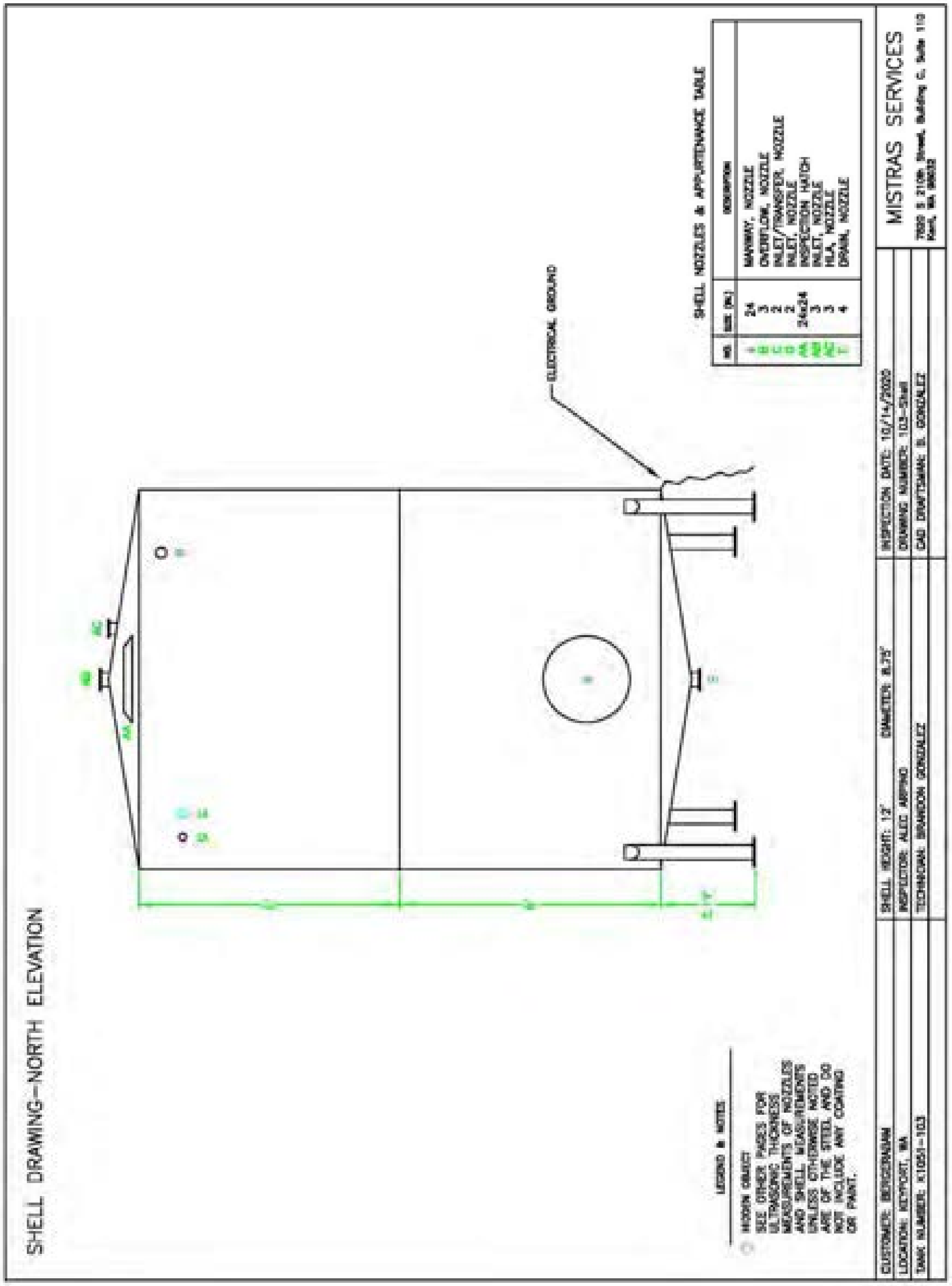
Current Certification Date *December 31, 2017*

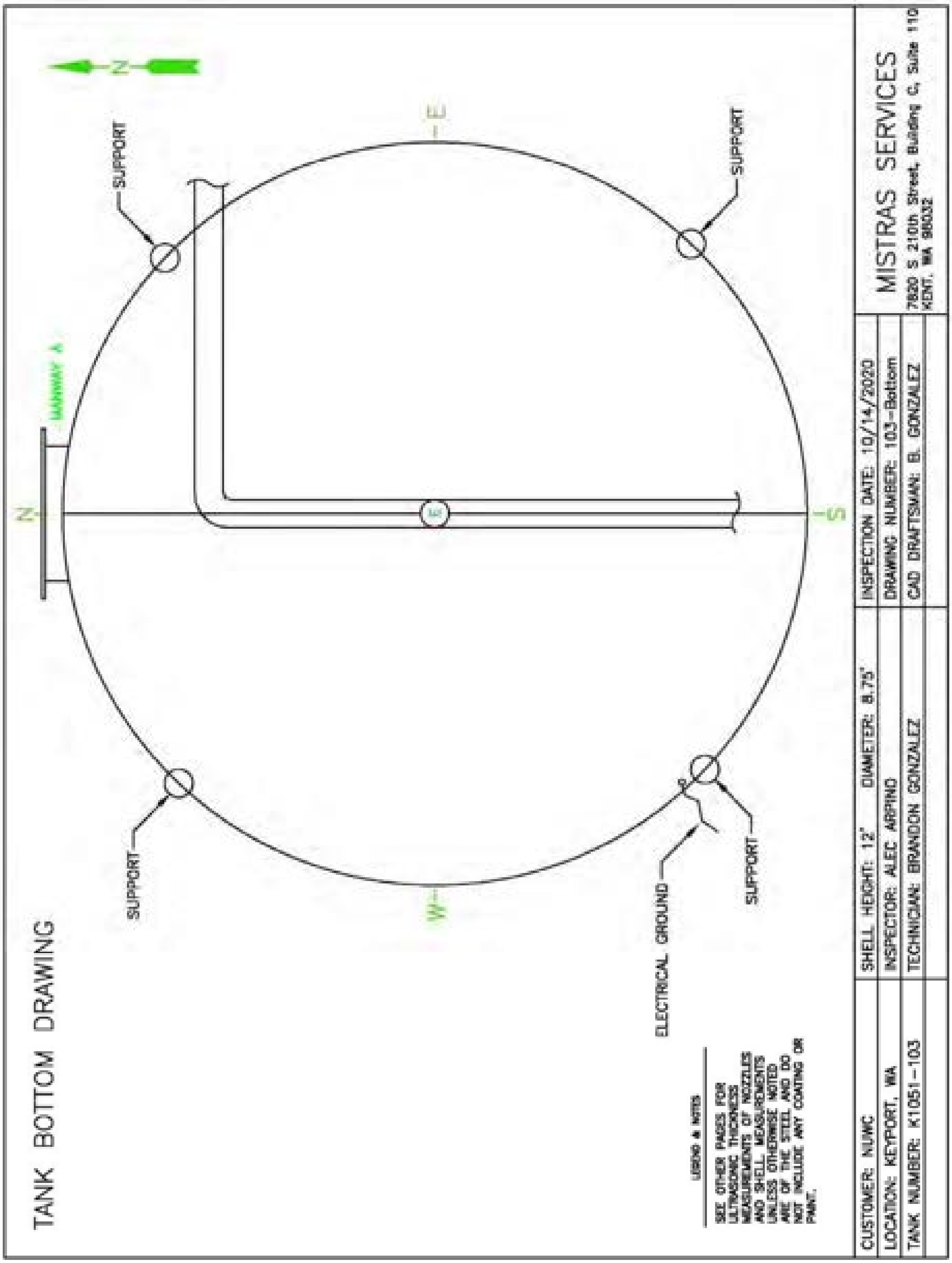
Expiration Date *December 31, 2020*

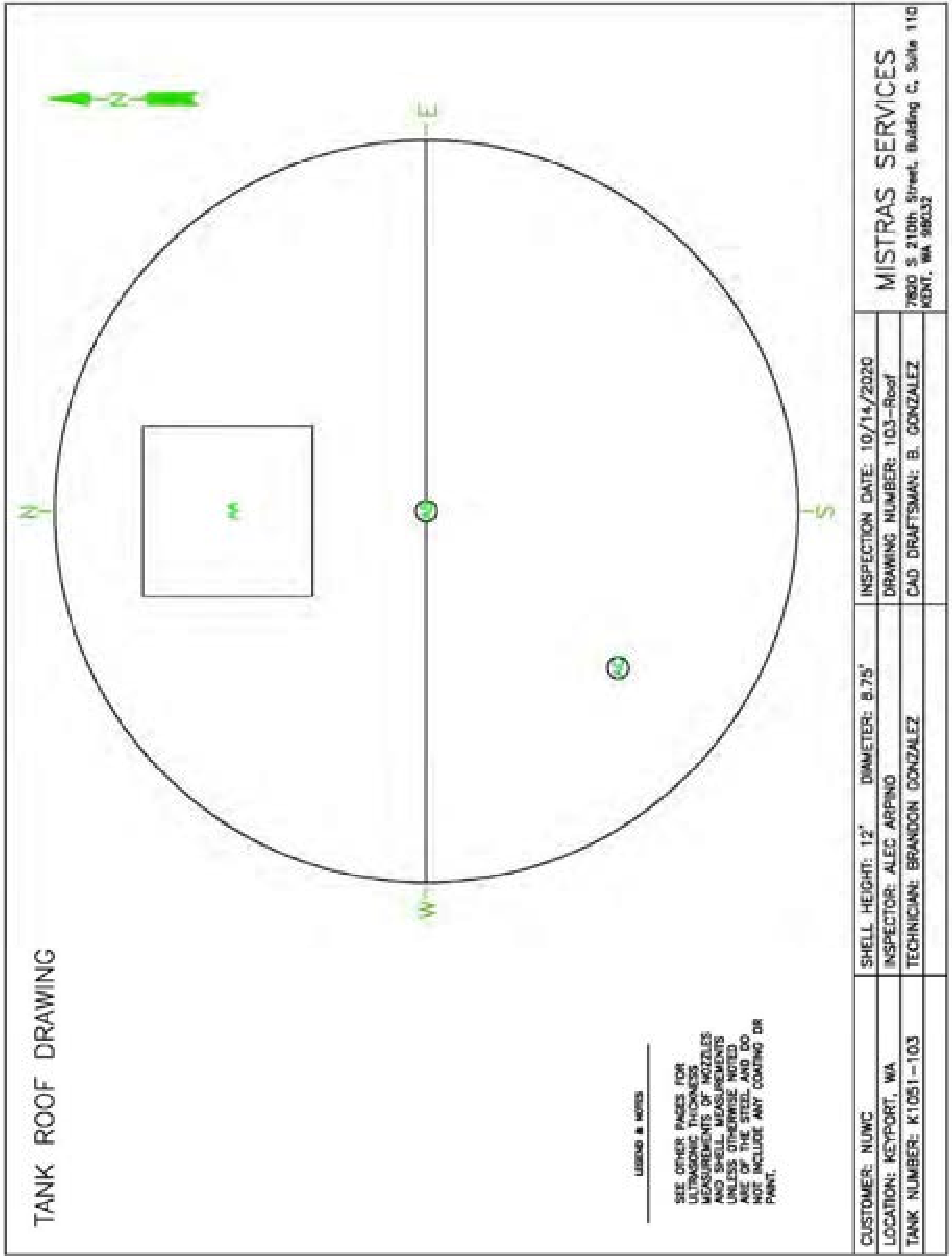
Manager, Individual Certification Programs

ICP

11. Drawings


SHELL DRAWING—NORTH ELEVATION
ELECTRICAL GROUND
SHELL NOZZLES & APPURTENANCE TABLE
MANWAY, NOZZLE
OVERFLOW, NOZZLE
INLET/TRANSFER, NOZZLE
INLET, NOZZLE
INSPECTION HATCH
INLET, NOZZLE
HLA, NOZZLE
DRAIN, NOZZLE
LEGEND & NOTES
SEE OTHER PAGES FOR ULTRASONIC THICKNESS MEASUREMENTS OF NOZZLES AND SHELL MEASUREMENTS UNLESS OTHERWISE NOTED ARE OF THE STEEL AND DO NOT INCLUDE ANY COATING OR PAINT.
CUSTOMER: BERGERMAN
LOCATION: KEYPORT, WA
TANK NUMBER: K1051-103
SHELL HEIGHT: 12'
DIAMETER: 8.75'
INSPECTOR: ALEC ARPINO
TECHNICIAN: BRANDON GONZALEZ
INSPECTION DATE: 10/14/2020
DRAWING NUMBER: 103-Shell
CAD DRAFTSMAN: B. GONZALEZ
MISTRAS SERVICES


TANK BOTTOM DRAWING
N
E
S
W
SUPPORT
SUPPORT
SUPPORT
SUPPORT
MANWAY A
ELECTRICAL GROUND
LEGEND & NOTES
SEE OTHER PAGES FOR ULTRASONIC THICKNESS MEASUREMENTS OF NOZZLES AND SHELL. MEASUREMENTS UNLESS OTHERWISE NOTED ARE OF THE STEEL AND DO NOT INCLUDE ANY COATING OR PAINT.
CUSTOMER: NUWC
LOCATION: KEYPORT, WA
TANK NUMBER: K1051-103
SHELL HEIGHT: 12'
DIAMETER: 8.75'
INSPECTOR: ALEC ARPINO
TECHNICIAN: BRANDON GONZALEZ
INSPECTION DATE: 10/14/2020
DRAWING NUMBER: 103-Bottom
CAD DRAFTSMAN: B. GONZALEZ
MISTRAS SERVICES
7820 S 210th Street, Building C, Suite 110
KENT, WA 98032


TANK ROOF DRAWING
N
E
S
W
LEGEND & NOTES
SEE OTHER PAGES FOR ULTRASONIC THICKNESS MEASUREMENTS OF NOZZLES AND SHELL MEASUREMENTS UNLESS OTHERWISE NOTED ARE OF THE STEEL AND DO NOT INCLUDE ANY COATING OR PAINT.
CUSTOMER: NUWC
LOCATION: KEYPORT, WA
TANK NUMBER: K1051-103
SHELL HEIGHT: 12'
DIAMETER: 8.75'
INSPECTOR: ALEC ARPINO
TECHNICIAN: BRANDON GONZALEZ
INSPECTION DATE: 10/14/2020
DRAWING NUMBER: 103-Roof
CAD DRAFTSMAN: B. GONZALEZ
MISTRAS SERVICES
7820 S 210th Street, Building C, Suite 110
KENT, WA 98032

12.0 Appendix A – References

References:

1) Washington State Department of Ecology, Dangerous Waste Regulations, Chapter 173-303 WAC
2) Conversations with the client
3) API RP 652, Lining of Above Ground Petroleum Storage Tanks
4) API RP 651, Cathodic Protection of Above Ground Storage Tanks
5) API Guide for the Inspection of Refinery Equipment – Chapter 13, Atmospheric and Low Pressure Tanks
6) API Standard 650, Welded Steel Tanks for Oil Storage
7) API Standard 653, Tank Inspection, Repair, Alteration, and Reconstruction
8) API Standard 620, Design and Construction of Large, Welded, Low Pressure Storage Tanks

APPENDIX F

INSPECTION REPORT TANK K1051-104

WSP

Naval Undersea Warfare Center

Tank K1051-104

In Service Inspection

Above Ground Storage Tank Inspection Report

In accordance with
WAC 173-303-640
Dangerous Waste
Regulations

WSP

Tank K1051-104

In Service Inspection

Keyport, WA

October 14, 2020 to October 14, 2020

Report Number 40865710-6

Prepared By :
7820 South 212th St. St. 110
Kent, WA, 98032

www.mistrasgroup.com

Inspection Date
October 14, 2020

Table of Contents

1.0 Job Information

Job Location :	**Naval Undersea Warfare Center**
	610 Dowell Street
	Keyport, WA
	98345-7610
Customer Representative :	Grace Roberts
Customer Phone Number :	206-431-2295
Job Charge Number :	N442555-15-D-0011-00
Report Number :	40304587-6
Mistras Work Order Number :	T67726-40865710
Inspection Personnel Provided :	Alec Arpino
	API 653 Certified Inspector
	API 653 (77549)/UTT/MT
	Brandon Gonzalez
	Level II Technician
	MFL/UTT/PT

2.0 Tank Inspection Data Sheet

General :

Tank Number	K1051-104
Owner	U.S. Navy
Design Standard	Unknown
Tank Location	Keyport, WA
Product	Otto Fuel/ Alcohol
Specific Gravity	1.23
Manufacturer	Flohr Metal Fabrication
Manufacture Date	1994
Cathodic Protection	No
Data Plate Present	Yes
Data Plate Condition	Good Condition

Dimensions :

Diameter (ft)	8.23
Height (ft)	13.02
Capacity Nominal (Gallons)	5,551.0

Geometry :

Foundation	Concrete Pad with Steel Support Legs
Bottom	Cone Down Butt Welded
Shell	Butt Welded
Fixed Roof Type	Self-Supported Fixed Cone

Access :

Stairway	None
Roof Access	Yes

Coatings :

Bottom	Internal Thin Film Epoxy
Shell	External White
Roof	External White

3.0 Suitability for Service

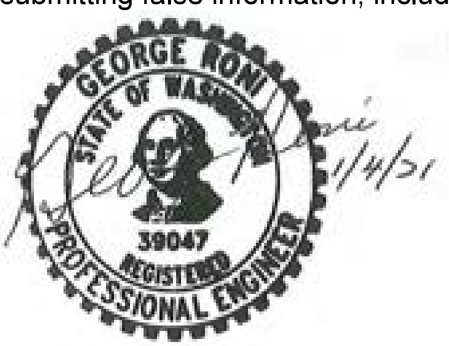
WSP on behalf of the U.S. Navy has contracted Mistras Group, Inc. to perform a in service inspection on Tank K1051-104 located in Building 1051 of the Naval Undersea Warfare Center located in Keyport, WA. This inspection was performed in accordance with the current criteria set forth in WAC 173-303-640 Dangerous Waste Regulations.

There were no issues found that would require repair at this time. The Navy should continue with routine maintenance and observation of the tank. The next formal WAC 173-303-640 inspection should be conducted per the established schedule which is 5 years per the current SPCC Plan for this site.

Tank K1051-104 can be considered suitable for continued service.

<u>TANK CERTIFICATION</u>

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."[1]



George Roni, P.E.

1) Per WAC 173-303-810 as required by WAC 173-303-640 (2)

Mistras Services has evaluated the condition of this tank based on the observations and measurements made by the tank Inspector. While our evaluation accurately describes the condition of the tank at the time of inspection, the tank owner/operator must independently assess the inspection information/report provided by Mistras Services and any conclusions reached by the tank owner/operator and any action taken or omitted to be taken are the sole responsibility of the owner/operator. With respect to inspection and testing, Mistras Services warrants only that the services have been performed in accordance with accepted industry practice. If any such services fail to meet the foregoing warranty, Mistras Services shall re-perform the service to the same extent and on the same conditions as the original service.

The preceding paragraph sets forth the exclusive remedy for claims based on failure or of defect in materials or services, whether such claim is made in contract or tort (including negligence) and however instituted, and, upon expiration of the warranty period, all such liability shall terminate. The foregoing warranty is exclusive and in lieu of all other warranties, whether written, oral, implied or statutory. NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE SHALL APPLY, nor shall Mistras Services be liable for any loss or damage whatsoever by reason of its failure to discover, report, repair or modify latent defects or defects inherent in the design of any tank inspected. In no event, whether a result of breach of contract, warranty or tort (including negligence) shall Mistras Services be liable for any consequential or incidental damages including, but not limited to, loss of profit or revenues, loss of use of equipment tested or services by Mistras Services or any associated damage to facilities, down-time costs or claims of other damages.

4.0 Inspection Findings

WSP on behalf of the U.S. Navy has contracted Mistras Group, Inc. to perform an in Service Inspection on Tank K1051-104 located in Keyport, WA. This inspection was performed in accordance Washington State Dangerous Waste Regulations WAC 173-303-640 (2).

Tank K1051-104 is a shop built 2 course Above Ground Storage Tank in Otto Fuel/ Alcohol service. This tank is 8.75 feet in diameter, and 13.02 feet in height and is equipped with a Fixed Cone Roof. The following details all inspection findings.

Foundation

This tank was installed on a concrete pad. The tank is elevated above the concrete pad by (4) 4 inch steel pipe support legs. Each support leg has an 8” X 8” X 1/2” steel pad at the base that is anchored to the concrete foundation via (4) 1/2 inch anchor bolts. The anchor bolts are embedded into the concrete foundation and secured at the top of the plate by the nuts.

The steel pipe support legs showed no evidence of dents, deformations, corrosion, pitting or other visible damage. The concrete at the base of each leg showed no evidence of cracking, spalling or broken concrete. The supports, footings, the anchor nuts and bolts are all coated. No coating failure or oxidation was noted.

The anchor nuts and bolts were found to be tight and secure. There was no evidence of elongation, corrosion, pitting or damage to the steel pads or the anchor nuts and bolts.

The tank sits within a below grade epoxy lined concrete vault. The vault appeared to structurally sound and showed no evidence of cracking, spalling or broken concrete. It appears that epoxy coating had been previously repaired at various locations around the vault. The repaired areas and the rest of the epoxy coating appeared well adhered and fluid tight.

The volume of the containment is large enough to contain the contents of the tank in the event of leaks or catastrophic failure, which is in compliance with WAC 173-303-640.

Cone Bottom

The cone bottom in Tank K1051-104 is made up of 2 plates. The nominal floor plate thickness is 0.3125 inches.

The exterior surfaces of the tank showed no evidence of leaks from the plates, the plate to plate weld seams or the bottom to shell weld. There was no evidence of active corrosion, pitting or coating failure occurring on the plates or welds of the bottom. There was no evidence of dents, bulges or other deformations noted on the bottom plates.

At the apex of the bottom there is a 4 inch stainless steel nipple (pipe section) welded to the tank. There was no evidence of leaks from the attachment welds of the nipple to the bottom or the weld to the T-reducer section.

There was no evidence of leaks from the associated piping in the immediate area of the tank bottom attachment.

Shell

The shell on Tank K1051-104 consists of 2 courses and all joints are Butt Welded. A visual inspection and ultrasonic examination of the shell was conducted, the following details all findings.

The bottom of the shell to bottom transition has a reinforcement ring consisting of a 2-1/2 inch angle iron. The top of the reinforcement ring is fully fillet welded and the bottom is stitch welded. There is caulking in between the stitch welds along the bottom. There was no evidence of weld failures or deformations noted to the reinforcement ring.

There was no evidence of bulges, dents or abnormal deformations noted to the tank shell. There was no evidence of leaks in the shell plates, shell to shell horizontal or vertical welds, the shell to cone weld or the shell to roof weld. There was no evidence of active corrosion or pitting noted on the shell exterior.

The shell coating appeared to be in very good condition.

The shell plates were ultrasonically inspected externally to verify the remaining thickness of the shell plates. Ultrasonic thickness readings were obtained on the shell in 4 equally spaced locations at approximately 6.68 feet. Each scan was conducted in one of the 4 cardinal directions. A total of 4 readings per course were obtained.

Section 6.1 of this report details all ultrasonic thickness (UT) readings obtained, detailing the low's to highs per course. There were no abnormally low readings noted on the shell. The lowest reading of 0.180 was located at the top of the 2nd course on the West drop.

Shell Nozzles

A visual inspection and ultrasonic examination of all accessible shell nozzles and manways was conducted to evaluate the current condition of each nozzle. Visual inspection of each nozzle included evaluation of the external neck, all attachment welds, and flange faces.

There was no evidence of leaks from the nozzle attachment welds, the flanges, the flange bolting and associated valves or nearby attached piping. There is no evidence of coating failure occurring on the nozzles or couplings.

The attached piping appears to be stainless steel and the nozzles are carbon steel with the exception of pipe nipple E which is stainless steel. There is no evidence of galvanic reactions taking place due to the dissimilar metals. The flange faces appear to be raised and have Teflon type PTFE gasket material. The nozzle bolting appears tight and secure with proper thread engagements on the bolting.

All nozzles and manways were ultrasonically inspected (UT) by recording four readings on the top, bottom and both sides of each neck, one reading on each flange and the manway cover. There were no abnormally low thickness readings obtained. Section 6.5 details all data from UT exam.

Fixed Roof

The roof plates on Tank K1051-104 have a nominal thickness of 0.187 inches. The fixed roof plates were ultrasonically examined to determine the average remaining thickness. A total of 16 readings were obtained on the roof, four readings per each cardinal direction. There was no evidence of thinning or corrosion on the roof plates. Section 6.3 details all the data from the UT exam.

The fixed roof plates were visually inspected. All plates were evaluated to determine the condition of the external coating system. Aside from a coating of dust the roof coating is in good condition. There was no evidence of corrosion, pitting, dents, bulges or other deformations to the roof plates.

There was no evidence of leaks in the roof plates, the roof plate to plate welds or the shell to roof weld.

Fixed Roof Nozzles

All fixed roof nozzles, nipples and couplings were visually inspected. The following details the findings from this inspection.

All roof nozzles were ultrasonically inspected to verify remaining thickness. A total of 4 readings per nozzle were obtained. All fixed roof nozzles and couplings were visually inspected. The following details the findings from this inspection.

There was no evidence of leaks from the roof nozzle and coupling attachment welds, flanges, flange bolting, threaded connections, associated valves or attached piping in the immediate area around the piping.

The roof top manway cover is securely attached to the roof with a hinge pin. There was no damage noted to the pin or the cover. There is a 3 inch nozzle attached to the manway cover for the liquid level float and tape gauge system. The system was not operated but appeared to be in satisfactory condition. There was no evident damage to the 3 inch nozzle or the flange face. The manway showed no evidence of coating failure, corrosion, pitting or other damage.

The 4 inch center roof vent piping runs to outside the building. The piping goes through the East wall and appears to have a pressure/vacuum style vent attached at the end of the piping run. The vent was unable to be inspected at the time of inspection due to its location and inaccessibility. The pressure/vacuum vent appeared to be in acceptable condition from the ground with no obvious visual damage noted.

All roof nozzles were ultrasonically inspected to verify remaining thickness. A total of 4 readings per nozzle were obtained. There were no abnormally low readings noted on the roof nozzles. Section 6.6 details the data from the UT exam.

Access Ways & Handrails

The roof is accessible from a free standing ladder and catwalk system. This catwalk is used to access all the tanks inside the containment for visual inspections and gauging purposes.

The ladder and the catwalk are in acceptable condition. There was no damage noted to the ladder frame or rungs. The steps showed no signs of damage to the frame, the treads or the handrails. The catwalk showed no damage to the frame, the grating or the handrails. Much of the handrail was covered in black plastic during the inspection.

The catwalk supports are 3” X 3” square piping uprights that are anchored to the concrete by (2) 3/4 inch anchor bolts at each support location. There is 2-1/2 inch angle iron braces used as cross bracing. There were no evident weld failures, damage to the support structures, attachment hardware or the anchorage locations. The attachment hardware appears to be tight and secure. The catwalk grating is galvanized and in acceptable condition. The grating is tack welded into place. There were no signs of weld failure. There was no evidence of corrosion caused thinning or holes noted in the grating.

The 2 inch steel pipe handrails are 42 inches high at the top rail, 24 inches at the mid-rail with 4 inch toe boards. There were no signs of holes, corrosion or pitting noted in the top rail, the mid-rail or the uprights.

Miscellaneous Appurtenances

For product level gauging, this tank is equipped with a float and tape style gauging system. This unit was found to be in what appears to be visually acceptable condition with no apparent damage. The unit was not operated at the time of inspection.

The tank is equipped with a Delta Controls roof transponder. The unit model is an 872C-V-10-2NPT-6SE-IS-CC with a serial number of UGD9966-A2. The unit appeared in satisfactory condition with no apparent damage to the unit noted.

For electrical safety issues and lightning protection, this tank is equipped with (1) 1/2 inch braided grounding cable. The cable was found to be satisfactory condition. The cable is attached to the reinforcement ring on one end and attached to a grounding bar that is embedded into the concrete foundation.

Inspectors Signature: ______________________________

Alec Arpino
API 653
Certification No. 77549 Exp. 12/31/2023

Reviewed by:

____
George Roni, PE
API 653 Cert. No. 2042, Exp. 4/30/23

Mistras Services has evaluated the condition of this tank based on the observations and measurements made by the tank Inspector. While our evaluation accurately describes the condition of the tank at the time of inspection, the tank owner/operator must independently assess the inspection information/report provided by Mistras Services and any conclusions reached by the tank owner/operator and any action taken or omitted to be taken are the sole responsibility of the owner/operator. With respect to inspection and testing, Mistras Services warrants only that the services have been performed in accordance with accepted industry practice. If any such services fail to meet the foregoing warranty, Mistras Services shall re-perform the service to the same extent and on the same conditions as the original service.

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5.0 Calculations

5.1 Thickness Calculations

Calculations for Shell & Cone-Shaped Tank Bottom - per API 620

Date of Inspection:	10/14/2020				
Owner		NUWC			
Tank No.		K1051-104			
Diameter, D		8.750	ft	105.00	inches
Shell Height, H		12.000	ft	144.00	inches
Fill Height		12.000	ft	144.00	inches
Original Shell thickness		0.188	inches		
Measured Shell thickness, t_c		0.183	inches		
Original Cone thickness		0.330	inches		
Measured Cone thickness, t_h		0.303	inches		
Specific Gravity of contents of tank, SG		1.230			
Depth of Cone, d		12.25	inches	1.0208	ft
S, allowable tensile stress of shell & cone		15,200	psi		
Joint Efficiency cone-to-shell & long cone joints, E_1		0.70			
Joint Efficiency shell vertical joints, E_2		0.70			
Operating Pressure at top of tank, P_o		0.00	psi	0	psf

Note that per API 620 the max. operating pressure at top of tank is 15 psig.

O.D. of connection at bottom of cone (if none enter 0)		4.50	inches		
1/2 Apex angle, alpha = a	1.331679	radians	76.2996	degrees	
Total Pressure, P at plane AA	921.02	psf (includes hydrostatic head + P_o)		6.40	psi

Plane AA is at the Spring Line.

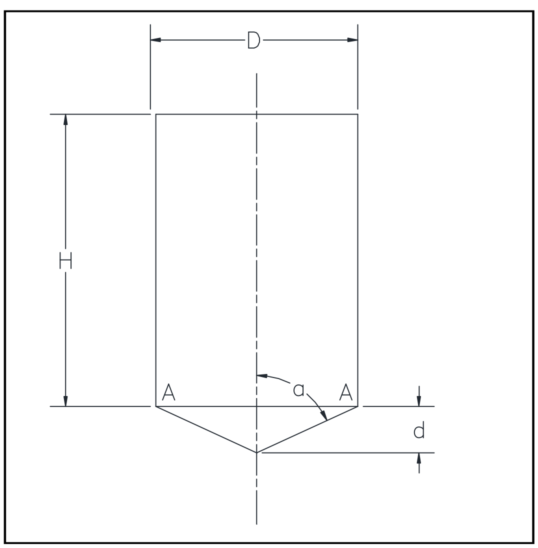


Figure No. A1

1) Shell Unit Forces @ Plane AA, See Figure No. A2

Sum $F_x = 0$

$2T_{2s} = PD$

$T_{2s} = PD/2$

$T_{2s} =$ 336 lb/in

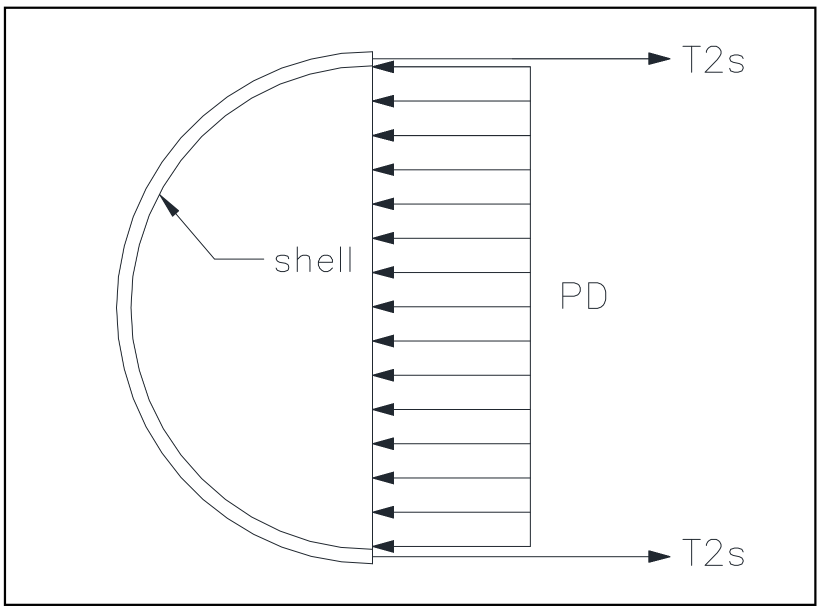


Figure No. A2

2) Cone unit force, T_2, the latitudinal unit force. Also known as the circumferential unit force.
See Figure No. A3

R_2, radius of curvature of cone at A

$R_2 = AB/\cos(a)$

$R_2 =$ 221.664 inches

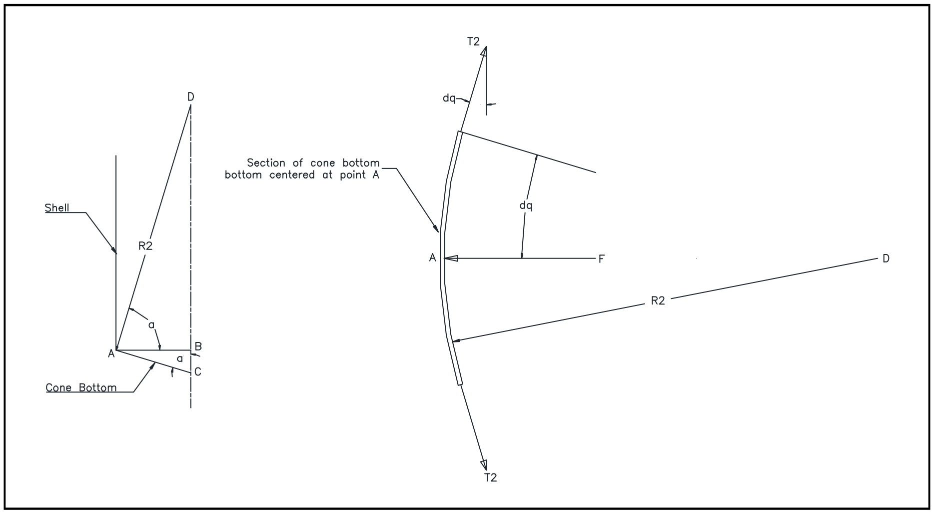


Figure No. A3

F = the force on 1 inch wide section of cone at point A with an infinitesimal arc length = 2 x dq

$F = P(1)(2)(dq)(R_2)$

$F = 2PdqR_2$

Sum of $F_x = 0$

$F - 2T_2 * \text{Sin}(dq) = 0$

$2PdqR_2 = 2T_2\text{Sin}(dq)$ and for small dq, Sin(dq) = dq

$PR_2 = T_2$

$T_2 = PR_2$

$T_2 =$ 1418 lb/in

3) Cone unit force, T_1, the Meridional unit force. See Figure No. A4

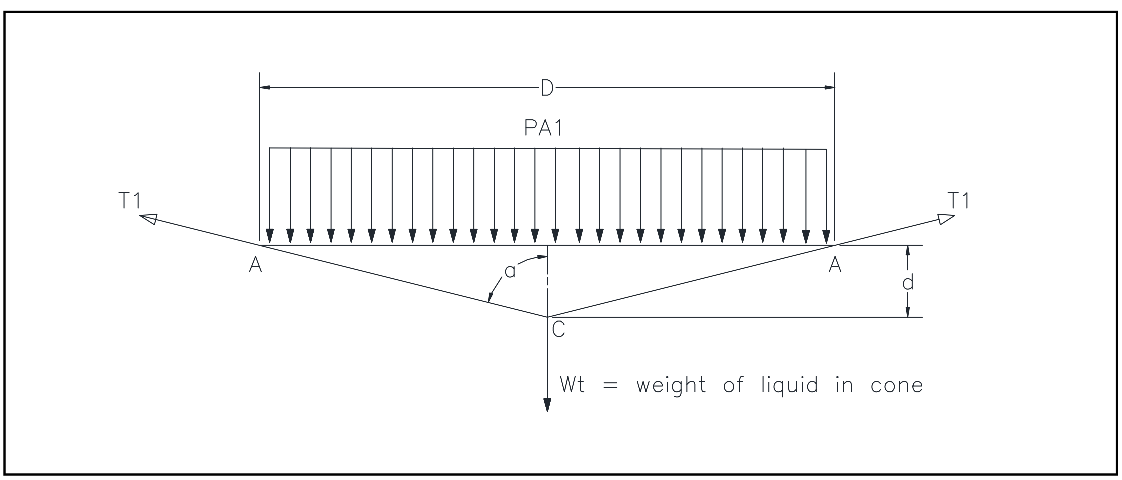


Figure No. A4

$A_1 = PI/4 * D^2$

A_1 = 8659.015 square inches 60.13205 square feet

V, Volume of Cone = (PI*D/2*D/2*d)/3
V = 20.461599 ft^3

W_t = SG* 62.4 lb/ft^3 * V
W_t = 1,570 lb

Sum F_y = 0
T_1Cos(a)PI*D - W_t -PA_1 =0
T_1 = (W_t + PA_1)/Cos(a)PI*D
T_1 = 729 lb/in

4) Knuckle Region Reinforcement Check per API 620 3.12

The measured cone bottom thickness is defined as t_h here, t_h =	0.303	inches
The measured shell thickness is defined as t_c here, t_c =	0.183	inches
R_2, radius of curvature of cone at A =	221.66	inches
R_c, radius of curvature shell =	52.5	inches

w_h = 0.6* sqrt(R_2 *t_h)
w_h = 4.917226 inches

w_c = 0.6* sqrt(R_c *t_c)
w_c = 1.859758 inches

Additional attached reinforcement area Ad
Ad = 1.1875

Available reinforcing area, A_a = w_h*t_h + w_c*t_c+Ad
A_a = 3.017755 sq inches
T_1 = 729 lb/in
T_{2s} = 336 lb/in
T_2 = 1418 lb/in

Per API 620, the magnitude of the total circumferential force acting on any vertical cross section through the compression ring region shall be computed as follows:

Q = T_2w_h + $T_{2s}w_c$ -T_1R_cSin(a) Note that if Q is negative, compression is indicated.
Q = 6,971 + 624 - 37,183
Q = -29,587

A_c, the required compression ring reinforcing area = Q/15,000
A_c = 1.972449 sq. inches

A_a	>	Ac	
3.017755	>	1.9724489	TRUE

and since Q is negative the following condition must be true also.

$w_h Sin(a)$	>	0.015 * R_c	
4.777319	>	0.7875	TRUE

Since both conditions are true, knuckle region is adequately reinforced.

5) Check Measured Shell Thickness vs Required Shell Thickness

The required shell thickness is $t_{cr} = T_{2s}/SE_2$

0.031559 However, thickness must be at least 0.100" per API 653, so final required shell thickness is 0.100

t_c	>	t_{cr}	
0.183	>	0.100	TRUE

6) Check Measured Cone Bottom Thickness vs Required Cone Bottom Thickness at Plane A-A

The required cone thickness, t_{hr}, is the greater of the following 2 formulas

$t_{hr} = T_1/SE_1$		or	$t_{hr} = T_2/SE_1$	
t_{hr} =	0.068513		t_{hr} =	0.133248

t_{hr} = 0.133248 However, thickness must be at least 0.100" per API 653, so final required cone bottom thickness is: t_{hr} = 0.133 inches

t_h	>	t_{hr}	
0.303		0.133	TRUE

7) Tank Volume or Capacity Calculation

V_{total} = Volume of Cone + Volume of Shell

20.4616	ft^3 +	(PI/4) *D^2*H
20.4616	+	721.5846

V_{total} = 742 ft^3 or 5,551 gallons

5.2 Seismic Calculations

SEISMIC ANALYSIS
For Tank Supported above grade on legs

1) Input Data

Tank Location			Keyport, WA			
Tank no.			K1051-104			
dia, D			8.75	ft	8.75	
shell height, Ht			12	ft		
fill height, H			12	ft. This is height from top liquid surface to bottom of tank.		
floor thk			0.318	in		
roof thk			0.190	in		
slope roof, ϑ	0.062418	radians	3.5763	degrees	This is standard slope of 3/4" in 12".	
shell thk, t			0.188	in		
sg liquid, G			1.230			
density steel			490	lb/sq ft		
Proportion of roof supported by shell			1	1 indicates 100%.		
Seismic zone factor, Z			0.300	See fig E-1 & Table E-2		
Importance Factor			1.00	See E.3.1		
Site coefficient			1.5	See table E-3		
Lateral force coefficient, C1			0.6			
For cone bottom supported above the grade, the depth of cone, Xb			1.125	feet		
Height, L that shell sup above grade			2.20833	feet		
Height from bottom of tank to grade, m			1.08333	feet		
b, the width of the base			6.7	feet		
Slope floor, a	0.25169	radians	14.42077	degrees		
1/2 apex angle of cone floor =			1.319106	radians	75.57923	degrees
		Radius	4.375	ft		
		D/H	0.7292	The diameter/fill height ratio from above		

2) Weights

a) Shell

Plate Area	330	sq ft
plate weight/sq ft	7.677	lb/sq ft
weight shell plate	2,532	lb
misc shell weight	200	lb
Total shell weight	2,732	lb

b) Roof

no. Rafters	0	
length rafters	0	
Type of rafter (shape)		
lb/ft rafters	0	lb/ft
weight rafters	0	lb

Plate Area = PI*(r/cos(ϑ))^2

Plate Area	60.37	sq ft
plate weight/sq ft	7.758	lb/sq ft
Plate weight	468	lb
snow load	0	lb
misc weight	100	lb
Total Roof weight, Wr	568	lb

c) Cone Bottom

Plate Area = PI*(r/cos(gamma))^2

Plate Area	64.11	sq ft
plate weight/sq ft	12.985	lb/sq ft
Plate weight	832	lb
misc weight	100	lb
Bottom weight,Wb	932	lb

3) Determination of Additional Seismic Inputs

Natural period of 1st sloshing mode, T

T = k* sq root (D)		For D/H =	0.73	k =	0.58	from Figure E-4
T	1.716	seconds		S =	1.5	from table E-3
Is T < 4.5s?	true, so C2=0.75S/T					

C2 = 0.75S/T

C2 0.656

W1 & W2

D/H = 0.73

The weight of liquid, Wt

Wtshell = pi/4*D^2*62.4*sg*Ht

4,615 x Ht

Wtshell = 55,383 lb

Wtcone = ((pi*r^2*depth of cone)/3)*62.4*sg

Wtcone = 1,407 lb

Wt = Wtshell + Wtcone

Wt 56,790 lb

W1 = Wt*W1/Wt		W1/Wt =	0.850	from fig E-2	
W1	48,272	lb			
W2		W2/Wt =	0.180	from fig E-2	
W2	10,222	lb			
X1 & X2					
X1/H =	0.45	from fig E-3		0.45	
X1=	5.40	ft			
X2/H =	0.82	from fig E-3		0.82	
X2	9.84				

Xs = height from cg of shell to bottom of tank = 7.125 feet

4) Calculation of Overturning Moment, M

M = Z*I*(C1*Ws*Xs'+C1*Wr*Ht'+C1*Wb*Xb'+C1*W1*X1'+C2*W2*X2') ft lb

m	1.08333	see above
Z	0.3	see above
I	1	see above
C1	0.6	see above
C2	0.656	see above
Ws	2,732	shell weight
Xs'	8.21	the height from grade to Fs
Wr	568	roof weight
Wb	932	bottom weight
Xb'	2	the height from the grade to Fb
Ht'	14.21	the height from grade to Fr
W1	48,272	effective weight of liquid responsible for impulse force
X1'	6.48	the height from the grade to F1
W2	10,222	effective weight of liquid responsible for sloshing or convective force of liquid.
X2'	10.92	the height from the grade to F2

Z*I =	0.3			
C1*Ws*Xs'=	13,456	Lateral Force, Fs =	492	Impulse force of tank shell
C1*Wr*Ht'=	4,845	Lateral Force, Fr =	102	Impulse force of tank roof
C1*W1*X1'=	187,777	Lateral Force, F1 =	8,689	Impulse force of liquid
C1*Wb*Xb' =	168	Lateral Force, Fb =	168	Impulse force of tank bottom
C2*W2*X2'=	73,219	Lateral Force, F2 =	2,011	Convective, or sloshing force of the liquid

M=	83,839	ft lb	Total Lateral Force, Ft =	11,462	lb

5) Check Stability of Tank:

The resisting Moment is Mr = (weight of tank + the weight of fluid) x 1/2 of the base width

weight of tank =	4,233	lb
weight of liquid =	56,790	lb
width of base =	6.7	ft

Mr = 204,428 ft-lb

Safety Factor for overturning = Mr/M

Safety Factor for overturning = **2.44** **> 1.5** **O.K., Tank is stable**

Note that if a tank is found to be unstable that indicates that tank anchors are needed to resist the uplift forces at the base plate to grade interface that will occur during an earthquake. An unstable tank is susceptible to tipping during an earthquake.

6) Check Need for Anchors Due Solely to Lateral Loads

Total weight of liquid	56,790	lb
Total weight of tank	4,233	lb
Total weight, W	61,023	lb
Coefficient of friction =	0.030	Between steel & ice, the worst possible case.

Frictional Force resisting the total lateral force = W*coefficient of static friction between base plates & grade

Ff = 1,831

Is Ff > Ft * 1.5 **Not true, therefore anchors are needed for lateral seismic forces**

The shear force on each bolt, using 16 anchor bolts = 716 lb

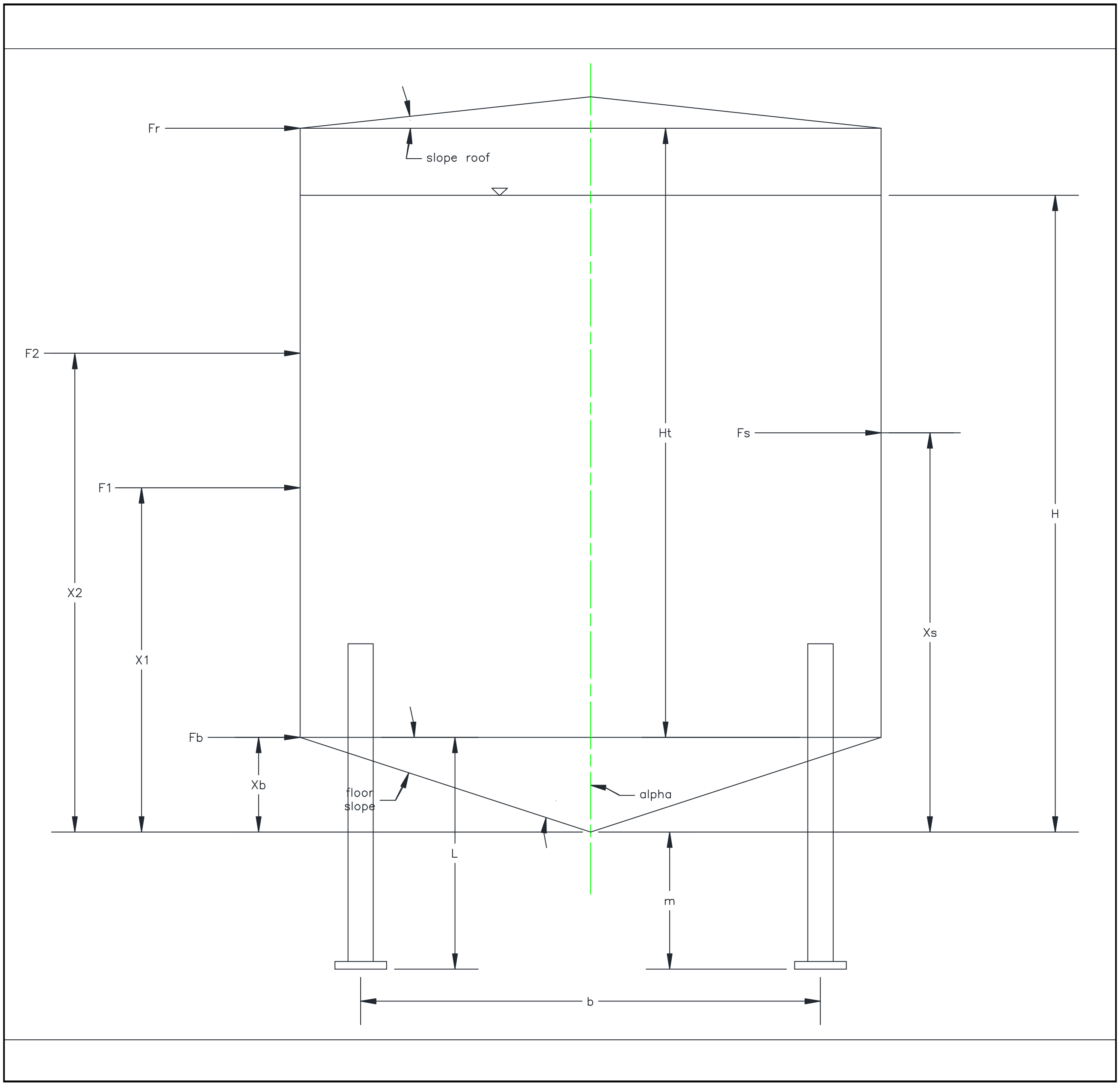
The anchors should be sized and designed to provide at least this much strength plus a safety margin and a corrosion allowance for the bolts.

The 4 ea. 1/2 inch anchor bolts provide adequate strength to resist this shear force.

7) Check Vertical Forces at Anchor Points
Both Seismic and Dead Load.

Vertical Load, P =	W =	-61,023	lb, this force is given a negative sign to indicate a downward
N, number of anchor locations =		4	direction.
For 4 anchor points, I =4*(b/2)^2 =		44.890	sq ft.
c =		3.350	ft

Max anchor forces, F = P/N + - Mc/I				
	Mc/I =	6,257	lb	
	F =	-8,999	lb	If negative that indicates a downward force and
	and F =	-21,512	lb	no tension in anchor bolt.
Foot print size of 1 base plate =		64	sq inches	
Bearing stress = F/footprint area =		336.1	psi	
Allowable compressive strength of the foundation under the base plates =		1,500	psi, the foundation is concrete, and the concrete is assumed to have at least this strength.	
Safety factor = 1,500	divided by	336.1	=	4.46
Safety Factor	**=**	**4.46**	**> 1.5**	**O.K., Foundation strength is acceptable**


Fr
slope roof
F2
Ht
Fs
F1
H
X2
X1
Xs
Fb
Xb
floor slope
alpha
L
m
b

6.0 Ultrasonic Thickness Data

6.1 Shell Plates UT

The following table details all readings (in) from the shell UT survey. All scan drops were equally spaced at 6.87 ft.

Data and Statistics		North	East	South	West	*Readings Line Average*
Course 2	4	0.185	0.183	0.185	0.183	0.184
	3	0.184	0.183	0.185	0.185	0.184
	2	0.183	0.185	0.185	0.181	0.183
	1	0.183	0.183	0.185	0.180	0.183
Course 1	4	0.183	0.185	0.186	0.186	0.185
	3	0.184	0.184	0.187	0.185	0.185
	2	0.183	0.185	0.186	0.184	0.185
	1	0.183	0.185	0.187	0.184	0.185
Scan Line Average		0.186	0.183	0.184	0.186	0.184

The tables below presents the statistics of the thickness readings (in) obtained on the Shell plates.

Course #	Min	Avg	Max
2	0.180	0.184	0.185
1	0.183	0.185	0.187
Global	0.180	0.184	0.187

6.2 Cone Bottom Plates UT

The following table details all readings (in) obtained on the cone bottom plates.

Plate ID \ Reading ID	1	2	3	4	5	6	7	8	*Avg*
North to South	0.305	0.305	0.307	0.305	0.305	0.306	0.308	0.311	0.307
East to West	0.309	0.311	0.312	0.303	0.310	0.308	0.308	0.310	0.309
Avg	0.307	0.308	0.310	0.304	0.308	0.307	0.308	0.310	0.308

The table below presents the statistics of the thickness readings obtained on the floor plates.

UT Summary	
Maximum	0.312
Average	0.308
Minimum	0.303

The following chart depicts the minimum thickness reading per plate

6.3 Fixed Roof Plates UT

The following table details all readings (in) obtained on the Fixed Roof plates.

Plate ID \ Reading ID	1	2	3	4	5	6	7	8	*Avg*
North to South	0.189	0.188	0.189	0.190	0.190	0.191	0.188	0.189	0.189
East to West	0.190	0.189	0.187	0.188	0.188	0.188	0.189	0.187	0.188
Avg	0.189	0.188	0.188	0.189	0.189	0.189	0.188	0.188	0.189

The table below presents the statistics of the thickness readings obtained on the roof plates.

UT Summary	
Maximum	0.191
Average	0.189
Minimum	0.187

6.4 Shell Nozzle and Appurtenance Table

Item	Type	Service	Pipe Size (in)	Station (ft)	Center Line Elevation (ft)	Distance From Shell to Flange Face (in)
A	Manway	Access	24.0	0	20.5	5.875
B	Nozzle	Transfer	3.0	9.1	135	7
C	Nozzle	Transfer	2.0	18.2	129	6.75
D	Nozzle	Transfer	2.0	23	129	7
E	Pipe Nipple	Bottom Draw	4.0	–	–	–

Note: The data represented in the weld spacing column is the minimum spacing measured. H, V, or N indicates which is the minimum distance from the nozzle measured. (H=Horizontal Weld, V=Vertical Weld, N=Nozzle Weld)

6.5 Shell Nozzle UT

Item	Type	Service	Pipe Size (in)	Top (in)	Bottom (in)	Right (in)	Left (in)	Repad Thickness (in)	Flange Thickness (in)	Cover Thickness (in)	Comments
A	Manway	Access	24.0	0.241	0.241	0.243	0.244	–	0.498	0.490	
B	Nozzle	Transfer	3.0	0.208	0.210	0.209	0.210	–	0.961	–	
C	Nozzle	Transfer	2.0	0.145	0.148	0.148	0.148	–	0.685	–	
D	Nozzle	Transfer	2.0	0.148	0.148	0.149	0.148	–	0.725	–	
E	Pipe Nipple	Bottom Draw	4.0	0.109	0.108	0.112	0.107	–	–	–	Stainless Steel

6.6 Fixed Roof Nozzle UT

Item	Type	Service	Pipe Size (in)	North (in)	South (in)	East (in)	West (in)	Comments
AA	Hatch	Access	22.0 x 22.0	0.243	0.243	0.243	0.243	
AB	Coupling	Air Line	0.50	–	–	–	–	
AC	Nozzle	HLA	3.0	0.209	0.210	0.210	0.208	
AD	Nozzle	Vent	3.0	0.211	0.214	0.211	0.209	

7.0 Shell Corrosion Rates

Course	$t_{previous}$ Previous Thickness (in)	Year Obtained	t_{actual} Actual Thickness (in)	Year Obtained	C_r Corrosion Rate (in/yr.)	t_{min} Minimum Allowable Thickness (in)	R_L Remaining Life (yr.)
2	0.188	1994	0.180	2020	0.00031	0.100	257.89
1	0.188	1994	0.183	2020	0.00019	0.100	428.10

8.0 Photographs

Tank Labeling	Data Plate
	
Manway	**Ground**
	

Nozzle B

Nozzle C

Nozzle D

Nozzle E (Bottom Draw)

Nozzle E (Bottom Draw)

Roof

Roof

Area Overview

Area Overview

Area Overview

Walkway

Walkway

Walkway	Area Overview
	

Ladder


9.0 NDE Equipment Used

The equipment utilized for the inspection of the tank included of the following :

Pit Gauge

Manufacturer	Model	Serial No
W.R. Thorpe	1	1.979.912

Ultrasonic Transducers

Manufacturer	Model	Serial No	MHz	Diameter
Olympus	D790-SM	865199	5	0.375

UT Equipment

Manufacturer	Model	Serial No
Olympus	38DL Plus	130573601
UTT Pole Crawler	MC-2258	1103095

10.0 Inspector Certifications

AMERICAN PETROLEUM INSTITUTE
Individual Certification Programs: ICP™

API Individual Certification Programs

verifies that

Michael Alec Arpino

has met the requirements for API certification

API-653 Aboveground Storage Tank Inspector

Certification Number *77549*

Original Certification Date *December 31, 2017*

Current Certification Date *December 31, 2017*

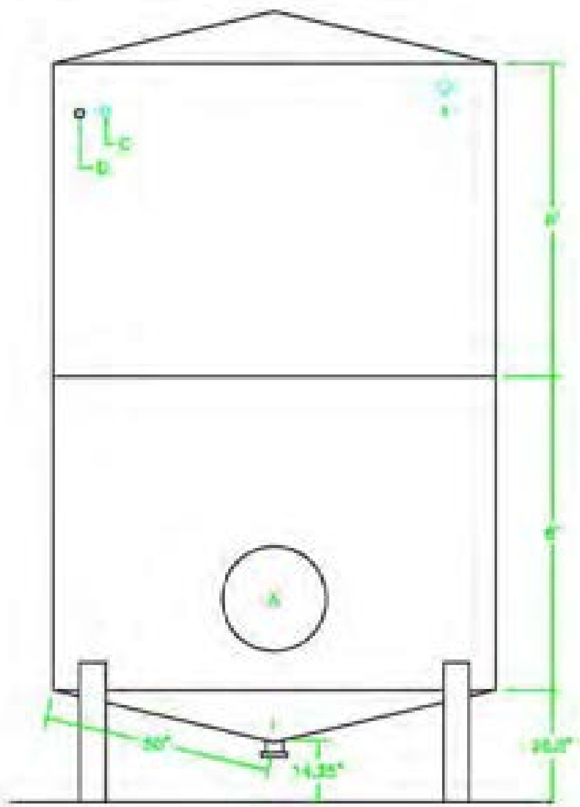
Expiration Date *December 31, 2020*

Manager, Individual Certification Programs

ICP

11.0 Drawings

SHELL DRAWING–NORTH ELEVATION



SHELL NOZZLES & APPURTENANCE TABLE

NO.	SIZE (IN.)	DESCRIPTION
A	24	NOZZLE FOR MANWAY
B	3	NOZZLE FOR OVERFLOW
C	2	NOZZLE FOR INLET
D	2	NOZZLE FOR INLET
E	4	NIPPLE FOR DISCHARGE

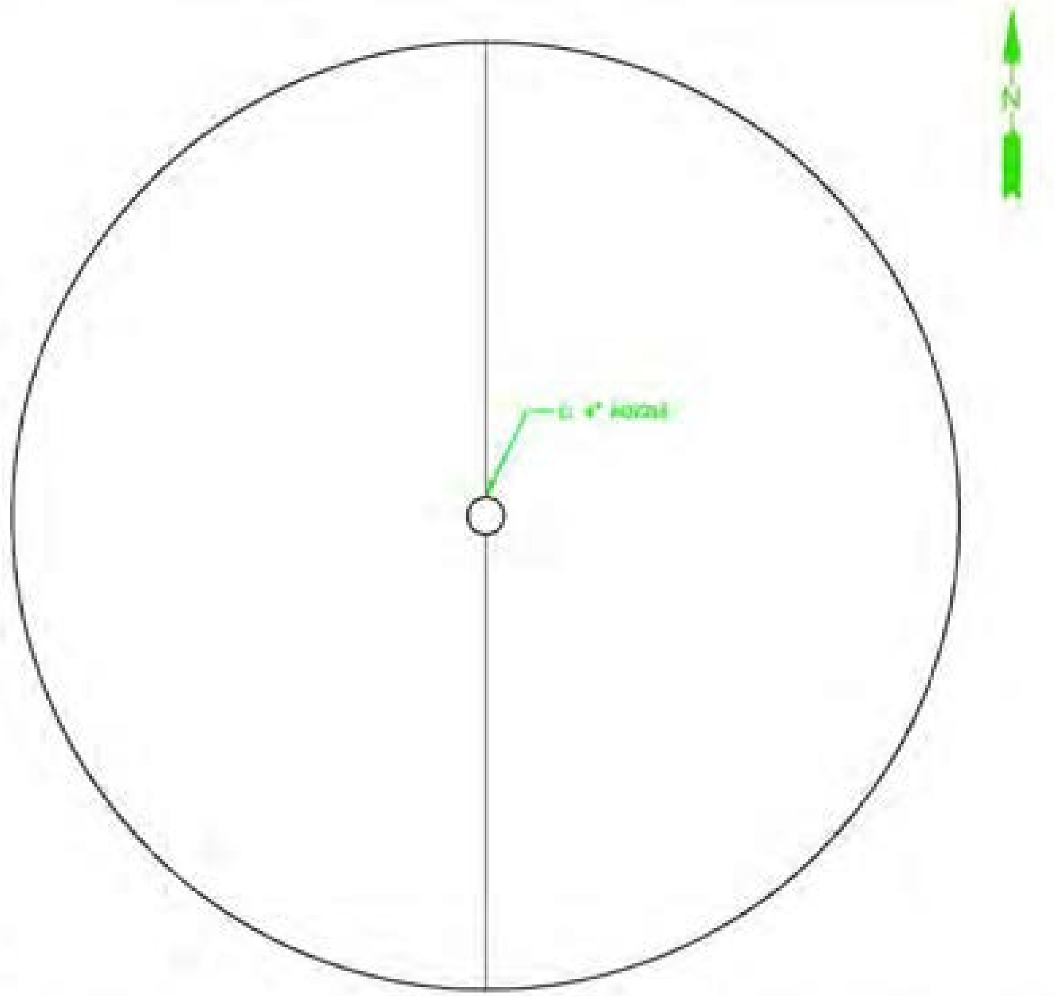
NOTES

○ – HIDDEN OBJECT

SEE OTHER PAGES FOR ULTRASONIC THICKNESS MEASUREMENTS OF NOZZLES AND SHELL. MEASUREMENTS UNLESS OTHERWISE NOTED ARE OF THE STEEL AND DO NOT INCLUDE ANY COATING OR PAINT.

CUSTOMER: WSP	SHELL HEIGHT: 12' DIAMETER: 8'-9"	INSPECTION DATE: 10/14/2020	MISTRAS SERVICES
LOCATION: KEYPORT, WA	INSPECTOR: ALEC ARPINO	DRAWING NUMBER: WSP-104-S	7820 S 210th Street, Building C, Suite 110 Kent, WA 98032
TANK NUMBER: K-1051-104	TECHNICIAN: BRANDON GONZALEZ	CAD DRAFTSMAN: B. GONZALEZ	

TANK BOTTOM DRAWING

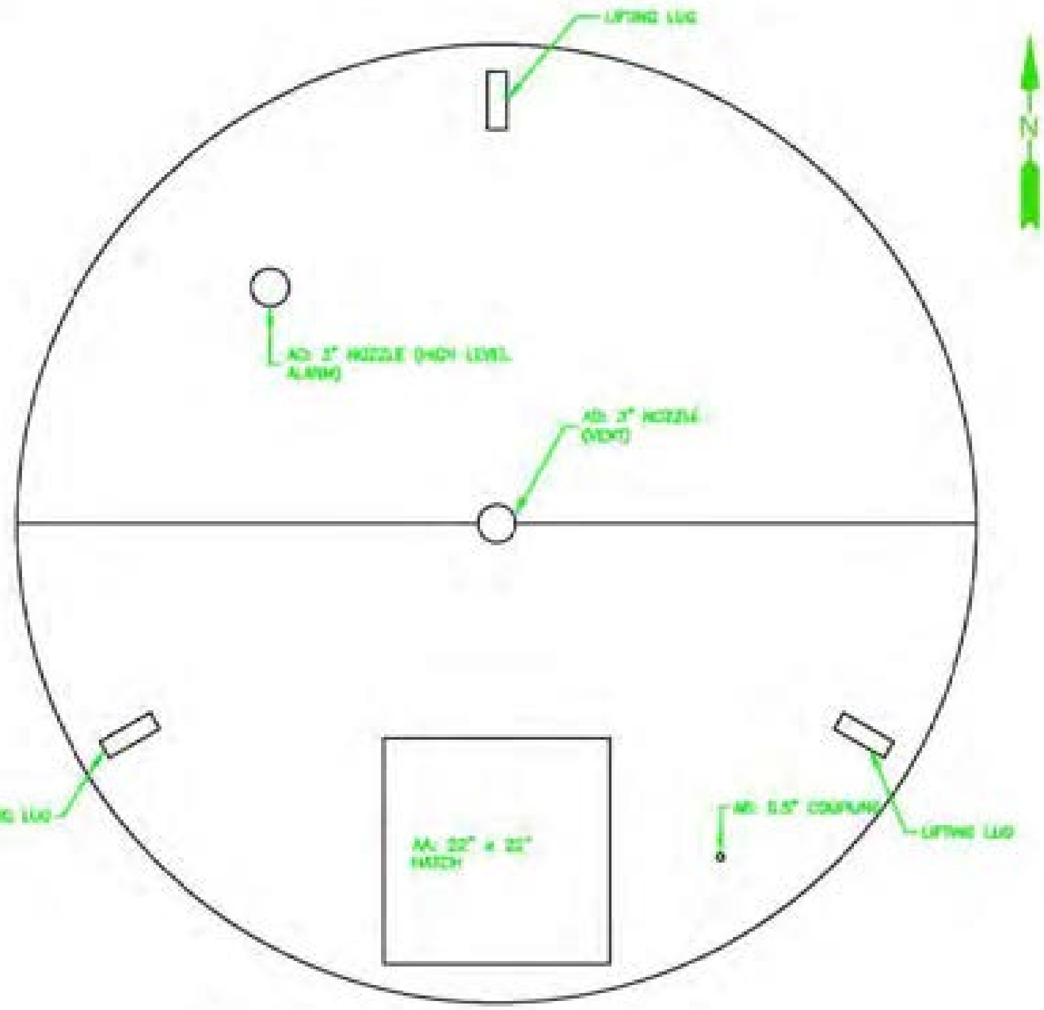


LEGEND & NOTES

SEE OTHER PAGES FOR ULTRASONIC THICKNESS MEASUREMENTS OF NOZZLES AND SHELL. MEASUREMENTS UNLESS OTHERWISE NOTED ARE OF THE STEEL AND DO NOT INCLUDE ANY COATING OR PAINT.

CUSTOMER: WSP	SHELL HEIGHT: 12' DIAMETER: 8'-9"	INSPECTION DATE: 10/14/2020	MISTRAS SERVICES
LOCATION: KEYPORT, WA	INSPECTOR: ALEC ARPINO	DRAWING NUMBER: WSP-104-B	
TANK NUMBER: K-1051-104	TECHNICIAN: BRANDON GONZALEZ	CAD DRAFTSMAN: B. GONZALEZ	7820 S 210th Street, Building C, Suite 110 KENT, WA 98032

TANK ROOF DRAWING



LEGEND & NOTES

SEE OTHER PAGES FOR ULTRASONIC THICKNESS MEASUREMENTS OF NOZZLES AND SHELL. MEASUREMENTS UNLESS OTHERWISE NOTED ARE OF THE STEEL AND DO NOT INCLUDE ANY COATING OR PAINT.

CUSTOMER: WSP	SHELL HEIGHT:12' DIAMETER: 8'-9"	INSPECTION DATE: 10/14/2020	MISTRAS SERVICES
LOCATION: KEYPORT, WA	INSPECTOR: ALEC ARPINO	DRAWING NUMBER: WSP-104-R	
TANK NUMBER: K-1051-104	TECHNICIAN: BRANDON GONZALEZ	CAD DRAFTSMAN: B. GONZALEZ	7820 S 210th Street, Building C, Suite 110 KENT, WA 98032

12.0 Appendix A – References

References:

1) Washington State Department of Ecology, Dangerous Waste Regulations, Chapter 173-303 WAC
2) Conversations with the client
3) API RP 652, Lining of Above Ground Petroleum Storage Tanks
4) API RP 651, Cathodic Protection of Above Ground Storage Tanks
5) API Guide for the Inspection of Refinery Equipment – Chapter 13, Atmospheric and Low Pressure Tanks
6) API Standard 650, Welded Steel Tanks for Oil Storage
7) API Standard 653, Tank Inspection, Repair, Alteration, and Reconstruction
8) API Standard 620, Design and Construction of Large, Welded, Low Pressure Storage Tanks

APPENDIX G

INSPECTION REPORT TANK K1051-105

WSP

Naval Undersea Warfare Center

Tank K1051-105

In Service Inspection

Above Ground Storage Tank Inspection Report

In accordance with
WAC 173-303-640
Dangerous Waste
Regulations

WSP

Tank K1051-105

In Service Inspection

Keyport, WA

October 14, 2020 to October 14, 2020

Report Number 40865710-7

Prepared By :
7820 South 212th St. St. 110
Kent, WA, 98032

www.mistrasgroup.com

Inspection Date
October 14, 2020

Table of Contents

1.0 Job Information

Job Location :	**Naval Undersea Warfare Center**
	610 Dowell Street
	Keyport, WA
	98345-7610
Customer Representative :	Grace Roberts
Customer Phone Number :	206-431-2295
Job Charge Number :	N442555-15-D-0011-00
Report Number :	40304587-7
Mistras Work Order Number :	T67726-40865710
Inspection Personnel Provided :	Alec Arpino
	API 653 Certified Inspector
	API 653 (77549)/UTT/MT
	Brandon Gonzalez
	Level II Technician
	MFL/UTT/PT

2.0 Tank Inspection Data Sheet

General :

Tank Number	K1051-105
Owner	U.S. Navy
Design Standard	Unknown
Tank Location	Keyport, WA
Product	Otto Fuel/ Alcohol
Specific Gravity	1.23
Manufacturer	Flohr Metal Fabrication
Manufacture Date	1994
Cathodic Protection	No
Data Plate Present	Yes
Data Plate Condition	Good Condition

Dimensions :

Diameter (ft)	8.23
Height (ft)	13.02
Capacity Nominal (Gallons)	5,551.0

Geometry :

Foundation	Concrete Pad with Steel Support Legs
Bottom	Cone Down Butt Welded
Shell	Butt Welded
Fixed Roof Type	Self-Supported Fixed Cone

Access :

Stairway	None
Roof Access	Yes

Coatings :

Bottom	Internal Thin Film Epoxy
Shell	External White
Roof	External White

3.0 Suitability for Service

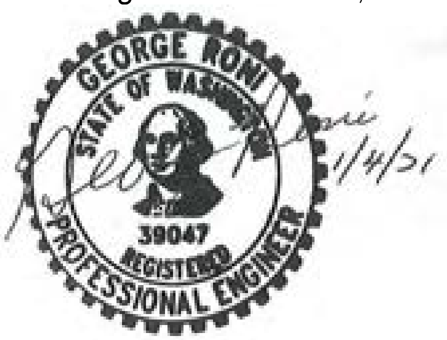
WSP on behalf of the U.S. Navy has contracted Mistras Group, Inc. to perform a in service inspection on Tank K1051-105 located in Building 1051 of the Naval Undersea Warfare Center located in Keyport, WA. This inspection was performed in accordance with the current criteria set forth in WAC 173-303-640 Dangerous Waste Regulations.

There were no issues found that would require repair at this time. The Navy should continue with routine maintenance and observation of the tank. The next formal WAC 173-303-640 inspection should be conducted per the established schedule which is 5 years per the current SPCC Plan for this site.

Tank K1051-105 can be considered suitable for continued service.

<u>TANK CERTIFICATION</u>

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."[1]



George Roni, P.E.

1) Per WAC 173-303-810 as required by WAC 173-303-640 (2)

Mistras Services has evaluated the condition of this tank based on the observations and measurements made by the tank Inspector. While our evaluation accurately describes the condition of the tank at the time of inspection, the tank owner/operator must independently assess the inspection information/report provided by Mistras Services and any conclusions reached by the tank owner/operator and any action taken or omitted to be taken are the sole responsibility of the owner/operator. With respect to inspection and testing, Mistras Services warrants only that the services have been performed in accordance with accepted industry practice. If any such services fail to meet the foregoing warranty, Mistras Services shall re-perform the service to the same extent and on the same conditions as the original service.

The preceding paragraph sets forth the exclusive remedy for claims based on failure or of defect in materials or services, whether such claim is made in contract or tort (including negligence) and however instituted, and, upon expiration of the warranty period, all such liability shall terminate. The foregoing warranty is exclusive and in lieu of all other warranties, whether written, oral, implied or statutory. NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE SHALL APPLY, nor shall Mistras Services be liable for any loss or damage whatsoever by reason of its failure to discover, report, repair or modify latent defects or defects inherent in the design of any tank inspected. In no event, whether a result of breach of contract, warranty or tort (including negligence) shall Mistras Services be liable for any consequential or incidental damages including, but not limited to, loss of profit or revenues, loss of use of equipment tested or services by Mistras Services or any associated damage to facilities, down-time costs or claims of other damages.

4.0 Inspection Findings

WSP on behalf of the U.S. Navy has contracted Mistras Group, Inc. to perform an in Service Inspection on Tank K1051-105 located in Keyport, WA. This inspection was performed in accordance Washington State Dangerous Waste Regulations WAC 173-303-640 (2).

Tank K1051-105 is a shop built 2 course Above Ground Storage Tank in Otto Fuel/ Alcohol service. This tank is 8.75 feet in diameter, and 13.02 feet in height and is equipped with a Fixed Cone Roof. The following details all inspection findings.

Foundation

This tank was installed on a concrete pad. The tank is elevated above the concrete pad by (4) 4 inch steel pipe support legs. Each support leg has an 8” X 8” X 1/2” steel pad at the base that is anchored to the concrete foundation via (4) 1/2 inch anchor bolts. The anchor bolts are embedded into the concrete foundation and secured at the top of the plate by the nuts.

The steel pipe support legs showed no evidence of dents, deformations, corrosion, pitting or other visible damage. The concrete at the base of each leg showed no evidence of cracking, spalling or broken concrete. The supports, footings, the anchor nuts and bolts are all coated. No coating failure or oxidation was noted.

The anchor nuts and bolts were found to be tight and secure. There was no evidence of elongation, corrosion, pitting or damage to the steel pads or the anchor nuts and bolts.

The tank sits within a below grade epoxy lined concrete vault. The vault appeared to structurally sound and showed no evidence of cracking, spalling or broken concrete. It appears that epoxy coating had been previously repaired at various locations around the vault. The repaired areas and the rest of the epoxy coating appeared well adhered and fluid tight.

The volume of the containment is large enough to contain the contents of the tank in the event of leaks or catastrophic failure, which is also in compliance with WAC 173-303-640.

Cone Bottom

The cone bottom in Tank K1051-105 is made up of 2 plates. The nominal floor plate thickness is 0.3125 inches.

The exterior surfaces of the tank showed no evidence of leaks from the plates, the plate to plate weld seams or the bottom to shell weld. There was no evidence of active corrosion, pitting or coating failure occurring on the plates or welds of the bottom. There was no evidence of dents, bulges or other deformations noted on the bottom plates.

At the apex of the bottom there is a 4 inch stainless steel nipple (pipe section) welded to the tank. There was no evidence of leaks from the attachment welds of the nipple to the bottom or the weld to the T-reducer section.
There was no evidence of leaks from the associated piping in the immediate area of the tank bottom attachment.

Shell

The shell on Tank K1051-105 consists of 2 courses and all joints are Butt Welded. A visual inspection and ultrasonic examination of the shell was conducted, the following details all findings.

The bottom of the shell to bottom transition has a reinforcement ring consisting of a 2-1/2 inch angle iron. The top of the reinforcement ring is fully fillet welded and the bottom is stitch welded. There is caulking in between the stitch welds along the bottom. There was no evidence of weld failures or deformations noted to the reinforcement ring.

There was no evidence of bulges, dents or abnormal deformations noted to the tank shell. There was no evidence of leaks in the shell plates, shell to shell horizontal or vertical welds, the shell to cone weld or the shell to roof weld. There was no evidence of active corrosion or pitting noted on the shell exterior.

The shell coating appeared to be in very good condition.

The shell plates were ultrasonically inspected externally to verify the remaining thickness of the shell plates. Ultrasonic thickness readings were obtained on the shell in 4 equally spaced locations at approximately 6.68 feet. Each scan was conducted in one of the 4 cardinal directions. A total of 4 readings per course were obtained.

Section 6.1 of this report details all ultrasonic thickness (UT) readings obtained, detailing the low's to highs per course. There were no abnormally low readings noted on the shell. The lowest reading of 0.182” was located on the 1st course on the East drop.

Shell Nozzles

A visual inspection and ultrasonic examination of all accessible shell nozzles and manways was conducted to evaluate the current condition of each nozzle. Visual inspection of each nozzle included evaluation of the external neck, all attachment welds, and flange faces.

There was no evidence of leaks from the nozzle attachment welds, the flanges, the flange bolting and associated valves or nearby attached piping. There is no evidence of coating failure occurring on the nozzles or couplings.

The attached piping appears to be stainless steel and the nozzles are carbon steel with the exception of pipe nipple E which is stainless steel. There is no evidence of galvanic reactions taking place due to the dissimilar metals. The flange faces appear to be raised and have Teflon type PTFE gasket material. The nozzle bolting appears tight and secure with proper thread engagements on the bolting.

All nozzles and manways were ultrasonically inspected (UT) by recording four readings on the top, bottom and both sides of each neck, one reading on each flange and the manway cover. There was no abnormally low thickness readings obtained. Section 6.5 details all data from UT exam.

Fixed Roof

The roof plates on Tank K1051-105 have a nominal thickness of 0.187 inches. The fixed roof plates were ultrasonically examined to determine the average remaining thickness. A total of 16 readings were obtained on the roof, four readings per each cardinal direction. There was no evidence of thinning or corrosion on the roof plates. Section 6.3 details all the data from the UT exam.

The fixed roof plates were visually inspected. All plates were evaluated to determine the condition of the external coating system. Aside from a coating of dust the roof coating is in good condition. There was no evidence of corrosion, pitting, dents, bulges or other deformations to the roof plates.

There was no evidence of leaks in the roof plates, the roof plate to plate welds or the shell to roof weld.

Fixed Roof Nozzles

All fixed roof nozzles, nipples and couplings were visually inspected. The following details the findings from this inspection.

All roof nozzles were ultrasonically inspected to verify remaining thickness. A total of 4 readings per nozzle were obtained. All fixed roof nozzles and couplings were visually inspected. The following details the findings from this inspection.

There was no evidence of leaks from the roof nozzle and coupling attachment welds, flanges, flange bolting, threaded connections, associated valves or attached piping in the immediate area around the piping.

The roof top manway cover is securely attached to the roof with a hinge pin. There was no damage noted to the pin or the cover. There is a 3 inch nozzle attached to the manway cover for the liquid level float and tape gauge system. The system was not operated but appeared to be in satisfactory condition. There was no evident damage to the 3 inch nozzle or the flange face. The manway showed no evidence of coating failure, corrosion, pitting or other damage.

The 4 inch center roof vent piping runs to outside the building. The piping goes through the East wall and appears to have a pressure/vacuum style vent attached at the end of the piping run. The vent was unable to be inspected at the time of inspection due to its location and inaccessibility. The pressure/vacuum vent appeared to be in acceptable condition from the ground with no obvious visual damage noted.

All roof nozzles were ultrasonically inspected to verify remaining thickness. A total of 4 readings per nozzle were obtained. There were no abnormally low readings noted on the roof nozzles. Section 6.6 details the data from the UT exam.

Access Ways & Handrails

The roof is accessible from a free standing ladder and catwalk system. This catwalk is used to access all the tanks inside the containment for visual inspections and gauging purposes.

The ladder and the catwalk are in acceptable condition. There was no damage noted to the ladder frame or rungs. The steps showed no signs of damage to the frame, the treads or the handrails. The catwalk showed no damage to the frame, the grating or the handrails. Much of the handrail was covered in black plastic during the inspection.

The catwalk supports are 3” X 3” square piping uprights that are anchored to the concrete by (2) 3/4 inch anchor bolts at each support location. There is 2-1/2 inch angle iron braces used as cross bracing. There were no evident weld failures, damage to the support structures, attachment hardware or the anchorage locations. The attachment hardware appears to be tight and secure. The catwalk grating is galvanized and in acceptable condition. The grating is tack welded into place. There were no signs of weld failure. There was no evidence of corrosion caused thinning or holes noted in the grating.

The 2 inch steel pipe handrails are 42 inches high at the top rail, 24 inches at the mid-rail with 4 inch toe boards. There were no signs of holes, corrosion or pitting noted in the top rail, the mid-rail or the uprights.

Miscellaneous Appurtenances

For product level gauging, this tank is equipped with a float and tape style gauging system. This unit was found to be in what appears to be visually acceptable condition with no apparent damage noted. The unit was not operated at the time of inspection.

The tank is equipped with a Delta Controls roof transponder. The unit model is an 872C-V-10-2NPT-6SE-IS-CC with a serial number of UGD9966-A2. The unit appeared in satisfactory condition with no apparent damage to the unit noted.

For electrical safety issues and lightning protection, this tank is equipped with (1) 1/2 inch braided grounding cable. The cable was found to be satisfactory condition. The cable is attached to the reinforcement ring on one end and attached to a grounding bar that is embedded into the concrete foundation.

Inspectors Signature: ______________________________

Alec Arpino
API 653
Certification No. 77549 Exp. 12/31/2023

Reviewed by:

____
George Roni, PE
API 653 Cert. No. 2042, Exp. 4/30/23

Mistras Services has evaluated the condition of this tank based on the observations and measurements made by the tank Inspector. While our evaluation accurately describes the condition of the tank at the time of inspection, the tank owner/operator must independently assess the inspection information/report provided by Mistras Services and any conclusions reached by the tank owner/operator and any action taken or omitted to be taken are the sole responsibility of the owner/operator. With respect to inspection and testing, Mistras Services warrants only that the services have been performed in accordance with accepted industry practice. If any such services fail to meet the foregoing warranty, Mistras Services shall re-perform the service to the same extent and on the same conditions as the original service.

The preceding paragraph sets forth the exclusive remedy for claims based on failure or of defect in materials or services, whether such claim is made in contract or tort (including negligence) and however instituted, and, upon expiration of the warranty period, all such liability shall terminate. The foregoing warranty is exclusive and in lieu of all other warranties, whether written, oral, implied or statutory. NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE SHALL APPLY, nor shall Mistras Services be liable for any loss or damage whatsoever by reason of its failure to discover, report, repair or modify latent defects or defects inherent in the design of any tank inspected. In no event, whether a result of breach of contract, warranty or tort (including negligence) shall Mistras Services be liable for any consequential or incidental damages including, but not limited to,

5.0 Calculations
5.1 Thickness Calculations

Calculations for Shell & Cone-Shaped Tank Bottom - per API 620

Date of Inspection: 10/14/2020				
Owner	NUWC			
Tank No.	K1051-105			
Diameter, D	8.500	ft	102.00	inches
Shell Height, H	12.000	ft	144.00	inches
Fill Height	12.000	ft	144.00	inches
Original Shell thickness	0.188	inches		
Measured Shell thickness, t_c	0.182	inches		
Original Cone thickness	0.313	inches		
Measured Cone thickness, t_h	0.303	inches		
Specific Gravity of contents of tank, SG	1.230			
Depth of Cone, d	14.00	inches	1.1667	ft
S, allowable tensile stress of shell & cone	15,200	psi		
Joint Efficiency cone-to-shell & long cone joints, E_1	0.70			
Joint Efficiency shell vertical joints, E_2	0.70			
Operating Pressure at top of tank, P_o	0.00	psi	0	psf

Note that per API 620 the max. operating pressure at top of tank is 15 psig.

O.D. of connection at bottom of cone (if none enter 0)	4.50	inches				
1/2 Apex angle, alpha = a	1.291143	radians	73.97702	degrees		
Total Pressure, P at plane AA	921.02	psf (includes hydrostatic head + P_o)			6.40	psi

Plane AA is at the Spring Line.

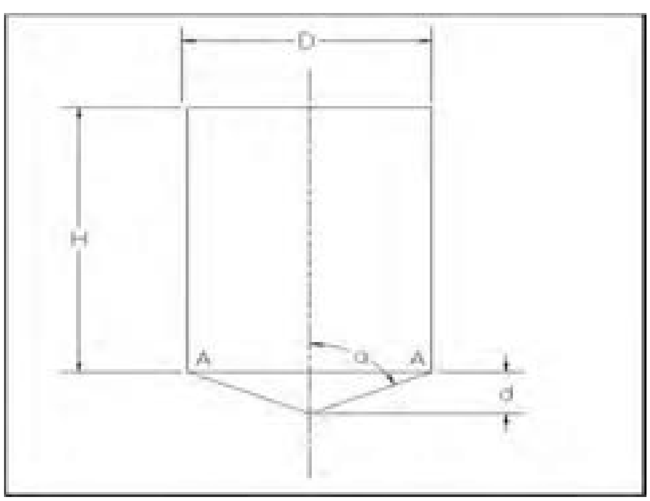


Figure No. A1

1) Shell Unit Forces @ Plane AA, See Figure No. A2

Sum $F_x = 0$

$2T_{2s} = PD$

$T_{2s} = PD/2$

$T_{2s} =$ 326 lb/in

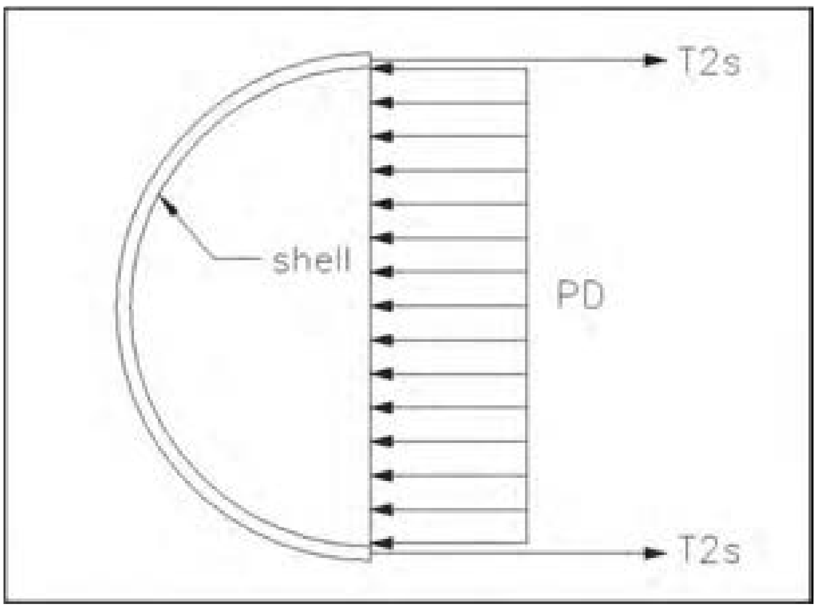


Figure No. A2

2) Cone unit force, T_2, the latitudinal unit force. Also known as the circumferential unit force. See Figure No. A3

R_2, radius of curvature of cone at A

$R_2 = AB/\cos(a)$

$R_2 =$ 184.7673 inches

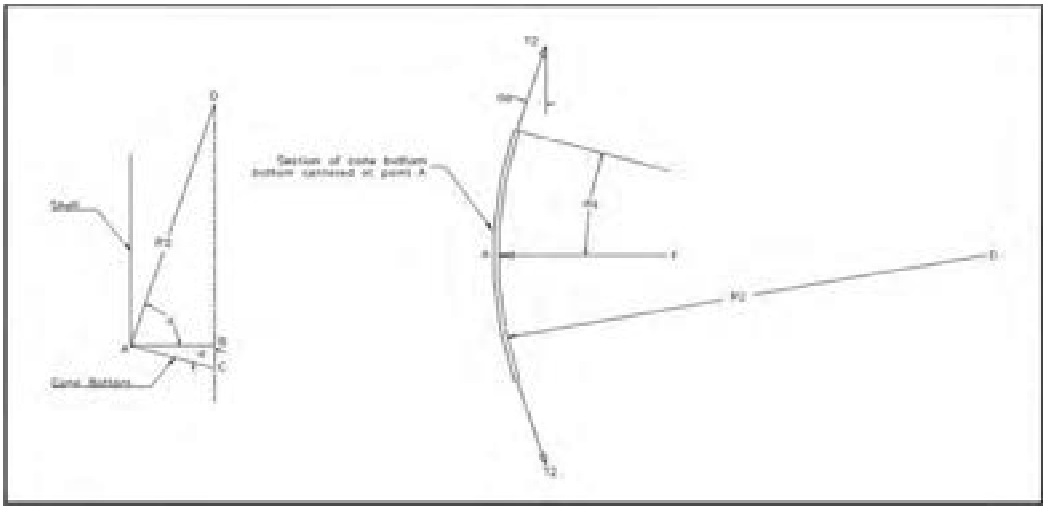


Figure No. A3

Sum of $F_x = 0$

F = the force on 1 inch wide section of cone at point A with an infinitesimal arc length = 2 x dq

$F = P(1)(2)(dq)(R_2)$

$F = 2PdqR_2$

$F - 2T_2 * Sin(dq) = 0$

$2PdqR_2 = 2T_2 Sin(dq)$ and for small dq, Sin(dq) = dq

$PR_2 = T_2$

$T_2 = PR_2$

$T_2 =$ 1182 lb/in

3) Cone unit force, T_1, the Meridional unit force. See Figure No. A4

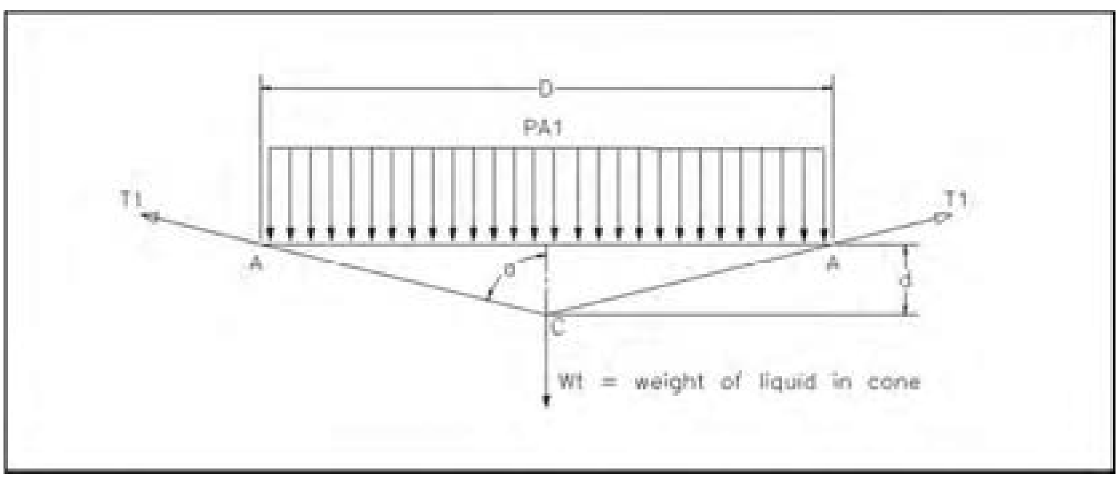


Figure No. A4

A_1 = PI/4 * D^2
A_1 = 8171.282 square inches 56.74502 square feet

V, Volume of Cone = (PI*D/2*D/2*d)/3
V = 22.067507 ft^3

W_t = SG* 62.4 lb/ft^3 * V
W_t = 1,694 lb

Sum F_y = 0
T_1Cos(a)PI*D - W_t -PA_1 =0
T_1 = (W_t + PA_1)/Cos(a)PI*D
T_1 = 610 lb/in

4) Knuckle Region Reinforcement Check per API 620 3.12

The measured cone bottom thickness is defined as t_h here, t_h =	0.303	inches
The measured shell thickness is defined as t_c here, t_c =	0.182	inches
R_2, radius of curvature of cone at A =	184.77	inches
R_c, radius of curvature shell =	51	inches

w_h = 0.6* sqrt(R_2 *t_h)
w_h = 4.489367 inches

w_c = 0.6* sqrt(R_c *t_c)
w_c = 1.827982 inches

Additional attached reinforcement area Ad
Ad = 1.1875

Available reinforcing area, A_a = w_h*t_h + w_c*t_c+Ad
A_a = 2.880471 sq inches

T_1 = 610 lb/in
T_{2s} = 326 lb/in
T_2 = 1182 lb/in

Per API 620, the magnitude of the total circumferential force acting on any vertical cross section through the compression ring region shall be computed as follows:

Q = T_2w_h + $T_{2s}w_c$ -T_1R_cSin(a) Note that if Q is negative, compression is indicated.
Q = 5,305 + 596 - 29,903
Q = -24,001

A_c, the required compression ring reinforcing area = Q/15,000
A_c = 1.600096 sq. inches

A_a	>	Ac	
2.880471	>	1.6000955	TRUE

and since Q is negative the following condition must be true also.

$w_h Sin(a)$	>	$0.015 * R_c$	
4.31496	>	0.765	TRUE

Since both conditions are true, knuckle region is adequately reinforced.

5) Check Measured Shell Thickness vs Required Shell Thickness

The required shell thickness is $t_{cr} = T_{2s}/SE_2$

0.030658 However, thickness must be at least 0.100" per API 653, so final required shell thickness is 0.100

t_c	>	t_{cr}	
0.182	>	0.100	TRUE

6) Check Measured Cone Bottom Thickness vs Required Cone Bottom Thickness at Plane A-A

The required cone thickness, t_{hr}, is the greater of the following 2 formulas

$t_{hr} = T_1/SE_1$ or $t_{hr} = T_2/SE_1$

$t_{hr} =$ 0.057334 $t_{hr} =$ 0.111069

$t_{hr} =$ 0.111069 However, thickness must be at least 0.100" per API 653, so final required cone bottom thickness is: $t_{hr} =$ 0.111 inches

t_h	>	t_{hr}	
0.303		0.111	TRUE

7) Tank Volume or Capacity Calculation

V_{total} = Volume of Cone + Volume of Shell

22.06751 ft^3 + (PI/4) $*D^2*H$

22.06751 + 680.9402

$V_{total} =$ 703 ft^3 or 5,259 gallons

5.2 Seismic Calculations

SEISMIC ANALYSIS
For Tank Supported above grade on legs

1) Input Data

Tank Location			Keyport, WA			
Tank no.			K1051-105			
dia, D			8.5	ft		
shell height, Ht			12	ft		
fill height, H			12	ft. This is height from top liquid surface to bottom of tank.		
floor thk			0.3125	in		
roof thk			0.188	in		
slope roof, ϑ	0.062418	radians	3.5763	degrees	This is standard slope of 3/4" in 12".	
shell thk, t			0.188	in		
sg liquid, G			1.230			
density steel			490	lb/sq ft		
Proportion of roof supported by shell			1	1 indicates 100%.		
Seismic zone factor, Z			0.300	See fig E-1 & Table E-2		
Importance Factor			1.00	See E.3.1		
Site coefficient			1.5	See table E-3		
Lateral force coefficient, C1			0.6			
For cone bottom supported above the grade, the depth of cone, Xb			1.1666	feet		
Height, L that shell sup above grade			2.3333	feet		
Height from bottom of tank to grade, m			1.1667	feet		
b, the width of the base			7.5	feet		
Slope floor, a	0.267896	radians	15.3493	degrees		
1/2 apex angle of cone floor =			1.3029	radians	74.6507	degrees
		Radius	4.25	ft		
		D/H	0.7083	The diameter/fill height ratio from above		

2) Weights

a) Shell

Plate Area	320	sq ft
plate weight/sq ft	7.677	lb/sq ft
weight shell plate	2,460	lb
misc shell weight	200	lb
Total shell weight	2,660	lb

b) Roof

no. Rafters	0	
length rafters	0	
Type of rafter (shape)		
lb/ft rafters	0	lb/ft
weight rafters	0	lb

Plate Area = PI*(r/cos(ϑ))^2

Plate Area	56.97	sq ft
plate weight/sq ft	7.677	lb/sq ft
Plate weight	437	lb
snow load	0	lb
misc weight	100	lb
Total Roof weight, Wr	537	lb

c) Cone Bottom

Plate Area = PI*(r/cos(gamma))^2

Plate Area	61.02	sq ft
plate weight/sq ft	12.760	lb/sq ft
Plate weight	779	lb
misc weight	100	lb
Bottom weight,Wb	879	lb

3) Determination of Additional Seismic Inputs

Natural period of 1st sloshing mode, T

T = k* sq root (D)		For D/H =	0.71	k =	0.58	from Figure E-4
T	1.691	seconds		S =	1.5	from table E-3

Is T < 4.5s? true, so C2=0.75S/T

C2 = 0.75S/T

C2 0.665

W1 & W2

D/H = 0.71

The weight of liquid, Wt

Wtshell = pi/4*D^2*62.4*sg*Ht — Wtcone = ((pi*r^2*depth of cone)/3)*62.4*sg

4,355 x Ht

Wtshell = 52,264 lb — Wtcone = 1,377 lb

Wt = Wtshell + Wtcone

Wt 53,640 lb

W1 = Wt*W1/Wt — W1/Wt = 0.820 from fig E-2

W1	43,985	lb	
W2		W2/Wt =	0.160 from fig E-2
W2	8,582	lb	

X1 & X2

X1/H =	0.42	from fig E-3
X1=	5.04	ft
X2/H =	0.76	from fig E-3
X2	9.12	

Xs = height from cg of shell to bottom of tank = 7.1666 feet

4) Calculation of Overturning Moment, M

M = Z*I*(C1*Ws*Xs'+C1*Wr*Ht'+C1*Wb*Xb'+C1*W1*X1'+C2*W2*X2') ft lb

m	1.1667	see above
Z	0.3	see above
I	1	see above
C1	0.6	see above
C2	0.665	see above
Ws	2,660	shell weight
Xs'	8.33	the height from grade to Fs
Wr	537	roof weight
Wb	879	bottom weight
Xb'	2	the height from the grade to Fb
Ht'	14.33	the height from grade to Fr
W1	43,985	effective weight of liquid responsible for impulse force
X1'	6.21	the height from the grade to F1
W2	8,582	effective weight of liquid responsible for sloshing or convective force of liquid.
X2'	10.29	the height from the grade to F2

Z*I =	0.3				
C1*Ws*Xs'=	13,300		Lateral Force, Fs =	479	Impulse force of tank shell
C1*Wr*Ht'=	4,621		Lateral Force, Fr =	97	Impulse force of tank roof
C1*W1*X1'=	163,802		Lateral Force, F1 =	7,917	Impulse force of liquid
C1*Wb*Xb' =	158		Lateral Force, Fb =	158	Impulse force of tank bottom
C2*W2*X2'=	58,736		Lateral Force, F2 =	1,713	Convective, or sloshing force of the liquid
M=	72,185	ft lb	Total Lateral Force, Ft =	10,364	lb

5) Check Stability of Tank:

The resisting Moment is Mr = (weight of tank + the weight of fluid) x 1/2 of the base width

weight of tank =	4,076	lb
weight of liquid =	53,640	lb
width of base =	7.5	ft

Mr = 216,436 ft-lb

Safety Factor for overturning = Mr/M

Safety Factor for overturning = **3.00** **> 1.5** **O.K., Tank is stable**

Note that if a tank is found to be unstable that indicates that tank anchors are needed to resist the uplift forces at the base plate to grade interface that will occur during an earthquake. An unstable tank is susceptible to tipping during an earthquake.

6) Check Need for Anchors Due Solely to Lateral Loads

Total weight of liquid	53,640	lb	
Total weight of tank	4,076	lb	
Total weight, W	57,716	lb	
Coefficient of friction =	0.030	Between steel & ice, the worst possible case.	

Frictional Force resisting the total lateral force = W*coefficient of static friction between base plates & grade

Ff = 1,731

Is Ff > Ft * 1.5 **Not true, therefore anchors are needed for lateral seismic forces**

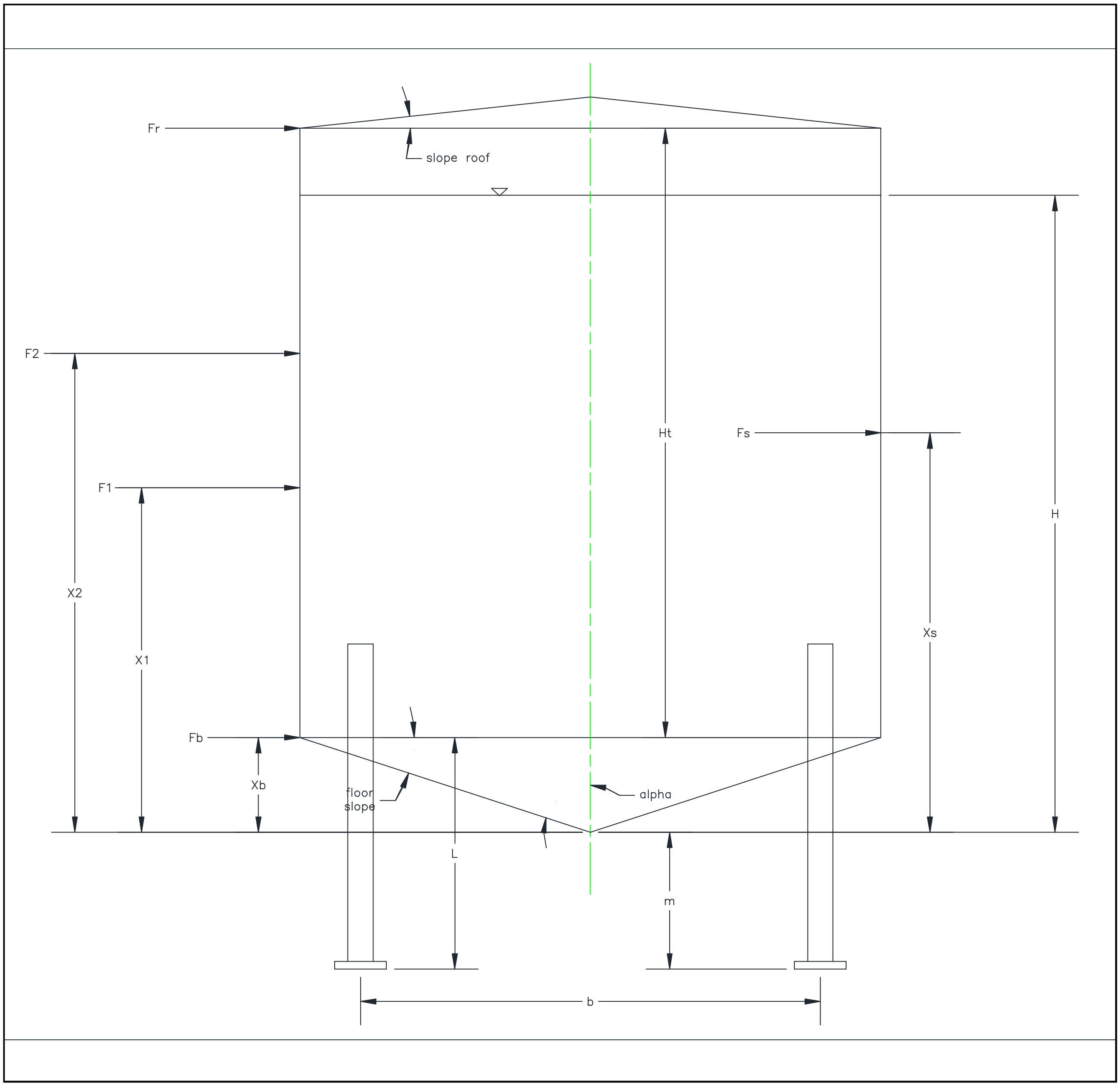
The shear force on each bolt, 16 anchor bolts are used is = 648 lb

The 16 ea. 1/2 anchors bolts should provide at least this much strength plus a safety margin and a corrosion allowance for the bolts.

7) Check Vertical Forces at Anchor Points
Both Seismic and Dead Load.

Vertical Load, P =	W =	-57,716	lb, this force is given a negative sign to indicate a downward
N, number of anchor locations =		4	direction.
For 4 anchor points, I =4*(b/2)^2 =		56.250	sq ft.
c =		3.750	ft
Max anchor forces, F = P/N + - Mc/I			
	Mc/I =	4,812	lb

	F =	-9,617	lb	If negative that indicates a downward force and
	and F =	-19,241	lb	no tension in anchor bolt.
Foot print size of 1 base plate =		100	sq inches	
Bearing stress = F/footprint area =		192.4	psi	
Allowable compressive strength of the foundation under the base plates =		1,500	psi, the foundation is concrete, and the concrete is assumed to have at least this strength.	
Safety factor = 1,500	divided by	192.4	=	7.80
Safety Factor	**=**	**7.80**	**> 1.5**	**O.K., Foundation strength is acceptable**


Fr
slope roof
F2
Ht
Fs
H
F1
X2
Xs
X1
Fb
Xb
floor slope
alpha
L
m
b

6.0 Ultrasonic Thickness Data

6.1 Shell Plates UT

The following table details all readings (in) from the shell UT survey. All scan drops were equally spaced at 6.87 ft.

Data and Statistics		**North**	**East**	**South**	**West**	*Readings Line Average*
Course 2	**4**	0.184	0.186	0.187	0.186	0.186
	3	0.184	0.185	0.187	0.186	0.186
	2	0.185	0.185	0.187	0.187	0.186
	1	0.184	0.186	0.186	0.186	0.186
Course 1	**4**	0.185	0.182	0.185	0.186	0.185
	3	0.185	0.182	0.184	0.184	0.184
	2	0.185	0.184	0.184	0.184	0.184
	1	0.185	0.183	0.184	0.184	0.184
Scan Line Average		0.186	0.185	0.184	0.186	0.185

The tables below presents the statistics of the thickness readings (in) obtained on the Shell plates.

Course #	**Min**	**Avg**	**Max**
2	0.184	0.186	0.187
1	0.182	0.184	0.186
Global	0.182	0.185	0.187

6.2 Cone Bottom Plates UT

The following table details all readings (in) obtained on the cone bottom plates.

Plate ID \ Reading ID	1	2	3	4	5	6	7	8	*Avg*
North to South	0.307	0.307	0.308	0.303	0.308	0.308	0.307	0.304	0.307
East to West	0.305	0.306	0.305	0.305	0.306	0.305	0.305	0.306	0.305
Avg	0.306	0.307	0.307	0.304	0.307	0.307	0.306	0.305	0.306

The table below presents the statistics of the thickness readings obtained on the floor plates.

UT Summary	
Maximum	0.308
Average	0.306
Minimum	0.303

6.3 Fixed Roof Plates UT

The following table details all readings (in) obtained on the Fixed Roof plates.

Plate ID \ Reading ID	1	2	3	4	5	6	7	8	*Avg*
North to South	0.186	0.186	0.187	0.188	0.187	0.187	0.186	0.188	0.187
East to West	0.188	0.187	0.187	0.185	0.188	0.186	0.185	0.185	0.186
Avg	0.187	0.187	0.187	0.186	0.188	0.187	0.186	0.186	0.187

The table below presents the statistics of the thickness readings obtained on the roof plates.

UT Summary	
Maximum	0.188
Average	0.187
Minimum	0.185

6.4 Shell Nozzle and Appurtenance Table

Item	Type	Service	Pipe Size (in)	Station (ft)	Center Line Elevation (ft)	Distance From Shell to Flange Face (in)
A	Manway	Access	24.0	0	21.0	6.0
B	Nozzle	Transfer	3.0	9.0	138.5	5.75
C	Nozzle	Transfer	2.0	18.0	133.0	5.75
D	Nozzle	Transfer	2.0	22.75	132.5	5.375
E	Pipe Nipple	Bottom Draw	4.0	–	–	–

Note: The data represented in the weld spacing column is the minimum spacing measured. H, V, or N indicates which is the minimum distance from the nozzle measured. (H=Horizontal Weld, V=Vertical Weld, N=Nozzle Weld)

6.5 Shell Nozzle UT

Item	Type	Service	Pipe Size (in)	Top (in)	Bottom (in)	Right (in)	Left (in)	Repad Thickness (in)	Flange Thickness (in)	Cover Thickness (in)	Comments
A	Manway	Access	24.0	0.243	0.241	0.242	0.244	–	0.410	0.487	
B	Nozzle	Transfer	3.0	0.208	0.211	0.208	0.209	–	0.944	–	
C	Nozzle	Transfer	2.0	0.148	0.145	0.148	0.148	–	0.726	–	
D	Nozzle	Transfer	2.0	0.148	0.148	0.147	0.148	–	0.720	–	
E	Pipe Nipple	Bottom Draw	4.0	0.108	0.105	0.108	0.109	–	–	–	Stainless Steel

6.6 Fixed Roof Nozzle UT

Item	Type	Service	Pipe Size (in)	North (in)	South (in)	East (in)	West (in)	Comments
AA	Hatch	Access	22.0 x 22.0	0.242	0.242	0.242	0.243	
AB	Coupling	Air Line	0.75	–	–	–	–	
AC	Nozzle	HLA	4.0	0.215	0.209	0.210	0.210	
AD	Nozzle	Vent	4.0	0.208	0.210	0.206	0.207	

7.0 Shell Corrosion Rates

Course	$t_{previous}$ Previous Thickness (in)	Year Obtained	t_{actual} Actual Thickness (in)	Year Obtained	C_r Corrosion Rate (in/yr.)	t_{min} Minimum Allowable Thickness (in)	R_L Remaining Life (yr.)
2	0.188	1994	0.184	2020	0.00016	0.100	541.57
1	0.188	1994	0.182	2020	0.00023	0.100	352.45

8.0 Photographs

Tank Labeling	Data Plate
	
Manway	Ground
	
Nozzle B	Nozzle C
	

Nozzle D	Bottom Draw
	
Bottom Draw	**Support Leg**
	
Stiffener	**Standoff**
	

Standoff	Support Leg
	
Anchor Plate	Roof
	
Roof	Area Overview
	

Area Overview

Area Overview

Walkway

Walkway

Walkway

Area Overview

Ladder	Ladder
	

9.0 NDE Equipment Used

The equipment utilized for the inspection of the tank included of the following :

Pit Gauge

Manufacturer	Model	Serial No
W.R. Thorpe	1	1.979.912

Ultrasonic Transducers

Manufacturer	Model	Serial No	MHz	Diameter
Olympus	D790-SM	865199	5	0.375

UT Equipment

Manufacturer	Model	Serial No
Olympus	38DL Plus	130573601
UTT Pole Crawler	MC-2258	1103095

10.0 Inspector Certifications

AMERICAN PETROLEUM INSTITUTE
Individual Certification Programs: ICP™

API Individual Certification Programs

verifies that

Michael Alec Arpino

has met the requirements for API certification

API-653 Aboveground Storage Tank Inspector

Certification Number *77549*

Original Certification Date *December 31, 2017*

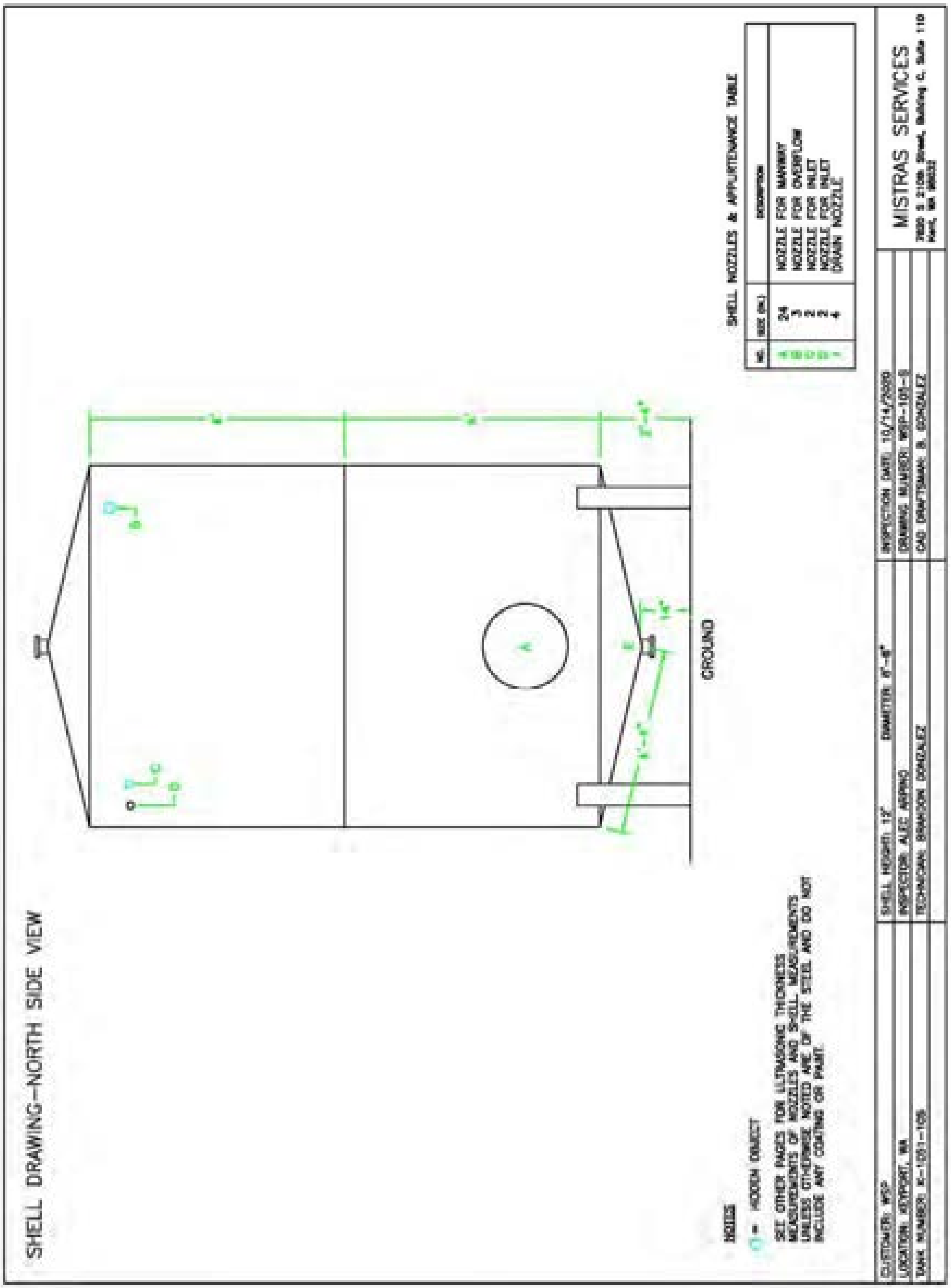
Current Certification Date *December 31, 2017*

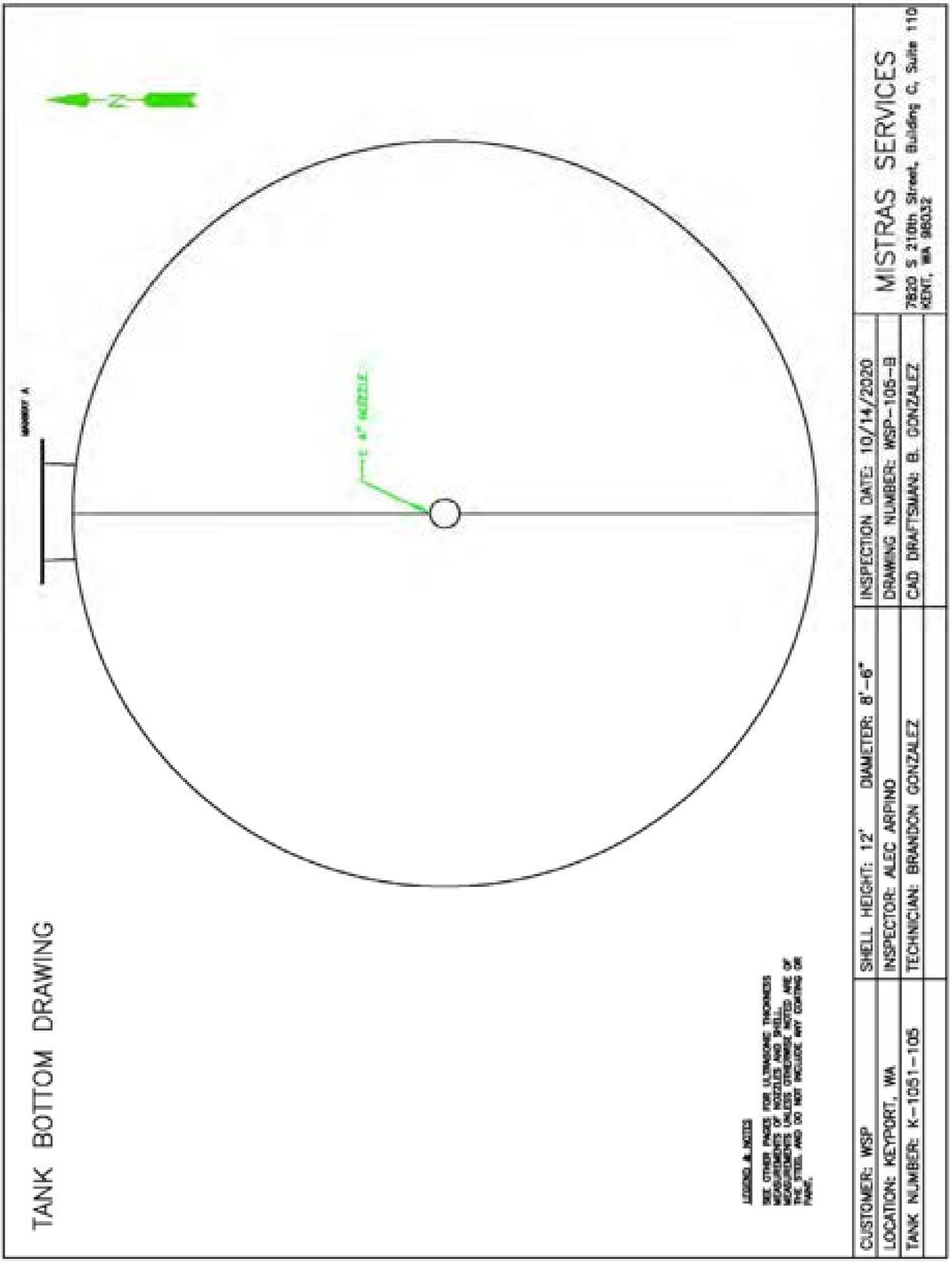
Expiration Date *December 31, 2020*

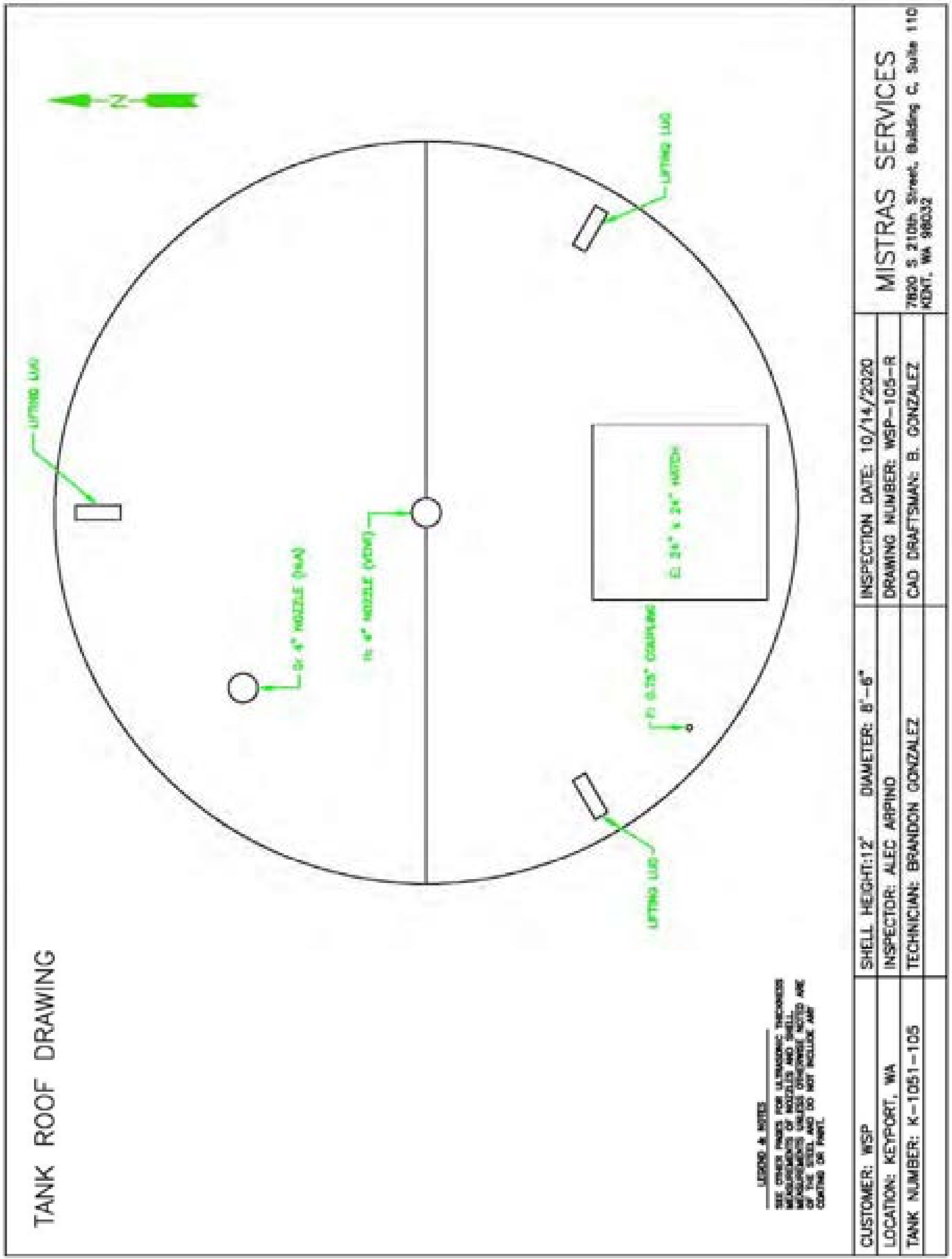
Manager, Individual Certification Programs

ICP

11.0 Drawings




TANK BOTTOM DRAWING
N
4" NOZZLE
LEGEND & NOTES
SEE OTHER PAGES FOR ULTRASONIC THICKNESS MEASUREMENTS OF NOZZLES AND SHELL. MEASUREMENTS UNLESS OTHERWISE NOTED ARE OF THE STEEL AND DO NOT INCLUDE ANY COATING OR PAINT.
CUSTOMER: WSP
LOCATION: KEYPORT, WA
TANK NUMBER: K-1051-105
SHELL HEIGHT: 12'
DIAMETER: 8'-6"
INSPECTOR: ALEC ARPINO
TECHNICIAN: BRANDON GONZALEZ
INSPECTION DATE: 10/14/2020
DRAWING NUMBER: WSP-105-B
CAD DRAFTSMAN: B. GONZALEZ
MISTRAS SERVICES
7820 S 210th Street, Building C, Suite 110
KENT, WA 98032


TANK ROOF DRAWING
N
LIFTING LUG
LIFTING LUG
LIFTING LUG
G: 4" NOZZLE (N/A)
H: 4" NOZZLE (VENT)
E: 24" x 24" HATCH
F: 0.75" COUPLING
CUSTOMER: WSP
LOCATION: KEYPORT, WA
TANK NUMBER: K-1051-105
SHELL HEIGHT:12'
DIAMETER: 8'-6"
INSPECTOR: ALEC ARPINO
TECHNICIAN: BRANDON GONZALEZ
INSPECTION DATE: 10/14/2020
DRAWING NUMBER: WSP-105-R
CAD DRAFTSMAN: B. GONZALEZ
MISTRAS SERVICES
7820 S 210th Street, Building C, Suite 110
KENT, WA 98032

12.0 Appendix A – References

References:

1) Washington State Department of Ecology, Dangerous Waste Regulations, Chapter 173-303 WAC
2) Conversations with the client
3) API RP 652, Lining of Above Ground Petroleum Storage Tanks
4) API RP 651, Cathodic Protection of Above Ground Storage Tanks
5) API Guide for the Inspection of Refinery Equipment – Chapter 13, Atmospheric and Low Pressure Tanks
6) API Standard 650, Welded Steel Tanks for Oil Storage
7) API Standard 653, Tank Inspection, Repair, Alteration, and Reconstruction
8) API Standard 620, Design and Construction of Large, Welded, Low Pressure Storage Tanks

APPENDIX H

INSPECTION REPORT TANK K1051-106

WSP

Naval Undersea Warfare Center

Tank K1051-106

In Service Inspection

Above Ground Storage Tank Inspection Report

In accordance with
WAC 173-303-640
Dangerous Waste
Regulations

WSP

Tank K1051-106

In Service Inspection

Keyport, WA

October 14, 2020 to October 14, 2020

Report Number 40865710-8

Prepared By :
7820 South 212th St. St. 110
Kent, WA, 98032

www.mistrasgroup.com

Inspection Date
October 14, 2020

Table of Contents

1.0 Job Information

Job Location :	**Naval Undersea Warfare Center**
	610 Dowell Street
	Keyport, WA
	98345-7610
Customer Representative :	Grace Roberts
Customer Phone Number :	206-431-2295
Job Charge Number :	N442555-15-D-0011-00
Report Number :	40304587-8
Mistras Work Order Number :	T67726-40865710
Inspection Personnel Provided :	Alec Arpino
	API 653 Certified Inspector
	API 653 (77549)/UTT/MT
	Brandon Gonzalez
	Level II Technician
	MFL/UTT/PT

2.0 Tank Inspection Data Sheet

General :

Tank Number	K1051-106
Owner	U.S. Navy
Design Standard	Unknown
Tank Location	Keyport, WA
Product	Otto Fuel/ Cyanide
Specific Gravity	1.23
Manufacturer	Flohr Metal Fabrication
Manufacture Date	1994
Cathodic Protection	No
Data Plate Present	Yes
Data Plate Condition	Good Condition

Dimensions :

Diameter (ft)	8.75
Height (ft)	13.02
Capacity Nominal (Gallons)	5,551.0

Geometry :

Foundation	Concrete Pad with Steel Support Legs
Bottom	Cone Down Butt Welded
Shell	Butt Welded
Fixed Roof Type	Self-Supported Fixed Cone

Access :

Stairway	None
Roof Access	Yes

Coatings :

Bottom	Internal Thin Film Epoxy
Shell	External White
Roof	External White

3.0 Suitability for Service

BergerABAM on behalf of the U.S. Navy has contracted Mistras Group, Inc. to perform a in service inspection on Tank K1051-106 located in Building 1051 of the Naval Undersea Warfare Center located in Keyport, WA. This inspection was performed in accordance with the current criteria set forth in WAC 173-303-640 Dangerous Waste Regulations.

There were no issues found that would require repair at this time. The Navy should continue with routine maintenance and observation of the tank. The next formal WAC 173-303-640 inspection should be conducted per the established schedule which is 5 years per the current SPCC Plan for this site.

Tank K1051-106 can be considered suitable for continued service.

<u>TANK CERTIFICATION</u>

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”[1]

George Roni, P.E.

1) Per WAC 173-303-810 as required by WAC 173-303-640 (2)

Mistras Services has evaluated the condition of this tank based on the observations and measurements made by the tank Inspector. While our evaluation accurately describes the condition of the tank at the time of inspection, the tank owner/operator must independently assess the inspection information/report provided by Mistras Services and any conclusions reached by the tank owner/operator and any action taken or omitted to be taken are the sole responsibility of the owner/operator. With respect to inspection and testing, Mistras Services warrants only that the services have been performed in accordance with accepted industry practice. If any such services fail to meet the foregoing warranty, Mistras Services shall re-perform the service to the same extent and on the same conditions as the original service.

The preceding paragraph sets forth the exclusive remedy for claims based on failure or of defect in materials or services, whether such claim is made in contract or tort (including negligence) and however instituted, and, upon expiration of the warranty period, all such liability shall terminate. The foregoing warranty is exclusive and in lieu of all other warranties, whether written, oral, implied or statutory. NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE SHALL APPLY, nor shall Mistras Services be liable for any loss or damage whatsoever by reason of its failure to discover, report, repair or modify latent defects or defects inherent in the design of any tank inspected. In no event, whether a result of breach of contract, warranty or tort (including negligence) shall Mistras Services be liable for any consequential or incidental damages including, but not limited to, loss of profit or revenues, loss of use of equipment tested or services by Mistras Services or any associated damage to facilities, down-time costs or claims of other damages.

4.0 Inspection Findings

WSP on behalf of the U.S. Navy has contracted Mistras Group, Inc. to perform an in Service Inspection on Tank K1051-106 located in Keyport, WA. This inspection was performed in accordance Washington State Dangerous Waste Regulations WAC 173-303-640 (2).

Tank K1051-106 is a shop built 2 course Above Ground Storage Tank in Otto Fuel/ Cyanide service. This tank is 8.75 feet in diameter, and 13.02 feet in height and is equipped with a Fixed Cone Roof. The following details all inspection findings.

Foundation

This tank was installed on a concrete pad. The tank is elevated above the concrete pad by (4) 4 inch steel pipe support legs. Each support leg has an 8” X 8” X 1/2” steel pad at the base that is anchored to the concrete foundation via (4) 1/2 inch anchor bolts. The anchor bolts are embedded into the concrete foundation and secured at the top of the plate by the nuts.

The steel pipe support legs showed no evidence of dents, deformations, corrosion, pitting or other visible damage. The concrete at the base of each leg showed no evidence of cracking, spalling or broken concrete. The supports, footings, the anchor nuts and bolts are all coated. No coating failure or oxidation was noted.

The anchor nuts and bolts were found to be tight and secure. There was no evidence of elongation, corrosion, pitting or damage to the steel pads or the anchor nuts and bolts.

The tank sits within a below grade epoxy lined concrete vault. The vault appeared to structurally sound and showed no evidence of cracking, spalling or broken concrete. It appears that epoxy coating had been previously repaired at various locations around the vault. The repaired areas and the rest of the epoxy coating appeared well adhered and fluid tight.

The volume of the containment is large enough to contain the contents of the tank in the event of leaks or catastrophic failure, which is also in compliance with WAC 173-303-640.

Cone Bottom

The cone bottom in Tank K1051-106 is made up of 2 plates. The nominal floor plate thickness is 0.3125 inches.

The exterior surfaces of the tank showed no evidence of leaks from the plates, the plate to plate weld seams or the bottom to shell weld. There was no evidence of active corrosion, pitting or coating failure occurring on the plates or welds of the bottom. There was no evidence of dents, bulges or other deformations noted on the bottom plates.

At the apex of the bottom there is a 2 inch carbon steel nozzle with a 90° bend welded to the tank. There was no evidence of leaks from the attachment welds of the nozzle to the bottom. There was no evidence of leaks from the associated piping in the immediate area of the tank bottom attachment.

Shell

The shell on Tank K1051-106 consists of 2 courses and all joints are Butt Welded. A visual inspection and ultrasonic examination of the shell was conducted, the following details all findings.

The bottom of the shell to bottom transition has a reinforcement ring consisting of a 2-1/2 inch angle iron. The top of the reinforcement ring is fully fillet welded and the bottom is stitch welded. There is caulking in between the stitch welds along the bottom. There was no evidence of weld failures or deformations noted to the reinforcement ring.

There was no evidence of bulges, dents or abnormal deformations noted to the tank shell. There was no evidence of leaks in the shell plates, shell to shell horizontal or vertical welds, the shell to cone weld or the shell to roof weld. There was no evidence of active corrosion or pitting noted on the shell exterior.

The shell coating appeared to be in very good condition.

The shell plates were ultrasonically inspected externally to verify the remaining thickness of the shell plates. Ultrasonic thickness readings were obtained on the shell in 4 equally spaced locations at approximately 6.87 feet. Each scan was conducted in one of the 4 cardinal directions. A total of 4 readings per course were obtained.

Section 6.1 of this report details all ultrasonic thickness (UT) readings obtained, detailing the low's to highs per course. There were no abnormally low readings noted on the shell. The lowest reading of 0.180” was located on the 2nd course on the West drop.

Shell Nozzles

A visual inspection and ultrasonic examination of all accessible shell nozzles and manways was conducted to evaluate the current condition of each nozzle. Visual inspection of each nozzle included evaluation of the external neck, all attachment welds, and flange faces.

There was no evidence of leaks from the nozzle attachment welds, the flanges, the flange bolting and associated valves or nearby attached piping. There is no evidence of coating failure occurring on the nozzles or couplings.

The attached piping appears to be stainless steel and the nozzles are carbon steel. There is no evidence of galvanic reactions taking place due to the dissimilar metals. The flange faces appear to be raised and have Teflon type PTFE gasket material. The nozzle bolting appears tight and secure with proper thread engagements on the bolting.

All nozzles and manways were ultrasonically inspected (UT) by recording four readings on the top, bottom and both sides of each neck, one reading on each flange and the manway cover. There were no abnormally low thickness readings obtained. Section 6.5 details all data from UT exam.

Fixed Roof

The roof plates on Tank K1051-106 have a nominal thickness of 0.187 inches. The fixed roof plates were ultrasonically examined to determine the average remaining thickness. A total of 16 readings were obtained on the roof, four readings per each cardinal direction. There was no evidence of thinning or corrosion on the roof plates. Section 6.3 details all the data from the UT exam.

The fixed roof plates were visually inspected. All plates were evaluated to determine the condition of the external coating system. Aside from a coating of dust the roof coating is in good condition. There was no evidence of corrosion, pitting, dents, bulges or other deformations to the roof plates.

There was no evidence of leaks in the roof plates, the roof plate to plate welds or the shell to roof weld.

Fixed Roof Nozzles

All fixed roof nozzles were visually inspected. The following details the findings from this inspection.

All roof nozzles were ultrasonically inspected to verify remaining thickness. A total of 4 readings per nozzle were obtained. All fixed roof nozzles were visually inspected. The following details the findings from this inspection.

There was no evidence of leaks from the roof nozzles attachment welds, flanges, and flange bolting, associated valves or attached piping in the immediate area around the piping.

The roof top manway cover is securely attached to the roof with a hinge pin. There was no damage noted to the pin or the cover. There is a 3 inch nozzle attached to the manway cover for the liquid level float and tape gauge system. The system was not operated but appeared to be in satisfactory condition. There was no evident damage to the 3 inch nozzle or the flange face. The manway showed no evidence of coating failure, corrosion, pitting or other damage.

The 4 inch center roof vent piping runs to outside the building. The piping goes through the East wall and appears to have a pressure/vacuum style vent attached at the end of the piping run. The vent was unable to be inspected at the time of inspection due to its location and inaccessibility. The pressure/vacuum vent appeared to be in acceptable condition from the ground with no obvious visual damage noted.

All roof nozzles were ultrasonically inspected to verify remaining thickness. A total of 4 readings per nozzle were obtained. There were no abnormally low readings noted on the roof nozzles. Section 6.6 details the data from the UT exam.

Access Ways & Handrails

The roof is accessible from a free standing ladder and catwalk system. This catwalk is used to access all the tanks inside the containment for visual inspections and gauging purposes.

The ladder and the catwalk are in acceptable condition. There was no damage noted to the ladder frame or rungs. The steps showed no signs of damage to the frame, the treads or the handrails. The catwalk showed no damage to the frame, the grating or the handrails. Much of the handrail was covered in black plastic during the inspection.

The catwalk supports are 3” X 3” square piping uprights that are anchored to the concrete by (2) 3/4 inch anchor bolts at each support location. There is 2-1/2 inch angle iron braces used as cross bracing. There were no evident weld failures, damage to the support structures, attachment hardware or the anchorage locations. The attachment hardware appears to be tight and secure. The catwalk grating is galvanized and in acceptable condition. The grating is tack welded into place. There were no signs of weld failure. There was no evidence of corrosion caused thinning or holes noted in the grating.

The 2 inch steel pipe handrails are 42 inches high at the top rail, 24 inches at the mid-rail with 4 inch toe boards. There were no signs of holes, corrosion or pitting noted in the top rail, the mid-rail or the uprights.

Miscellaneous Appurtenances

For product level gauging, this tank is equipped with a float and tape style gauging system. This unit was found to be in what appears to be visually acceptable condition with no apparent damage noted. The unit was not operated at the time of inspection.

The tank is equipped with a Delta Controls roof transponder. The unit model is an 872C-V-10-2NPT-6SE-IS-CC with a serial number of UGD9966-A2. The unit appeared in satisfactory condition with no apparent damage to the unit noted.

For electrical safety issues and lightning protection, this tank is equipped with (1) 1/2 inch braided grounding cable. The cable was found to be satisfactory condition. The cable is attached to the reinforcement ring on one end and attached to a grounding bar that is embedded into the concrete foundation.

Inspectors Signature:

Alec Arpino
API 653
Certification No. 77549 Exp. 12/31/2023

Reviewed by:

George Roni, PE
API 653 Cert. No. 2042, Exp. 4/30/23

Mistras Services has evaluated the condition of this tank based on the observations and measurements made by the tank Inspector. While our evaluation accurately describes the condition of the tank at the time of inspection, the tank owner/operator must independently assess the inspection information/report provided by Mistras Services and any conclusions reached by the tank owner/operator and any action taken or omitted to be taken are the sole responsibility of the owner/operator. With respect to inspection and testing, Mistras Services warrants only that the services have been performed in accordance with accepted industry practice. If any such services fail to meet the foregoing warranty, Mistras Services shall re-perform the service to the same extent and on the same conditions as the original service.

The preceding paragraph sets forth the exclusive remedy for claims based on failure or of defect in materials or services, whether such claim is made in contract or tort (including negligence) and however instituted, and, upon expiration of the warranty period, all such liability shall terminate. The foregoing warranty is exclusive and in lieu of all other warranties, whether written, oral, implied or statutory. NO IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE SHALL APPLY, nor shall Mistras Services be liable for any loss or damage whatsoever by reason of its failure to discover, report, repair or modify latent defects or defects inherent in the design of any tank inspected. In no event, whether a result of breach of contract, warranty or tort (including negligence) shall Mistras Services be liable for any consequential or incidental damages including, but not limited to,

5.0 Calculations

5.1 Thickness Calculations

Calculations for Shell & Cone-Shaped Tank Bottom - per API 620

Date of Inspection:	10/14/2020			
Owner	NUWC			
Tank No.	K1051-106			
Diameter, D	8.750	ft	105.00	inches
Shell Height, H	12.000	ft	144.00	inches
Fill Height	12.000	ft	144.00	inches
Original Shell thickness	0.188	inches		
Measured Shell thickness, t_c	0.181	inches		
Original Cone thickness	0.313	inches		
Measured Cone thickness, t_h	0.308	inches		
Specific Gravity of contents of tank, SG	1.230			
Depth of Cone, d	12.25	inches	1.0208	ft
S, allowable tensile stress of shell & cone	15,200	psi		
Joint Efficiency cone-to-shell & long cone joints, E_1	0.70			
Joint Efficiency shell vertical joints, E_2	0.70			
Operating Pressure at top of tank, P_o	0.00	psi	0	psf

Note that per API 620 the max. operating pressure at top of tank is 15 psig.

O.D. of connection at bottom of cone (if none enter 0)	4.50	inches

1/2 Apex angle, alpha = a   1.331679 radians   76.2996 degrees

Total Pressure, P at plane AA   921.02 psf (includes hydrostatic head + P_o)   6.40 psi

Plane AA is at the Spring Line.

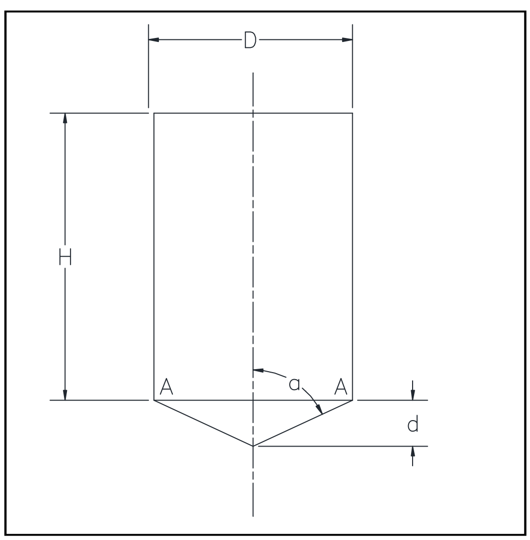


Figure No. A1

1) Shell Unit Forces @ Plane AA, See Figure No. A2

Sum $F_x = 0$

$2T_{2s} = PD$

$T_{2s} = PD/2$

$T_{2s} =$ 336 lb/in

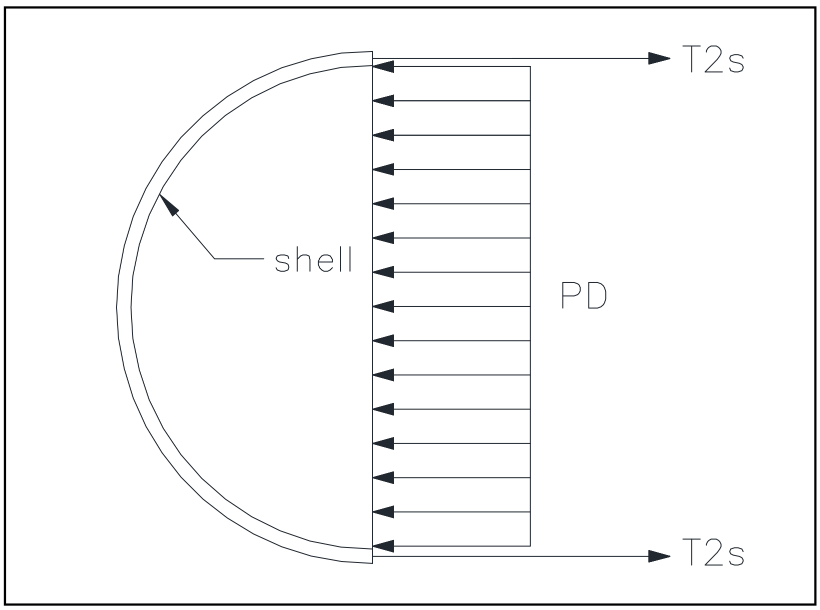


Figure No. A2

2) Cone unit force, T_2, the latitudinal unit force. Also known as the circumferential unit force.
See Figure No. A3

R_2, radius of curvature of cone at A

$R_2 = AB/\cos(a)$

$R_2 =$ 221.664 inches

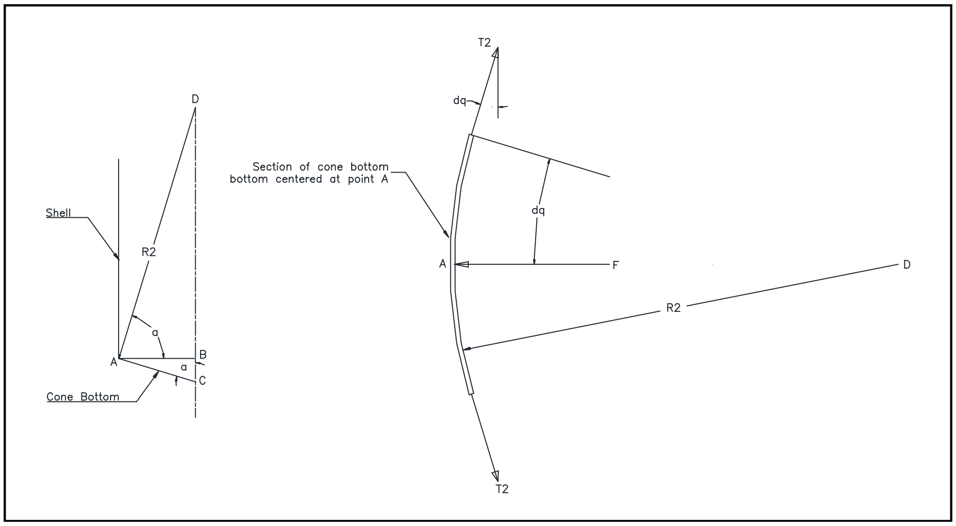


Figure No. A3

Sum of $F_x = 0$

F = the force on 1 inch wide section of cone at point A with an infinitesimal arc length = 2 x dq

$F = P(1)(2)(dq)(R_2)$

$F = 2PdqR_2$

$F - 2T_2{*}\mathrm{Sin}(dq) = 0$

$2PdqR_2 = 2T_2\mathrm{Sin}(dq)$ and for small dq, Sin(dq) = dq

$PR_2 = T_2$

$T_2 = PR_2$

$T_2 =$ 1418 lb/in

3) Cone unit force, T_1, the Meridional unit force. See Figure No. A4

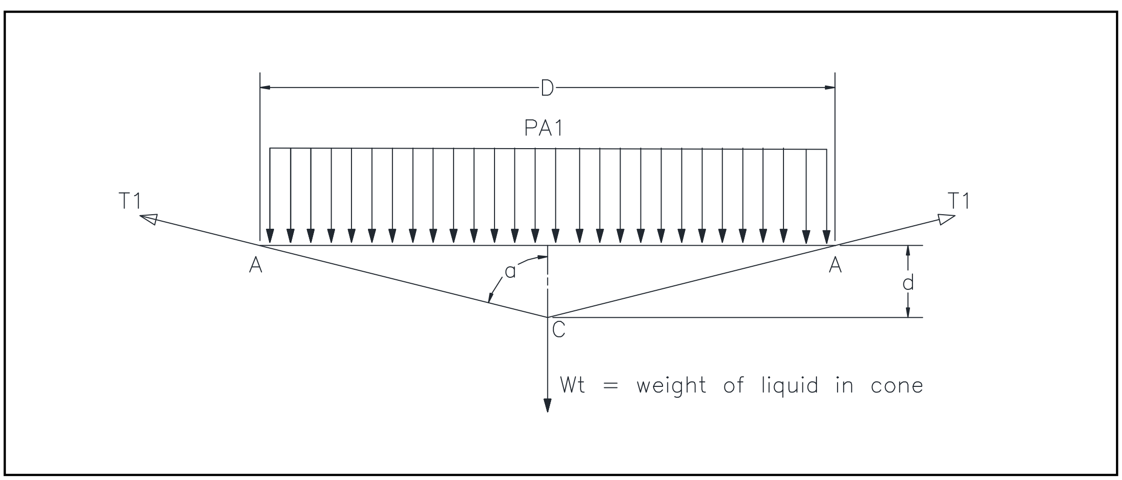


Figure No. A4

A_1 = PI/4 * D^2

A_1 =	8659.015	square inches	60.13205	square feet

V, Volume of Cone = (PI*D/2*D/2*d)/3

V = 20.461599 ft^3

W_t = SG* 62.4 lb/ft^3 * V

W_t = 1,570 lb

Sum F_y = 0

T_1Cos(a)PI*D - W_t -PA_1 =0

T_1 = (W_t + PA_1)/Cos(a)PI*D

T_1 = 729 lb/in

4) Knuckle Region Reinforcement Check per API 620 3.12

The measured cone bottom thickness is defined as t_h here, t_h =	0.308	inches
The measured shell thickness is defined as t_c here, t_c =	0.181	inches
R_2, radius of curvature of cone at A =	221.66	inches
R_c, radius of curvature shell =	52.5	inches

w_h = 0.6* sqrt(R_2 *t_h) — w_c = 0.6* sqrt(R_c *t_c) — Additional attached reinforcement area Ad

w_h = 4.957631 inches — w_c = 1.849568 inches — Ad = $\boxed{1.1875}$

Available reinforcing area, A_a = w_h*t_h + w_c*t_c+Ad

A_a = 3.049222 sq inches

T_1 =	729	lb/in
T_{2s} =	336	lb/in
T_2 =	1418	lb/in

Per API 620, the magnitude of the total circumferential force acting on any vertical cross section through the compression ring region shall be computed as follows:

Q = T_2w_h + $T_{2s}w_c$ -T_1R_cSin(a) Note that if Q is negative, compression is indicated.

Q = 7,029 + 621 - 37,183

Q = -29,533

A_c, the required compression ring reinforcing area = Q/15,000

A_c = 1.968858 sq. inches

A_a	>	Ac	
3.049222	>	1.968858	TRUE

and since Q is negative the following condition must be true also.

w_hSin(a)	>	0.015 * R_c	
4.816574	>	0.7875	TRUE

<u>Since both conditions are true, knuckle region is adequately reinforced.</u>

5) Check Measured Shell Thickness vs Required Shell Thickness

The required shell thickness is $t_{cr} = T_{2s}/SE_2$
0.031559 However, thickness must be at least 0.100" per API 653, so final required shell thickness is 0.100

t_c	>	t_{cr}	
0.181	>	0.100	TRUE

6) Check Measured Cone Bottom Thickness vs Required Cone Bottom Thickness at Plane A-A

The required cone thickness, t_{hr}, is the greater of the following 2 formulas

$t_{hr} = T_1/SE_1$ or $t_{hr} = T_2/SE_1$

$t_{hr} =$ 0.068513 $t_{hr} =$ 0.133248

$t_{hr} =$ 0.133248 However, thickness must be at least 0.100" per API 653, so final required cone bottom thickness is: $t_{hr} =$ 0.133 inches

t_h	>	t_{hr}	
0.308		0.133	TRUE

7) Tank Volume or Capacity Calculation

V_{total} = Volume of Cone + Volume of Shell

20.4616 ft^3 + (PI/4) *D^2*H

20.4616 + 721.5846

$V_{total} =$ 742 ft^3 or 5,551 gallons

5.2 Seismic Calculations

SEISMIC ANALYSIS
For Tank Supported above grade on legs

1) Input Data

Tank Location			Keyport, WA			
Tank no.			K1051-106			
dia, D			8.75	ft		
shell height, Ht			12	ft		
fill height, H			12	ft. This is height from top liquid surface to bottom of tank.		
floor thk			0.302	in		
roof thk			0.185	in		
slope roof, ϑ	0.062418	radians	3.5763	degrees	This is standard slope of 3/4" in 12".	
shell thk, t			0.183	in		
sg liquid, G			1.230			
density steel			490	lb/sq ft		
Proportion of roof supported by shell			1	1 indicates 100%.		
Seismic zone factor, Z			0.300	See fig E-1 & Table E-2		
Importance Factor			1.00	See E.3.1		
Site coefficient			1.5	See table E-3		
Lateral force coefficient, C1			0.6			
For cone bottom supported above the grade, the depth of cone, Xb			1.1666	feet		
Height, L that shell sup above grade			2.17	feet		
Height from bottom of tank to grade, m			1.0034	feet		
b, the width of the base			7.5	feet		
Slope floor, a	0.260588	radians	14.9306	degrees		
1/2 apex angle of cone floor =			1.310208	radians	75.0694	degrees
		Radius	4.375	ft		
		D/H	0.7292	The diameter/fill height ratio from above		

2) Weights

a) Shell

Plate Area	330	sq ft
plate weight/sq ft	7.473	lb/sq ft
weight shell plate	2,465	lb
misc shell weight	200	lb
Total shell weight	2,665	lb

b) Roof

no. Rafters	0	
length rafters	0	
Type of rafter (shape)		
lb/ft rafters	0	lb/ft
weight rafters	0	lb

Plate Area = PI*(r/cos(ϑ))^2

Plate Area	60.37	sq ft
plate weight/sq ft	7.554	lb/sq ft
Plate weight	456	lb
snow load	0	lb
misc weight	100	lb
Total Roof weight, Wr	556	lb

c) Cone Bottom

Plate Area = PI*(r/cos(gamma))^2

Plate Area	64.41	sq ft
plate weight/sq ft	12.332	lb/sq ft
Plate weight	794	lb
misc weight	100	lb
Bottom weight,Wb	894	lb

3) Determination of Additional Seismic Inputs

Natural period of 1st sloshing mode, T

T = k* sq root (D)		For D/H =	0.73	k =	0.58	from Figure E-4
T	1.716	seconds		S =	1.5	from table E-3
Is T < 4.5s?	true, so C2=0.75S/T					

C2 = 0.75S/T

C2 0.656

W1 & W2

D/H = 0.73

The weight of liquid, Wt

Wtshell = pi/4*D^2*62.4*sg*Ht 4,615 x Ht

Wtcone = ((pi*r^2*depth of cone)/3)*62.4*sg

Wtshell = 55,383 lb

Wtcone = 1,459 lb

Wt = Wtshell + Wtcone

Wt 56,842 lb

W1 = Wt*W1/Wt W1/Wt = 0.820 from fig E-2

W1	46,611	lb		
W2		W2/Wt =	0.160	from fig E-2
W2	9,095	lb		

X1 & X2

X1/H =	0.42	from fig E-3
X1=	5.04	ft
X2/H =	0.76	from fig E-3
X2	9.12	

Xs = height from cg of shell to bottom of tank = 7.1666 feet

4) Calculation of Overturning Moment, M

M = Z*I*(C1*Ws*Xs'+C1*Wr*Ht'+C1*Wb*Xb'+C1*W1*X1'+C2*W2*X2') ft lb

m	1.0034	see above
Z	0.3	see above
I	1	see above
C1	0.6	see above
C2	0.656	see above
Ws	2,665	shell weight
Xs'	8.17	the height from grade to Fs
Wr	556	roof weight
Wb	894	bottom weight
Xb'	2	the height from the grade to Fb
Ht'	14.17	the height from grade to Fr
W1	46,611	effective weight of liquid responsible for impulse force
X1'	6.04	the height from the grade to F1
W2	9,095	effective weight of liquid responsible for sloshing or convective force of liquid.
X2'	10.12	the height from the grade to F2

Z*I =	0.3				
C1*Ws*Xs'=	13,064		Lateral Force, Fs =	480	Impulse force of tank shell
C1*Wr*Ht'=	4,727		Lateral Force, Fr =	100	Impulse force of tank roof
C1*W1*X1'=	169,012		Lateral Force, F1 =	8,390	Impulse force of liquid
C1*Wb*Xb' =	161		Lateral Force, Fb =	161	Impulse force of tank bottom
C2*W2*X2'=	60,372		Lateral Force, F2 =	1,789	Convective, or sloshing force of the liquid
M=	74,201	ft lb	Total Lateral Force, Ft =	10,920	lb

5) Check Stability of Tank:

The resisting Moment is Mr = (weight of tank + the weight of fluid) x 1/2 of the base width

weight of tank =	4,115	lb
weight of liquid =	56,842	lb
width of base =	7.5	ft

Mr = 228,590 ft-lb

Safety Factor for overturning = Mr/M

Safety Factor for overturning = **3.08** **> 1.5** **O.K., Tank is stable**

Note that if a tank is found to be unstable that indicates that tank anchors are needed to resist the uplift forces at the base plate to grade interface that will occur during an earthquake. An unstable tank is susceptible to tipping during an earthquake.

6) Check Need for Anchors Due Solely to Lateral Loads

Total weight of liquid	56,842	lb	
Total weight of tank	4,115	lb	
Total weight, W	60,957	lb	
Coefficient of friction =	0.030	Between steel & ice, the worst possible case.	

Frictional Force resisting the total lateral force = W*coefficient of static friction between base plates & grade

Ff = 1,829

Is Ff > Ft * 1.5 **Not true, therefore anchors are needed for lateral seismic forces**

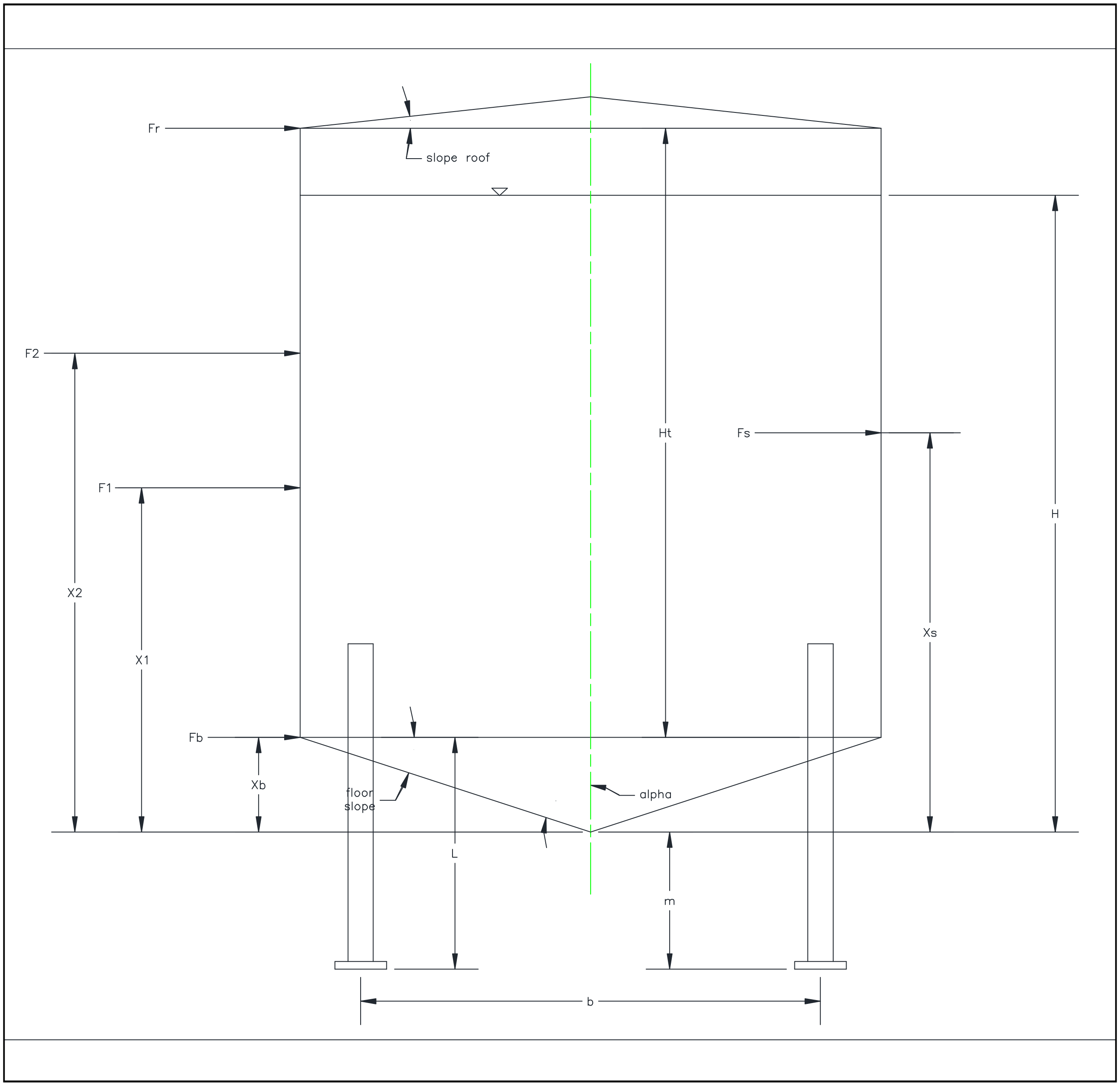
The shear force on each bolt, using 16 anchor bolts is = 682 lb

The anchors should provide at least this much strength plus a safety margin and a corrosion allowance for the bolts.

7) Check Vertical Forces at Anchor Points
Both Seismic and Dead Load.

Vertical Load, P =	W =	-60,957	lb, this force is given a negative sign to indicate a downward
N, number of anchor locations =		4	direction.
For 4 anchor points, I =4*(b/2)^2 =		56.250	sq ft.
c =		3.750	ft
Max anchor forces, F = P/N + - Mc/I			
	Mc/I =	4,947	lb

	F =	-10,293	lb	If negative that indicates a downward force and
	and F =	-20,186	lb	no tension in anchor bolt.
Foot print size of 1 base plate =		100	sq inches	
Bearing stress = F/footprint area =		201.9	psi	
Allowable compressive strength of the foundation under the base plates =		1,500	psi, the foundation is concrete, and the concrete is assumed to have at least this strength.	
Safety factor = 1,500	divided by	201.9	=	7.43
Safety Factor	**=**	**7.43**	**> 1.5**	**O.K., Foundation strength is acceptable**


Fr
slope roof
F2
Ht
Fs
F1
H
X2
Xs
X1
Fb
Xb
floor slope
alpha
L
m
b

6.0 Ultrasonic Thickness Data

6.1 Shell Plates UT

The following table details all readings (in) from the shell UT survey. All scan drops were equally spaced at 6.87 ft.

Data and Statistics		1	2	3	4	*Readings Line Average*
Course 2	4	0.184	0.184	0.182	0.181	0.183
	3	0.183	0.185	0.182	0.182	0.183
	2	0.182	0.184	0.181	0.180	0.182
	1	0.182	0.184	0.183	0.181	0.182
Course 1	4	0.185	0.185	0.182	0.185	0.184
	3	0.185	0.184	0.181	0.185	0.184
	2	0.186	0.184	0.186	0.185	0.185
	1	0.185	0.186	0.185	0.185	0.185
Scan Line Average		0.184	0.185	0.183	0.183	0.184

The tables below presents the statistics of the thickness readings (in) obtained on the Shell plates.

Course #	Min	Avg	Max
2	0.180	0.182	0.185
1	0.181	0.185	0.186
Global	0.180	0.184	0.186

6.2 Cone Bottom Plates UT

The following table details all readings (in) obtained on the cone bottom plates.

Plate ID \ Reading ID	1	2	3	4	5	6	7	8	*Avg*
North to South	0.320	0.315	0.314	0.308	0.310	0.310	0.311	0.312	0.313
East to West	0.315	0.309	0.313	0.313	0.314	0.316	0.315	0.313	0.313
Avg	0.317	0.312	0.314	0.310	0.312	0.313	0.313	0.313	0.313

The table below presents the statistics of the thickness readings obtained on the cone plates.

UT Summary	
Maximum	0.320
Average	0.313
Minimum	0.308

6.3 Fixed Roof Plates UT

The following table details all readings (in) obtained on the Fixed Roof plates.

Plate ID \ Reading ID	1	2	3	4	5	6	7	8	*Avg*
North to South	0.186	0.188	0.187	0.187	0.186	0.186	0.187	0.186	0.187
East to West	0.185	0.186	0.186	0.185	0.186	0.188	0.186	0.187	0.186
Avg	0.186	0.187	0.187	0.186	0.186	0.187	0.187	0.187	0.186

The table below presents the statistics of the thickness readings obtained on the roof plates.

UT Summary	
Maximum	0.188
Average	0.186
Minimum	0.185

6.4 Shell Nozzle and Appurtenance Table

Item	Type	Service	Pipe Size (in)	Station (ft)	Center Line Elevation (ft)	Distance From Shell to Flange Face (in)
A	Manway	Access	24.0	0	20.5	5.875
B	Nozzle	Transfer	3.0	9.1	135.0	7.0
C	Nozzle	Transfer	2.0	18.2	129.0	6.75
D	Nozzle	Transfer	2.0	23.0	129.0	7.0
E	Nozzle	Bottom Draw	2.0	–	–	–

Note: The data represented in the weld spacing column is the minimum spacing measured. H, V, or N indicates which is the minimum distance from the nozzle measured. (H=Horizontal Weld, V=Vertical Weld, N=Nozzle Weld)

Repad Shapes

6.5 Shell Nozzle UT

Item	Type	Service	Pipe Size (in)	Top (in)	Bottom (in)	Right (in)	Left (in)	Repad Thickness (in)	Flange Thickness (in)	Cover Thickness (in)	Comments
A	Manway	Access	24.0	0.242	0.243	0.242	0.242	–	0.466	0.491	
B	Nozzle	Transfer	3.0	0.219	0.210	0.209	0.212	–	0.975	–	
C	Nozzle	Transfer	2.0	0.149	0.149	0.150	0.149	–	0.690	–	
D	Nozzle	Transfer	2.0	0.148	0.146	0.148	0.148	–	0.712	–	
E	Nozzle	Bottom Draw	2.0	0.145	0.144	0.145	0.145	–	–	–	

6.6 Fixed Roof Nozzle UT

Item	Type	Service	Pipe Size (in)	North (in)	South (in)	East (in)	West (in)	Comments
AA	Hatch	Access	22.0 x 22.0	0.243	0.243	0.244	0.243	
AB	Nozzle	Vent	4.0	0.210	0.208	0.208	0.208	
AC	Nozzle	HLA	4.0	0.210	0.209	0.209	0.210	

7.0 Shell Corrosion Rates

Course	$t_{previous}$ Previous Thickness (in)	Year Obtained	t_{actual} Actual Thickness (in)	Year Obtained	C_r Corrosion Rate (in/yr.)	t_{min} Minimum Allowable Thickness (in)	R_L Remaining Life (yr.)
2	0.188	1994	0.180	2020	0.00029	0.100	275.09
1	0.188	1994	0.181	2020	0.00027	0.100	298.42

8.0 Photographs

Tank Labeling	Data Plate
	
Manway	**Ground**
	

Nozzle B	Nozzle B Piping
	
Nozzle C	Nozzle D
	
Bottom Draw	Support Leg
	

Roof	Roof
	
Area Overview	Area Overview
	
Area Overview	Walkway
	

<table>
<tr><th>Walkway</th><th>Walkway</th></tr>
<tr><td></td><td></td></tr>
<tr><th>Area Overview</th><th>Ladder</th></tr>
<tr><td></td><td></td></tr>
</table>

9.0 NDE Equipment Used

The equipment utilized for the inspection of the tank included of the following :

Pit Gauge

Manufacturer	Model	Serial No
W.R. Thorpe	1	1.979.912

Ultrasonic Transducers

Manufacturer	Model	Serial No	MHz	Diameter
Olympus	D790-SM	865199	5	0.375

UT Equipment

Manufacturer	Model	Serial No
Olympus	38DL Plus	130573601
UTT Pole Crawler	MC-2258	1103095

10.0 Inspector Certifications

energy API

AMERICAN PETROLEUM INSTITUTE
Individual Certification Programs: ICP™

API Individual Certification Programs

verifies that

Michael Alec Arpino

has met the requirements for API certification

API-653 Aboveground Storage Tank Inspector

Certification Number *77549*

Original Certification Date *December 31, 2017*

Current Certification Date *December 31, 2017*

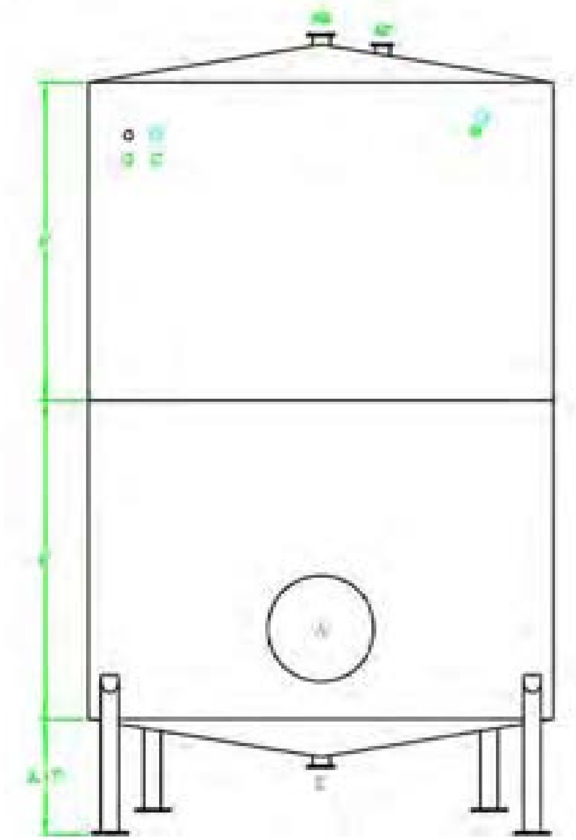
Expiration Date *December 31, 2020*

Manager, Individual Certification Programs

ICP

11.0 Drawings

SHELL DRAWING–NORTH ELEVATION



LEGEND & NOTES

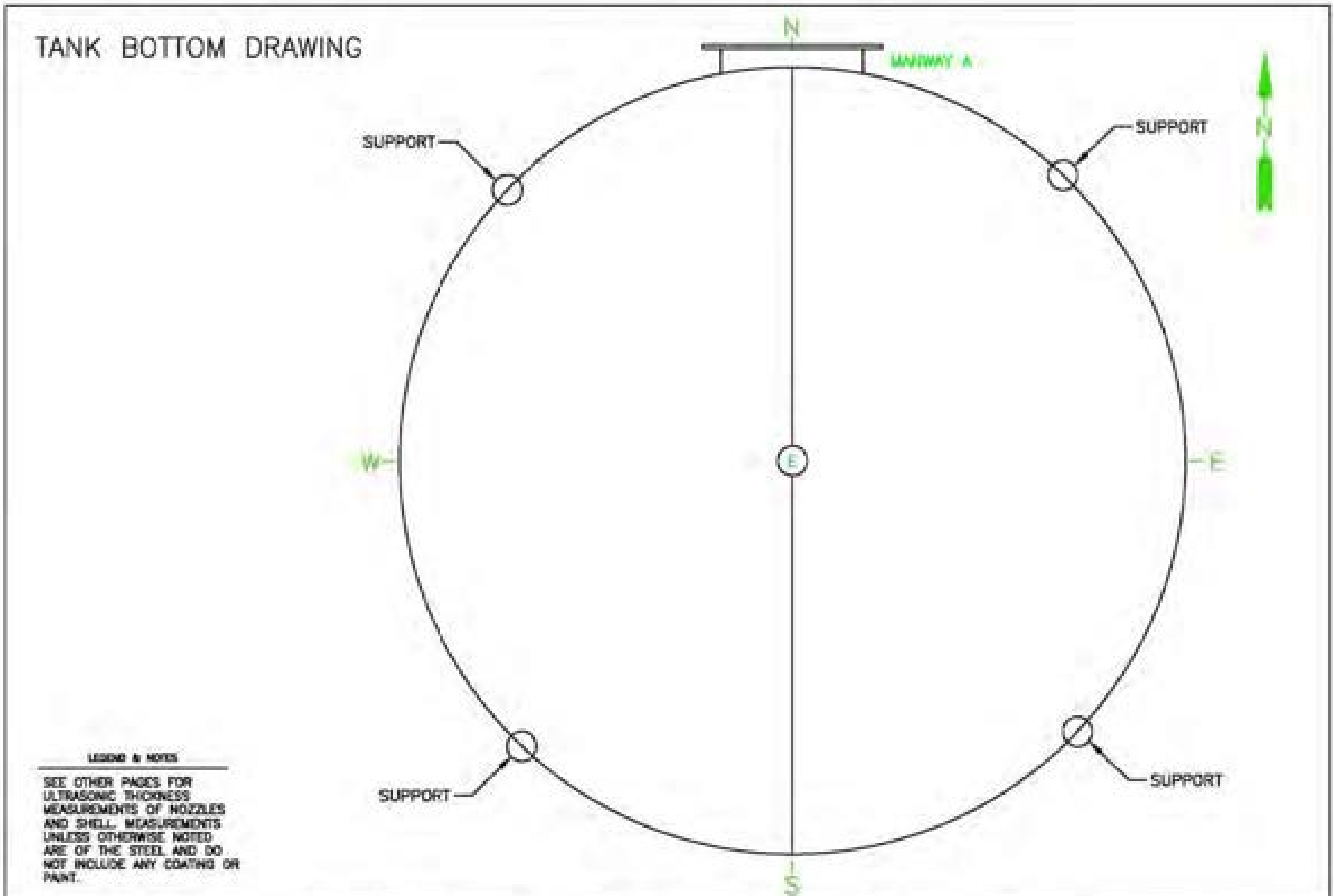
HIDDEN OBJECT

SEE OTHER PAGES FOR ULTRASONIC THICKNESS MEASUREMENTS OF NOZZLES AND SHELL. MEASUREMENTS UNLESS OTHERWISE NOTED ARE OF THE STEEL AND DO NOT INCLUDE ANY COATING OR PAINT.

SHELL NOZZLES & APPURTENANCE TABLE

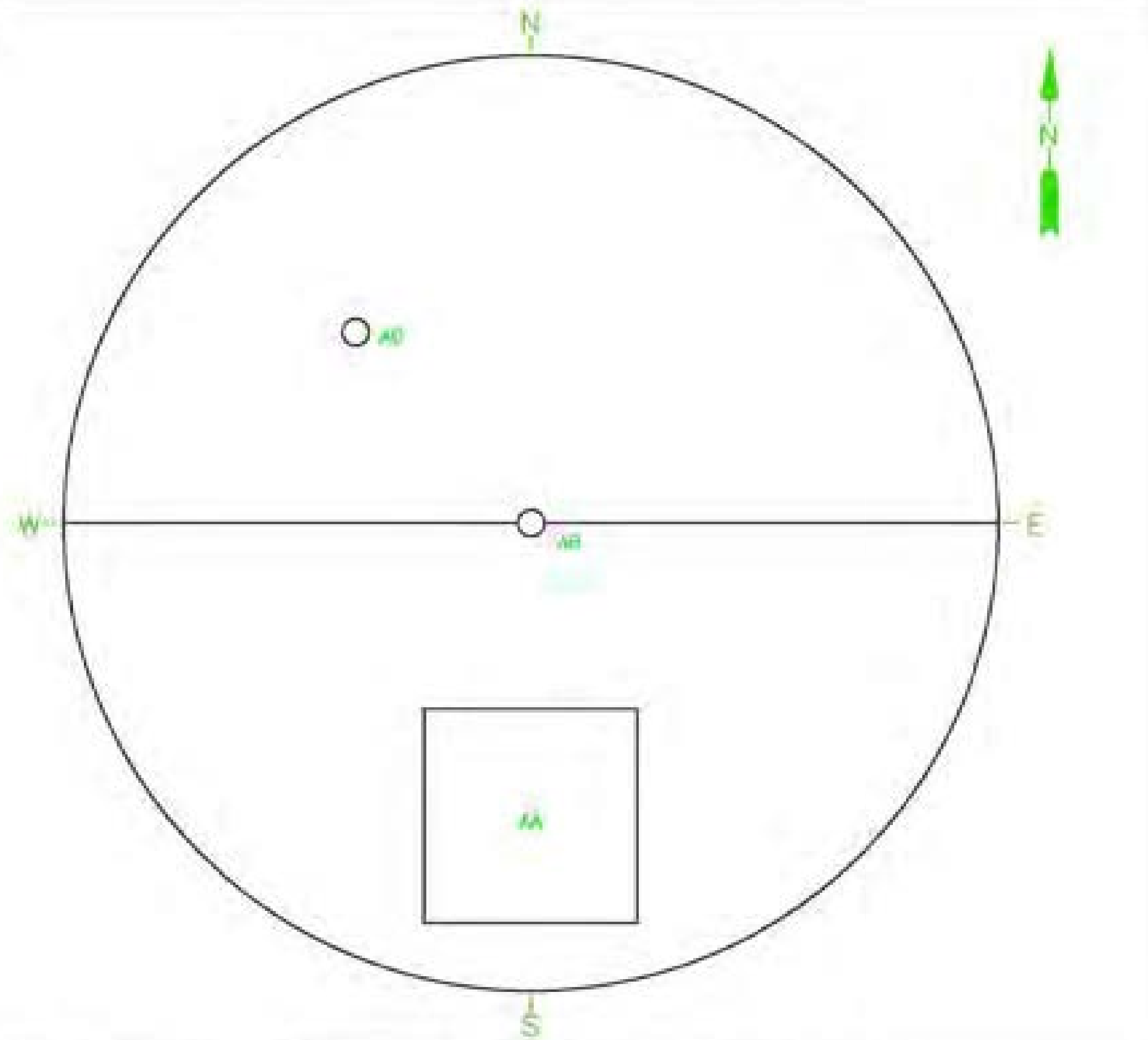
NO.	SIZE (IN.)	DESCRIPTION
[illegible]	24	MANWAY, NOZZLE
[illegible]	3	COF-5, NOZZLE
[illegible]	2	CIF-2, NOZZLE
[illegible]	2	CRF-8, NOZZLE
[illegible]	2	DRAIN, NOZZLE
AA	24x24	INSPECTION HATCH
AB	3	VENT, NOZZLE
AC	3	HLA, NOZZLE

CUSTOMER: WSP	SHELL HEIGHT: 12' DIAMETER: 8.75'	INSPECTION DATE: 10/14/2020	MISTRAS SERVICES
LOCATION: KEYPORT, WA	INSPECTOR: ALEC ARPINO	DRAWING NUMBER: 106-Shell	7920 S 210th Street, Building C, Suite 110 Kent, WA 98032
TANK NUMBER: K1051-106	TECHNICIAN: BRANDON GONZALEZ	CAD DRAFTSMAN: BRANDON GONZALEZ	



CUSTOMER: WSP	SHELL HEIGHT: 12' DIAMETER: 8.75'	INSPECTION DATE: 10/14/2020	MISTRAS SERVICES
LOCATION: KEYPORT, WA	INSPECTOR: ALEC ARPINO	DRAWING NUMBER: 106-Bottom	
TANK NUMBER: K1051-106	TECHNICIAN: BRANDON GONZALEZ	CAD DRAFTSMAN: B. GONZALEZ	7820 S 210th Street, Building C, Suite 110 KENT, WA 98032

TANK ROOF DRAWING



LEGEND & NOTES

SEE OTHER PAGES FOR ULTRASONIC THICKNESS MEASUREMENTS OF NOZZLES AND SHELL. MEASUREMENTS UNLESS OTHERWISE NOTED ARE OF THE STEEL AND DO NOT INCLUDE ANY COATING OR PAINT.

CUSTOMER: WSP	SHELL HEIGHT: 12' DIAMETER: 8.75'	INSPECTION DATE: 10/14/2020	MISTRAS SERVICES
LOCATION: KEYPORT, WA	INSPECTOR: ALEC ARPINO	DRAWING NUMBER: 106-Roof	7820 S 210th Street, Building C, Suite 110 KENT, WA 98032
TANK NUMBER: K1051-106	TECHNICIAN: BRANDON GONZALEZ	CAD DRAFTSMAN: B. GONZALEZ	

12.0 Appendix A – References

References:

1) Washington State Department of Ecology, Dangerous Waste Regulations, Chapter 173-303 WAC
2) Conversations with the client
3) API RP 652, Lining of Above Ground Petroleum Storage Tanks
4) API RP 651, Cathodic Protection of Above Ground Storage Tanks
5) API Guide for the Inspection of Refinery Equipment – Chapter 13, Atmospheric and Low Pressure Tanks
6) API Standard 650, Welded Steel Tanks for Oil Storage
7) API Standard 653, Tank Inspection, Repair, Alteration, and Reconstruction
8) API Standard 620, Design and Construction of Large, Welded, Low Pressure Storage Tanks

SECTION D

APPENDIX D10

TANK SYSTEMS COATING SPECIFICATIONS

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SECTION 09875

INTERIOR COATING SYSTEM FOR WELDED STEEL STORAGE TANKS

PART 1 GENERAL

1.1 REFERENCES

The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.134	Respiratory Protection
29 CFR 1910.1000	Air Contaminants
29 CFR 1910.1018	Inorganic Arsenic
29 CFR 1910.1025	Lead
29 CFR 1910.1200	Hazard Communication
40 CFR 260	Hazardous Waste Management Systems: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Generators of Hazardous Waste
40 CFR 263	Transporters of Hazardous Waste
40 CFR 264	Owners and Operators of Hazardous Wastes Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities

MILITARY SPECIFICATION (MIL)

MIL-B-131	(Rev. H) Barrier Materials, Watervaporproof, Greaseproof, Flexible, Heat-Sealable
MIL-P-3420	(Rev. F) Packaging Materials, Volatile Corrosion Inhibitor Treated, Opaque
MIL-S-22262	(Rev. A) (Am. 2) Abrasive Blasting Media Ship Hull Blast Cleaning
MIL-P-24441	(Rev. B) Paint, Epoxy-Polyamide

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC VIS 1	1989 Visual Standard for Abrasive Blast Cleaned Steel (Standard Reference Photographs)
SSPC SP 5	1989 White Metal Blast Cleaning
SSPC SP 7	1989 Brush-Off Blast Cleaning
SSPC PA 2	1982 Measurement of Dry Paint Thickness with Magnetic Gages.

1.3 SUBMITTALS

Submit the following in accordance with Section 01300, “Submittals.”

1.3.1 SD-06, Instructions

a. Coating system

Before applications, submit three copies of formulator’s printed instructions to include brand names, catalog numbers, and names of manufacturers. The instructions shall include detailed mixing and application procedures, number and types of coats required, minimum and maximum application temperatures, curing procedures, pot life, and shelf life.

1.3.2 SD-08, Statements

a. Operation procedures

b. Material safety data sheets

1.3.2.1 Statement Requirements

Submit four copies of the industrial hygienist certification of the operation procedures and personal protection equipment the Contractor is proposing to use. Provide six copies of materials safety data sheets for materials to be used at the job site in accordance with CFR 29 CFR 1910.1200.

1.3.3 SD-10, Test Reports

a. Blasting abrasive

1.2.4 SD-13, Certificates

a. Coating system

Before delivery of the coating system, submit four copies of certificates.

1.3 DELIVERY AND STORAGE

Epoxy materials should be shipped and stored out of the sun and weather, preferably in air conditioned spaces.

1.4 SAFETY

The Contractor shall ensure that employees are trained in the requirements of CFR 29 CFR 1910.1200 and understand the information contained in the MSDS for their protection against toxic and hazardous chemical effects.

1.5 GOVERNMENT-FURNISHED MATERIALS AND SERVICES

The Government will furnish, without cost, all test fuel products for leakproof testing of coated tank as specified in the paragraph titled “Final Inspection.”

1.6 JOB SITE REFERENCES

The contractor shall have a t least one copy of each of SSPC SP 5, SSPC PA 2, and SSPC IS 1 at the job site and made available to the Contracting Officer.

PART 2 PRODUCTS

2.1 COATING SYSTEM

Shall conform to the respective specifications and to the requirements specified herein.

2.1.1 Primer

Epoxy-Polyamide, Green Primer, Formula 150 of MIL-P-24441.

2.1.2 Intermediate Coat

Epoxy-Polyamide, Haze Gray Intermediate Coat, Formula 151 of MIL-P-24441.

2.1.3 Top Coat

Epoxy-Polyamide, White Top Coat, Formula 152 of MIL-P-25551.

2.2 BLASTING ABRASIVE

Abrasive shall be sharp, washed, salt-free, angular, crushed wet bottom boiler slag or nickel slag, free from feldspar or other constituents that tend to break down and remain on the surface. Abrasive shall not contain magnetic materials and shall conform to MIL-S-22262, Type I (Inorganic materials).

2.3 VAPORTIGHT MATERIAL

MIL-B-131 or MIL-P-3420.

PART 3 EXECUTION

3.1 PROTECTION FROM TOXIC AND HAZARDOUS CHEMICAL AGENTS

During tank cleaning, cleanup, surface preparation, and paint application phases, ensure that employees are adequately protected from toxic and hazardous chemical agents which exceed the concentrations in CFR 29 CFR 1910.1000, CFR 29 CFR 1910.1018, and CFR 29 CFR 1910.1025. Comply with respiratory protection requirements in CFR 29 CFR 1910.134.

3.1.1 Epoxy-Polyamide Coating Hazards

MIL-P-24441 formulations have a minimum flash point of 95° F (35° C). Solvent fumes from epoxy paints systems are combustible and toxic. Precautions shall be taken to prevent their accumulations, particularly in confined spaces. In addition to fire and toxic hazards, epoxy coatings can cause allergic reactions when allowed to come in contact with the skin. Prompt skin cleanup after contact using soap and water, not solvents, is recommended. Solvents will thin and spread the paint over the skin, permitting deeper penetration and increasing the hazards of a delayed allergic reaction.

3.2. VENTILATION

Provide ventilation inside tanks throughout course of work as required to maintain a vapor-free condition. Use exhaust fans, either explosion-proof electrically operated or air-driven. Fans shall have sufficient capacity to hold vapor concentration below four percent of lower explosive limit as determined with an approved explosive meter. Keep fans in operation whenever workmen are in tanks and as long as may be necessary for proper application and curing of coatings. Ventilation shall meet at least minimum safety requirements appropriate to thinners or chemicals used. During application of the coating system, provide a minimum of 10 air changes per hour. Where this is not feasible due to size of tank or limitations in number and size of manhole openings, then provide suction ductwork extending to areas of heaviest concentrations including lowest levels of tank. In no case shall exhaust fan capacity be less than 10,000 CFM except for small tanks of 250,000 gallons capacity or less. Ventilate tanks during abrasive blasting and during application and curing of coating. Provide heating, cooling, or dehumidification if required to satisfy conditions specified in paragraph titled "Weather Conditions."

3.3 CLEAN AND REPAIR SURFACE

Brush-off blast clean surfaces to receive epoxy coating in accordance with SSPC SP 7. Remove abrasive and dust from the surfaces by brushing, blowing with dry compressed air, and vacuuming, and then remove loose material from the tank interior. Examine the tank interior for defects. Test bottom weld seams and suspect areas with a vacuum box. Use a glass top vacuum box with Hypalon or neoprene sealing gasket. Apply a commercial bubble forming solution to the weld or area to be tested; position the vacuum box over the area and pull a partial vacuum. Observe the solution film for bubble formation between 0-2 psi (0-14 kPa) differential pressure. Continue to open the valve until a differential pressure of 5 psi (34 kPa) is achieved and hold for at least 20 seconds while continuing to observe the solution for bubbles. Correct defects found, such as cracks or splits, by welding. Grind off rough surfaces on weld seams, sharp edges, and corners to a radius of not less than 1/8 inch (3 mm).

3.4 ABRASIVE BLAST

3.4.1 Equipment

Use blasting equipment of the conventional air, force-feed, or pressure type. No water blasting or vapor blasting will be permitted in order to keep steel surfaces moisture-free. Use a nozzle of such size that a pressure of 90 plus or minus 10 psig (621 plus or minutes 59 kPa) will be maintained at the nozzle. Filter air supply so that the air is free of oil and moisture. Blow the compressed air through a clean white cloth to check for oil and moisture.

3.4.2 Surface Standard

Inspect the tank walls and select plate with similar characteristics and surface profile for use as a surface standard. White blast clean one or more foot-square steel panels in accordance with SSPC SP 5. White metal blast surfaces shall conform to SSPC VIS 1. Record the blast nozzle type and size, air pressure at the nozzle or compressor, distance of nozzle from the panel, and angle of blast to establish procedures for blast cleaning to develop a one- to 2-mil (25.4 to 50.8 micron) anchor pattern. Use a surface profile comparator, appropriate to the abrasive being used, to determine the profile of the standard panel before an after the white blast. A Keane-Tator surface profile comparator to determine the anchor pattern has been found useful. Keep the surface standard wrapped and sealed in vapor tight material for use as a standard of comparison for the steel surfaces throughout the course of the work.

3.4.3 Preparation

Abrasive blast steel surfaces to white metal in accordance with SSPC SP 5 as described in and as determined by the paragraph entitled "Surface Standard." Blast surfaces in sections or blocks small enough to permit application of the epoxy coating system during the same work shift. After blasting, remove abrasive and dust from the surfaces by brushing and vacuuming. Remove loose material from the tank interior. Fill voids, pits, sharp depressions, or other imperfections by welding as approved by the Contracting Officer. Apply application of pretreatment wash primer within eight hours of blasting. Inspect the blasted surfaces with black light to check for fluorescence from compressor oil. Surfaces to receive coating shall be free of oil.

3.4.4 Disposal of Used Abrasive

Test used abrasive in accordance with CFR 40 CFR 261 to determine if it is a hazardous waste using the EP toxicity test for metals. Handle and dispose of abrasive determined to be hazardous waste in accordance with CFR 40 CFR 260, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265, and 40 CFR 266. Dispose of abrasive which is not hazardous waste at a landfill off Government property in accordance with applicable regulations. The contract price will be adjusted if the used abrasive is determined to be hazardous waste. However, payment for disposal of hazardous waste will not be made until a completed manifest from the treatment or disposal facility is returned, and a copy furnished to the Government.

3.4.5 Recycled Abrasive

Recycled abrasive at the job site shall be screened and air washed to remove dirt and fines. New abrasive shall then be added so that the combined new and recycled abrasive mixture shall meet specified abrasive requirements for chemical composition, moisture, friability, silica, anchor pattern, and oil content. Do not recycle abrasive which has picked up toxic or hazardous material. Nickel slag shall not be recycled.

3.5 WEATHER CONDITIONS

Coating operations shall be done only when the ambient air temperature is above 40° F, below 95° F, and the steel surface temperature is more than 5° F above the dew-point of the ambient air. Coatings shall not be applied to damp or wet surfaces or while there is any precipitation.

3.6 EPOXY-POLYAMIDE COATING APPLICATION

Epoxy-polyamide coatings, MIL-P-24441, shall be in accordance with manufacturer's application procedures applied by brushing, spraying, or dip application.

3.7 APPLICATION THICKNESS

Unless otherwise specified, apply each coat of paint to produce approximately three mils dry film thickness (DFT). Application which yields in excess of 4.0 mils dry film thickness to be avoided to prevent sagging. Time between coats shall not exceed seven days.

1st – Formula 150 Epoxy-Polyamide Green Primer, MIL-P-24441 – 2 to 4 mils DFT

2ND – Formula 151 Epoxy-Polyamide Haze Gray Intermediate Coat, MIL-P-24441 – 2 to 4 mils DFT

3rd – Formula 152 Epoxy-Polyamide White Top Coat, MIL-P=24441 – 2 to 4 mils DFT

3.8.2 Coating System

During coating application, ground nozzles and metallic components against static discharges. Surfaces to receive coating shall be free of dust, dirt, oil, and other contaminants as determined by visual examination. Use clean canvas shoe covers when walking on prepared surfaces. Coat interior steel surfaces of the tank including the bottom, shell, ceiling, or underside of floating roof, where applicable; internal piping; roof legs, where applicable; other internal, structural-steel and appurtenances.

3.8.2 General Procedure

The first coat, Formula 150 green primer, shall be applied as soon as possible after the blast cleaning and always the same day. If visible rusting does occur after blasting, regardless of the time interval, the rusted surface shall be re-blasted prior to applying the specified primer. The coating system shall be applied by experienced applicators. Welds, lap seams, reinforcing beams, and sharp edges shall be brush painted before spray painting of each coat of paint over the entire tank interior. The epoxy intermediate, Formula 151, and top coat Formula 152, shall be applied successively allowing a drying time of not less than 16 hours nor more than seven days between each coat. Each coat of the 3 coats shall have a dry film thickness of approximately 3 mils. The total dry film thickness of the complete system shall be not less than 8 mils. If necessary to obtain the required minimum thickness of 8 mils, and additional top coat of Formula 152 shall be applied.

3.9 FIELD TESTS AND INSPECTIONS

3.9.1 General

Use clean canvas shoe covers when walking on coated surfaces. Advise the Contracting Officer when the work in progress is at the following steps so that appropriate inspection may be made:

Step	Action
Prior to preparation of tank(s) for cleaning and repair	Safety inspection
After cleaning of tank(s) and prior to abrasive blasting	Safety inspection, removal of dirt, trash debris, and any hindrance to abrasive
After abrasive blasting	Surface inspection for appropriate finish for coating application as specified in the paragraph entitled "APPLICATION OF COATING SYSTEM"
During and after coating application	Coating application inspection as specified in paragraphs entitled "APPLICATION OF COATING SYSTEM" and "Final Inspection"
After final cleanup	Clean up inspection specified in the paragraph entitled "FINAL CLEANUP"

3.9.2 Final Inspection

Following completion and cure of the coating system, inspect the surfaces for pinholes, blisters, inadequate coating thickness, and other defects. Correct imperfections found. Measure the dry film thickness in accordance with SSPC PA 2 at 10 equally spaced points within a 10-foot by 10-foot (3-m by 3-m) area as designated by the Contracting Officer. Discard the high and low values, and average the remaining eight values as the coating thickness. If the average is less than the specified minimum dry film thickness, take additional readings in adjacent areas to define the extent of the thin area. Re-coat such areas with the white top coat, Formula 152 as necessary, to achieve the specified thickness. Re-coat within the time period specified in the paragraph titled "APPLICATION OF COATING SYSTEM." Brush blast or hand sand any coated areas that exceed 48 hours to remove the glossy surface before applying the additional top coat.

3.9.3 Fill Test

After the work has been inspected and approved, fill test the tanks. Allow a cure time of at least 14 days after the final coat has been applied before carrying out the fill test. Remove the blind flanges and reconnect tank piping ready for service. The Government will provide the necessary liquid and labor to fill the tanks. Advise the Contracting Officer, in writing, at least 10 days in advance of the need for this service. Fill tanks half full and check that drain valves are closed and check tanks for leaks. Keep tanks half full the first 12 hours of test, then fill tanks to full capacity, and check that drain valves are closed and check tanks for leaks. Monitor tank levels hourly during the first 24 hours of the fill test and notify the Contracting Officer immediately of any leaks detected. Padlock drain valves closed for the duration of the test and provide one

3.10 FINAL CLEANUP

Following completion of the work, remove all debris, equipment, and materials from the site. Remove temporary connections to Government or Contractor furnished water and electrical services. Restore all existing facilities in and around the work areas to their original condition.

SECTION 09874

EXTERIOR COATING SYSTEM FOR WELDED STEEL PETROLEUM STORAGE TANKS

PART 1 GENERAL

1.1 REFERENCES

The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.134	Respiratory Protection
29 CFR 1910.1000	Air Contaminants
29 CFR 1910.1200	Hazard Communication

FEDERAL STANDARDS (FED-STD)

FED-STD-595	(Rev. B) Colors

MILITARY SPECIFICATIONS (MIL)

MIL-B-131	(Rev. H) Barrier Materials, Watervaporproof, Greaseproof, Flexible, Heat-Sealable
MIL-P-3420	(Rev. F) Packaging Materials, Volatile Corrosion Inhibitor Treated, Opaque
MIL-P-24441	(Rev. B) Paint, Epoxy-Polyamide
MIL-C-81907	(Am. 1) Coating System, Polyurethane, Aliphatic, Weather Resistant
MIL-C-85285	(Rev. B) (Am. 2) Coatings: Polyurethane, High-Solids

MILITARY STANDARDS (MIL-STD)

MIL-STD-161	(Rev. F) (Notice 2) Identification Methods for Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC VIS 1	1989 Visual Standard for Abrasive Blast Cleaned Steel (Standard Reference Photographs)
SSPC SP 10	1991 Near-White Blast Cleaning
SSPC PA 2	1991 Measurement of Dry Paint Thickness with Magnetic Gages

1.2 SUBMITTALS

a. Coating system

Before application, submit three copies of supplier's (formulator's) printed instructions which include brand names, catalog numbers, and names of manufacturers. Instructions shall include detailed mixing and application procedures except as modified herein, number and types of coats required, minimum and maximum application temperatures, curing procedures, pot life, and shelf life.

1.2.2 SD-08, Statements

a. Material safety data sheets

Provide six copies of material safety data sheets (MSDS) for materials to be used at the job site in accordance with CFR 29 CFR 1910.1200.

1.2.3 SD-13, Certificates

a. Coating system

Submit four certificates of compliance attesting that the materials proposed for use meet the requirements specified.

1.3 DELIVERY AND STORAGE

Epoxy and polyurethane materials should be shipped and stored out of the sun and weather, preferably in air conditioned spaces.

1.4 SAFETY

The Contractor shall ensure that employees are trained in the requirements of CFR 29 CFR 1910.1200 and understand the information contained in the material safety data sheets for their protection against toxic and hazardous chemical effects.

1.5 JOB SITE REFERENCES

The Contractor shall have at least one copy each of SSPC SP 10, SSPC PA 2, and SSPC VIS 1 at the job site and made available to the Contracting Officer.

PART 2 PRODUCTS

2.1 COATING SYSTEM

Shall conform to the respective specifications and to the requirements specified herein.

2.1.1 Primer

Epoxy polyamide, zinc rich primer, formula 159 of MIL-P-24441.

2.1.2 Intermediate Coat

Epoxy polyamide, No. 50 gray intermediate coat, formula 157 of MIL-P-24441.

2.1.3. Topcoat

Polyurethane coating topcoat of MIL-C-85285, Type II (white FED-STD-595 color number 17925).

2.2 COLOR

Piping, conduit, and tank identification shall be in accordance with MIL-STD 161. Mark direction of fluids in accordance with MIL-STD-161.

PART 3 EXECUTION

3.1 PROTECTION FROM TOXIC AND HAZARDOUS CHEMICAL AGENTS

During tank cleaning, cleanup, surface preparation, and paint application phases, ensure employees are adequately protected from toxic and hazardous chemical agents which exceed the concentrations in CFR 29 CFR 1910.1000. Comply with respirator protection requirements in CFR 29 CFR 1010.134.

3.1.1 Epoxy-Polyamide Coating Hazards

MIL-P-24441 formulations have a minimum flash point of 95° F (35° C). Solvent fumes from epoxy paint systems are combustible and toxic. Take suitable precautions to prevent their accumulations. In addition to fire and toxic hazard, epoxy coatings can cause allergic reactions when allowed to come in contact with the skin. Prompt skin cleanup after contact using soap and water, not solvents, is recommended. Solvents will thin and spread paint over the skin, permitting deeper penetration and increasing the hazard of a delayed allergic reaction.

SECTION 09875

INTERIOR COATING SYSTEM FOR WELDED STEEL STORAGE TANKS

PART 1 GENERAL

1.1 REFERENCES

The following publications of the issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910.134	Respiratory Protection
29 CFR 1910.1000	Air Contaminants
29 CFR 1910.1018	Inorganic Arsenic
29 CFR 1910.1025	Lead
29 CFR 1910.1200	Hazard Communication
40 CFR 260	Hazardous Waste Management Systems: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Generators of Hazardous Waste
40 CFR 263	Transporters of Hazardous Waste
40 CFR 264	Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Management of Specific Hazardous Waste Treatment, Storage, and Disposal Facilities

MILITARY SPECIFICATIONS (MIL)

MIL-B-131	(Rev. H) Barrier Materials, Watervaporproof, Greaseproof, Flexible, Heat-Sealable
MIL-P-3420	(Rev. F) Packaging Materials, Volatile Corrosion Inhibitor Treated, Opaque
MIL-S-22262	(Rev A) (Am. 2) Abrasive Blasting Media Ship Hull Blast Cleaning

MIL-P-24441	(Rev. B) Paint, Epoxy-Polyamide

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC VIS 1	1989 Visual Standard for Abrasive Blast Cleaned Steel (Standard Reference Photographs)
SSPC SP 5	1991 White Metal Blast Cleaning
SSPC SP 7	1991 Brush-Off Blast Cleaning
SSPC PA 2	1991 Measurement of Dry Paint Thickness with Magnetic Gages

1.2 SUBMITTALS

Submit the following in accordance with Section 01300, “Submittals.”

1.2.1 SD-06, Instructions

a. Coating systems

Before application, submit three copies of formulator’s printed instructions to include brand names, catalog numbers, and names of manufacturers. The instructions shall include detailed mixing and application procedures, number and types of coats required, minimum and maximum application temperatures, curing procedures, pot life, and shelf life.

1.2.2 SD-08, Statements

a. Operation procedures

b. Material safety data sheets

1.2.2.1 Statement Requirements

Submit four copies of the industrial hygienist certification of the operation procedures and personal protection equipment the Contractor is proposing to use. Provide six copies of material safety data sheets for materials to be used at the job site in accordance with CFR 29 CFR 1910.1200.

1.2.3 SD-10, Test Reports

a. Blasting abrasive

Provide laboratory test results of blasting abrasive and certify conformance to contract requirements. Provide six copies of results of tests required by MIL-S-22262 and certifications.

1.2.4 SD-13, Certificates

a. Coating system

Before delivery of the coating system, submit four copies of certificates.

1.3 DELIVERY AND STORAGE

Epoxy materials should be shipped and stored out of the sun and weather, preferably in air conditioned spaces.

1.4 SAFETY

The Contractor shall ensure that employees are trained in the requirements of CFR 29 CFR 1910.1200 and understand the information contained in the MSDS for their protection against toxic and hazardous chemical effects.

1.5 GOVERNMENT-FURNISHED MATERIALS AND SERVICES

The Government will furnish, without cost; all test fuel products for leakproof testing of coated tank as specified in the paragraph titled “Final Inspection.”

1.6 JOB SITE REFERENCES

The contractor shall have at least one copy of each of SSPC SP 5, SSPC OA 2, and SSPC VIS 1 at the job site and made available to the Contracting Officer.

PART 2 PRODUCTS

2.1 COATING SYSTEM

Shall conform to the respective specifications and to the requirements specified herein.

2.1.1 Primer

Epoxy-Polyamide, Green Primer, Formula 150 of IL-P-24441.

2.1.2 Intermediate Coat

Epoxy-Polyamide, Haze Gray Intermediate Coat, Formula 151 of MIL-P-24441.

2.1.3 Top Coat

Epoxy-Polyamide, White Top Coat, Formula 152 of MIL-P-24441.

2.2 BLASTING ABRASIVE

Abrasive shall be sharp, washed, salt-free, angular, crushed wet bottom boiler slag or nickel slag, free from feldspar or other constituents that tend to break down and remain on the surface. Abrasive shall not contain magnetic materials and shall conform to MIL-S-22262, Type I (Inorganic).

Rodda Point

June 3, 1994

Mr. David Seier
Coatings Unlimited
18250 68th Ave S
Kent WA 98032

SUBJECT: Hazardous Waste TSD
REF: Protective Coating System

Dear Dave,

We are pleased to offer the Sigma Coatings protective coating/systems for the subject project. The Sigma product/systems are equivalent to the system specified and permit a "single manufacturer" source for all products, assuring total compatability. Enclosed is documentation verifying the product equivalency.

It is our understanding the original specifications called for the following product.

INTERIOR

Primer:	Mil-P-24441, Formula 150 (Green)	@ 2 to 4 mils dry
Intermediate:	Mil-P-24441, Formula 151 (Haze Gray)	@ 2 to 4 mils dry
Topcoat:	Mil-P-24441, Formula 152 (White)	@ 2 to 4 mils dry

EXTERIOR

Primer:	Mil-P-24441, Formula 159 (Zinc Rich)	@ 2 to 4 mils dry
Intermediate:	Mil-P-24441, Formula 157 (Gray)	@ 2 to 4 mils dry
Topcoat:	Mil-C-85285 (white)	@ 2 to 4 mils dry

As indicated on the attached "Spread Sheet", we are proposing the Sigma Coating system.

Independent laboratory reports, Qualified Product listing, and Technical Product Data sheets are enclosed for your review.

Please contact our office if we may be of further service.

Very truly yours,

James S. Lockwood

James S. Lockwood
Manager, Marine &
Industrial Sales

JSL/dle

Enclosures

Corporate Office: 6932 Southwest Macadam - Portland, Oregon [illegible]

Rodda Paint

Marine & Industrial Division
P.O. Box 84801
Seattle, WA 98124
(206) 762-1818
FAX: (206) 767-7462
Toll Free: 1-800-275-6924

SPREAD SHEET

PROJECT DESIGNATION HAZARDOUS WASTE TSD DATE 6/3/94

PROPOSAL NUMBER CU-S-R-94 NO. 1 OF 1

AREA	COATS	SIGMA COATINGS MATERIAL DESCRIPTION	SIGMA CODE NUMBER	Minimum Dry Film Thickness (Mils)	Percent Volume Solids	Theoretical Coverage Per Gal. in Square Feet @ 1 mil D.F.T.	[illegible]	Theoretical Cost Sq. Foot PER COAT	TOTAL
INTERIOR STEEL SURFACES									
	1	MIL-P-24441, Formula 150 (Green Primer) QPL	3232/3298	2 to 4	60	321			
	1	MIL-P-24441, Formula 151 (Haze Gray) QPL	3251/3297	2 to 4	60	321			
	1	MIL-P-24441, Formula 152 (White) QPL	3253/3297	2 to 4	60	321			
Total:	3			6 to 12					
EXTERIOR STEEL SURFACES									
	1	MIL-P-24441, Formula 159 Polyamide Zinc Rich Primer	7400	2 to 4	54	294			
	1	MIL-P-24441, Formula 157 Polyamide Epoxy (Gray)	3253/3297	2 to 4	60	321			
	1	MIL-C-83286 Polyurethane (White)	5523-7000	2 to 3	60	321			
Total:	3			6 to 10					

NOTE: COVERAGE RATES ARE THEORETICAL - A SUITABLE LOSS FACTOR SHOULD BE APPLIED.

SUBMITTED BY: James E. Lockwood

o:\spdsht72.jal

[illegible]
(FORMER NAME: COLTURIET ZINC PRIMER 02)

7402

December 1992

DESCRIPTION

Sigmacover Zinc Primer is a two component polyamide cured zinc epoxy primer.

PRINCIPAL CHARACTERISTICS

- Designed as a system primer for various paint systems.
- Good corrosion prevention properties.
- Quick drying, can be overcoated after a short interval.
- Can also serve as a holding primer for various maintenance systems when a short overcoating interval is required.
- The superimposed system must be unsaponifiable.
- Can be applied up to 3 mils (75 microns) d.f.t. depending on amount of thinner.

COLOR AND GLOSS

Green - Flat

BASIC DATA AT 68°F (20°C)

Mass Density	Approx. 18.4 lbs/gal (2.2 kg/ltr)
Solids content by volume	Approx. 55%
VOC (before thinning)	3.8 lbs/gal (456 grm/ltr)
Recommended dry film thickness	1.5-2.0 mils (35-50 microns) depending on use. D.F.T.'s of more than 2.0 mils (50 microns) are not advised under thick, rigid epoxy systems.
Theoretical spreading rate @ 1 MDFT	883 ft²/gal (22 m²/ltr)
Touch dry after	15 Minutes at 68°F (20°C), 40 min. at 50°F (10°C)
Min. interval before overcoating	8 Hours at 68°F (20°C), 8 Hours at 50°F (10°C)
Max. interval before overcoating	Zinc rich primers can form zinc salts on the surface. They should not be exposed to weathering for long periods before overcoating. An interval of several months can be allowed, however, under clean interior exposure conditions. In clean exterior conditions a maximum interval of 14 days can be tolerated, but in industrial or marine conditions this interval should be reduced to the practical minimum. At all times visible contamination must be removed before overcoating by sandwashing, sweepblasting, or mechanical cleaning.

P.O. BOX 816, HARVEY, LA 70059 (504) 347-4321 - (FAX) 341-8120

SIGMA COATINGS

FEDERAL TESTING LABORATORIES 28½ Dravus • Seattle, WA 98109 • 283-4202 • FAX 284-4589

April 8, 1991

Rodda Paint
5058 4th Avenue South
Seattle, Washington 98134

Test Report: #91-1150

Process: Paint Anal/JO 37337
Specification: Mil-P-24441
Date Tested: April 1 – 5, 1991

Below are listed the results of analyses conducted in accordance with MIl-P-24441. Form 159

Sample: Sigma 7402 A
Form: Color Red Grey Date of Manu: Dec 1990
Batch: 135-120
Quant: 306 Gallons

Sample: Sigma 7402 B
Form: Color Red Grey Date of Manu: Sept 1990
Batch: 127-090
Quant: 125 gallons

McChord Fuel Tanks
DACA-67-90-C-0154

Characteristics:

1. % Solids by Weight.......84.84%
3. Moisture content.........<0.01%
4. Weight per gallon........21.3
5. Viscosity................110 K
6. Dry Time.................6 hours
7. Gloss....................2
8. Sag Test.................8 mm
9. Adhesion.................no delamination

We certify that these test results do meet those requirements of listed in MIl-P-24441.

FEDERAL TESTING LABORATORIES
Patrick P. Raney

SIGMA STA-TUF GREEN PRIMER 3252

March 1993

DESCRIPTION

Sta-Tuf Green Primer is a two component primer for land and marine structures based on polyamide cured epoxy resin. Listed on Navy QPL for Formula 150, MIL-P-24441, Type 1.

PRINCIPAL CHARACTERISTICS

- Excellent rust preventing properties, in adverse or chemically polluted atmospheres.
- Easy application by airless spray up to 3.0 mils (75 microns) dry film thickness.
- Good adhesion properties on steel, concrete, fiberglass and aluminum when the surface is properly prepared.
- Excellent water and weather resistance.
- For interior or exterior use.
- Good impact resistance.
- Resistant to spill/splash of mild chemicals.

COLOR AND GLOSS Green - Flat

BASIC DATA AT 68°F (20°C)

Mass density	Approx. 10.9 lbs/gal (1.3 kg/ltr)
Solids by volume	Approx. 59%
VOC (Before Thinning)	2.8 lbs/gal. (336 gms/ltr)
Theoretical spreading rate @ 1 MDFT	940 ft²/gal (23.2m²/ltr)
Recommended dry film thickness	3 mils (75 microns)
Touch dry after	2 Hours
Min. interval before overcoating	6 Hours
Max. interval before overcoating	7 Days
Full cure after	7 days
Temperature resistance (dry)	250°F (121°C)
Ordering Information	Sigma Sta-Tuf Green Primer #3252" in 2 & 10 gal. kits. The 2 gal. kit is 1 gal. of Base 3252 a 1 gal. container and 1 gal. of hardener 3298 in a 1 gal. container. The 10 gal. kit is 5 gal. of Base in a 5 gal. container and 5 gal. of Hardener in a 5 gal. container.
Shelf life (cool and dry place)	Subject to reinspection after 12 months
Flashpoint (T.C.C.)	Base: 97°F (36°C) Hardener: 109°F (43°C)

P.O. BOX 815, HARVEY, LA 70059 (504) 347-4321 - (FAX) 341-9129

SIGMA COATINGS

SIGMA STA-TUF EPOXY SERIES

(FORMER NAME: STA-TUF EPOXY SERIES)

3200

February 1991

DESCRIPTION

Sigma *Sta-Tuf Epoxy Series* products are polyamide cured epoxy tank coatings. Listed on navy QPL for MIL-P-24441, Type I.

PRINCIPAL CHARACTERISTICS

- Designed for application under adverse conditions as found in moist, cold, ship interiors in the winter months.
- Excellent water resistance.
- Very good impact and abrasion resistance.

COLOR AND GLOSS

#3250/3296	-	Dark Gray	Formula 154
#3251/3297	-	Haze Gray	Formula 151
#3253/3297	-	White	Formula 152
#3254/3296	-	Red	Formula 156
#3255/3297	-	Black	Formula 153
#3256/3297	-	Dark Gray	Formula 155

BASIC DATA AT 68°F (20°C)

Weight per gallon (U.S.)	Approx. 10.8 pounds (1.29 kg/ltr)
Solids content by volume	Approx. 59%
VOC (before thinning)	2.8 lbs/gal (336 gram/ltr)
Recommended dry film thickness	3 mils (75 microns)
Theoretical spreading rate @ 1MDFT	945 ft²/gal (23.2m²/ltr)
Touch dry after	2 Hours
Min. interval before overcoating	16 Hours
Max. interval before overcoating	7 Days
Full cure after	7 days
Temperature resistance (dry)	250°F (121°C)
Shelf life (cool and dry place)	Subject to reinspection after 12 months
Flashpoint (T.C.C.)	Base: 100°F (38°C) Hardener: 100°F (38°C)

INSTRUCTIONS FOR USE

Power agitate each component to uniform consistency before combining, then again after combining. DO NOT vary proportions.

Mixing Instructions

ratio: base to hardener 52:48 by weight
base to hardener 50:50 by volume

The temperature of the mixture of base and hardener during mixing and application should be above 59°F (15°C), otherwise more solvents must be used to obtain application viscosity. This results in lower sag resistance and slower cure. Thinner should be added after mixing the components.

P.O. BOX 816, HARVEY, LA 70059 (504) 347-4221 - (FAX) 341-8120

SIGMA COATINGS

QUALIFIED PRODUCTS LIST

OF

FSC 8010

PRODUCTS QUALIFIED UNDER MILITARY SPECIFICATION

MIL-P-24441

PAINT, EPOXY-POLYAMIDE,

GENERAL SPECIFICATION FOR

This list has been prepared for use by or for the Government in the acquisition of products covered by the subject specification and such listing of a product is not intended to and does not connote indorsement of the product by the Department of Defense. All products listed herein have been qualified under the requirements for the product as specified in the latest effective issue of the applicable specification. This list is subject to change without notice; revision or amendment of this list will be issued as necessary. The listing of a product does not release the contractor from compliance with the specification requirements.

THE ACTIVITY RESPONSIBLE FOR THIS QUALIFIED PRODUCTS LIST IS THE NAVAL SEA SYSTEMS COMMAND, SEA 3112, DEPARTMENT OF THE NAVY, WASHINGTON, DC 20362.

GOVERNMENT DESIGNATION	MANUFACTURER'S DESIGNATION	TEST OR QUALIFICATION REFERENCE	MANUFACTURER'S NAME AND ADDRESS
Formula 150.	3252/3298	MARE ISLAND NAVSHIPYD Rpt. 24441-108	Sigma Coatings U.S.A. Inc. P. O. Box 826 Harvey, LA 70059 Plant: 3300 River Rd. Harvey, LA 70094
Formula 151	3251/3297	MARE ISLAND NAVSHIPYD Rpt. 24441-108	Sigma Coatings U.S.A. Inc. P. O. Box 826 Harvey, LA 70059 Plant: 3300 River Rd. Harvey, LA 70094
Formula 152	3253/3297	MARE ISLAND NAVSHIPYD Rpt. 24441-108	Sigma Coatings U.S.A. Inc. P. O. Box 826 Harvey, LA 70059 Plant: 3300 River Rd. Harvey, LA 70094

SIGMADUR HSA

(FORMER NAME: SIGMA HSA URETHANE FINISH)

5523

October 1993

DESCRIPTION

A two-component high solids aliphatic acrylic polyurethane coating.

PRINCIPAL CHARACTERISTICS

- Excellent color and gloss retention.
- High film build in one coat.
- Excellent hiding power.
- Excellent resistance to chemicals, water, oils and many solvents.
- Very good application properties with conventional or airless spray equipment.
- Tough, flexible and abrasion resistant.
- Meets VOC requirements for stationary sites.

COLORS AND GLOSS

Available in white and colors. - High-gloss finish.

BASIC DATA AT 68°F (20°C)

(Data Varies Slightly With Color)

Mass density	Approx. 10.5 Lbs./ft.^{3} (1.25 kg/l)
Solids Content By Volume	Approx. 60%
VOC	3.10-3.25 lbs/gal. (372-390 grm/ltr) (depending on color)
Recommended Dry Film Thickness	2.0 - 3.0 Mils (51-76 microns)
Theoretical Spreading Rate @ 1 MDFT	962 ft^2/gal. (23.6 m^2/l)
Touch dry after	1 Hour
Overcoating Interval	Min. 12 Hours Max. - No limitation. (Surfaces free of contamination.)
Temperature Resistance (Dry)	250°F (121°C)
Ordering Information	"Sigmadur High Solid Finish 5523 - color". Available in 5-gallon kits with 4.13 gallons of base in a 5-gallon can plus 0.87 gallon of hardener in a one-gallon can. Available in 1-gallon kits consisting of 0.83 gal. of base in a one-gallon can and 0.17 gal. of hardener in a quart can. In case of roller application order 5523C available in half pint cans for addition to a one-gallon kit.
Shelf Life (Cool and Dry Place)	Subject to reinspection after 12 months.
Flashpoint (DIN 53213)	Base: 75°F (24°C) Hardener: 117°F (47°C)

P.O. BOX 816, HARVEY, LA 70059 (504) 347-4321 - (FAX) 341-8120

FEDERAL TESTING LABORATORIES 2930 Dravus • Seattle, WA 98109 • 283-4202 • FAX 284-4583

May 12, 1994

Rodda Paint
P.O. Box 84801
Seattle, Washington 98124
Attn: Robert Leaf

Test Report: #94-1921

Process: Paint Anal/JO 47563
Specification: Mil-C-85285B(AS)
Date Tested: Feb 23 - May 10, 1994

PO: 80949

A sample of paint was received on February 23, 1994 to perform specification tests in accordance with Mil-C-85285B(AS).

Sample: Polyurethane 5523-7000A and 5523B

Properties	Test Results	Limits
Fineness of grind	>8	7 minimum
Coarse particles on a 325 sieve	<0.1% by wt	<0.5% by wt
Odor, residual 48 hrs	no odor	no odor
Viscosity, #4 Ford Cup	23 sec	30 sec max
Pot Life, #4 Ford Cup after 4 hours	48 sec	60 sec max
Pot Life, before 8 hrs	no gel	no gel
Drying Time, Touch	2.5 hours	3.0 hours max
Drying Time, Hard	6.0 hours	8.0 hours max
Gloss, 60°	92.0	90 minimum
Hiding Power	0.9	0.9 minimum
Adhesion	no removal	no removal

FEDERAL TESTING LABORATORIES [illegible] • Seattle, WA 98108 • 283-4202 • FAX 284-[illegible]

Rodda Paint
Test Report #94-1921 cont
May 12, 1994
page 2

Flexibility Room Temperature	no failure	no failure
Flexibility Low Temperature	no failure	no failure
Fluid Resistance 4 hour immersion	no blistering no softening no staining	no failure
Weather resistance 500 hours	82.0 gloss	80 minimum
Humidity 720 hours $120^{o}F$	no blistering no adhesion failure no softening	no failure
Heat Resistance 1 hr @ 250^{F}	no color change	no failure
Solvent Resistance 50 rubs MEK	no removal	no failure
Tape Resistance	no removal	no removal

We certify that these test results meet the requirements of Mil-C-89528A(AS)

FEDERAL TESTING LABORATORIES

Patrick P. Yaney

CHAPTER 6

STORAGE AND HANDLING ASHORE

6-1. SCOPE.

6-2. This chapter provides guidelines for the safe storage and handling ashore of Otto Fuel II, including materials, equipment, facilities, and special instructions for transfer, cleanup, decontamination, and disposal. The health and safety precautions presented in chapter 4 shall also be observed. Regulation requirements which shall be referred to for handling and storage of Otto Fuel II ashore are provided in OP 5. These guidelines are also applicable to used and contaminated Otto Fuel II which must be kept in separate identifiable containers but which can be handled and stored similarly.

6-3. HANDLING.

6-4. Routine handling of Otto Fuel II ashore includes loading and unloading of shipping and storage containers, preparation and maintenance of Torpedoes Mk 46 and Mk 48, and the conduct of testing operations.

6-5. MATERIALS.

6-6. The recommended materials for use with Otto Fuel II are listed in table 6-1. Refer to appendix E for a more extensive listing. Otto Fuel II is compatible with most common metals, although long-term contact with copper-based alloys is not recommended. Most elastomers swell and absorb the fuel upon contact. Those recommended are not affected or show minimal effects. Ethylene-propylene, butyl rubber, and silicone rubber are recommended materials for seals and O-rings. Materials which are not approved for use as seals or O-rings with Otto Fuel II include Viton, Buna-N, and neoprene which swell upon contact but present no hazard, and polysulfide rubber which is chemically incompatible. Petroleum-based lubricants are not recommended. Otto Fuel II does not chemically react with varnish, enamel, and water latex paints, but it will remove the paint finish. Epoxy paints appear to offer the greatest protection against Otto Fuel II. To ensure satisfactory service, any previously untested paint should be subjected to tests with Otto Fuel II prior to use. A minimum of three coats of fully cured epoxy paint has been found to provide adequate protection for concrete surfaces. Porous absorbent material which can act as a wick and emit the fuel vapors should be minimized where contact with the fuel is likely. Porous items which cannot be adequately decontaminated after exposure shall be discarded after use and replaced. Wood is an acceptable product for handles on tools and shipping pallets for Otto Fuel II and its wastes. Once wood is contaminated with Otto Fuel II or its wastes, the wood products shall be disposed of as an Otto Fuel II solid waste. Recommended materials suitable for use in flooring work areas are listed in table 6-1. For additional information concerning materials for use with Otto Fuel II, contact the Naval Ordnance Station, Indian Head, Maryland (Code 5233). Material Safety Data sheets on all solvents and hazardous chemicals used during Otto Fuel II operations shall be made available to personnel.

Table 6-1. Recommended Materials for Use with Otto Fuel II

Material	Approved
Metals	Most common metals except copper
Nonmetals	Ethylene-propylene; Teflon-impregnated asbestos[1]; fluorocarbons, such as Kel-F and Teflon; polyethylene; glass; natural rubber; gum rubber; butyl rubber; and red rubber
Lubricants	Most silicone- and fluorocarbon-based lubricants
Paint	Any epoxy paint conforming to MIL-P-24441
Flooring (for work area only)	1. Northern plastic mortar with acid resistant sealer made by Northern Industrial Maintenance, Bethel Park, PA
	2. Bruzem 77 industrial floor topping with Bruzem 70 surface sealer made by I.W. Industries, Houston, TX
	3. Stonclad and Stonclad HT, both coated with Super Stonchem made by Stonhard, Inc., Maple Shade, NJ

[1] Asbestos shall not be used if substitute is available.

6-7. EQUIPMENT.

6-8. The operating procedure and local piping designs will determine the equipment requirements; however, all valves, pumps, and switches shall be identified.

6-9. **VALVES.** Valves shall be provided as necessary for safe operation. Valves shall always perform a positive closure. Ball, plug, or balanced poppet designs are recommended. Valves shall be leak free. All wetted parts of the valve shall be of approved material. Once used, valves shall not be used for transfer or storage of oxidizers.

SECTION D

APPENDIX D11

SUBPART BB EQUIPMENT DETAILS

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Bulk Storage Waste (Oily Wastewater)

EXTERIOR TANK PIPE RACK	system	101	102	HW TANK RECIRCULATION	system	101	102
fill pipe end cap	PID-1			recirc drain valve	PRV-1		
fill pipe check valve	PIV-1			recirc drain sample port valve	PRV-2		
fill pipe valve	PIV-2			recirc drain sample port	PRD-1		
drain pipe end cap	POD-3			first recirc strainer	PRF-1		
drain pipe valve	POV-3			second recirc strainer	PRF-2		
TANK TOP EQUIPMENT				recirc drain valve	PRV-3		
fill pipe valves		PIV-3	PIV-4	recirc drain flex hose flanges	PRF-3		
tank overflow flange		POF-2	POF-5	ten air pump clamp fittings	PRF-4		
top hatch cover seal perimeter		PIF-1	PIF-4	recirc fill flex hose flanges	PRF-5		
mechanical level sensor flange		PIF-2	PIF-5	recirc fill valve	PRV-4		
tank vent flange		POF-1	POF-4	three accumulator flanges	PRF-6		
electronic level sensor		PIF-3	PIF-6	recirc fill valve	PRV-5		
TANK BOTTOM EQUIPMENT				recirc fill sample port valve	PRV-6		
tank overflow open end		POD-1	POD-2	recirc fill sample port	PRD-2		
bottom access cover seal		POF-3	POF-6	pressure gauge valve	PRV-7		
tank drain valve		POV-1	POV-2	pressure gauge	PRF-7		
				recirc fill valve	PRV-8		
				recirc tank fill valve		PRV-9	PRV-11
				recirc tank fill flange		PRF-8	PRF-9
				recirc fill valve	PRV-10		
				recirc drain valve	PRV-12		
				recirc tank drain valve		PRV-13	PRV-15
				recirc drain valve	PRV-14		

MISC OTHER EQUIPMENT	Int. vent	Exh. vent
Paint Can Crusher Carbon Filter	PCCV-I	PCCV-E

first letter P = oily (petroleum) wastewater system

second letter:
I = input system
O = output system
R = recirculation system

third letter:
V = valve
F = fitting (flange, threads, etc)
D = drain (any device openable to atmosphere)

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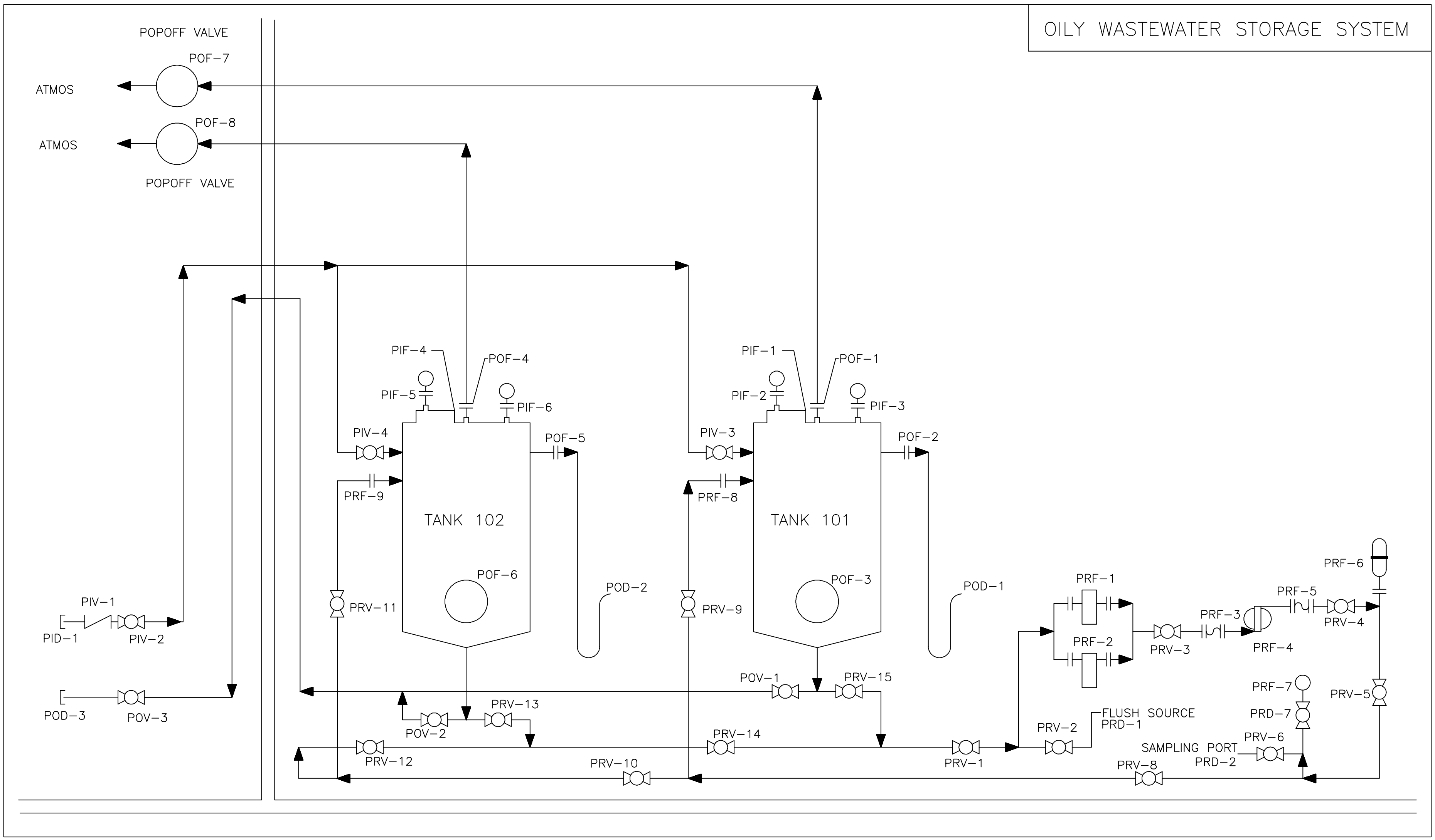
OILY WASTEWATER STORAGE SYSTEM
POPOFF VALVE
POF-7
ATMOS
POF-8
ATMOS
POPOFF VALVE
PIF-4
POF-4
PIF-5
PIF-6
PIV-4
POF-5
PRF-9
TANK 102
POF-6
POD-2
PIF-1
POF-1
PIF-2
PIF-3
PIV-3
POF-2
PRF-8
TANK 101
POF-3
POD-1
PIV-1
PID-1
PIV-2
PRV-11
PRV-9
POD-3
POV-3
POV-1
PRV-15
POV-2
PRV-13
PRV-14
PRV-12
PRV-10
PRV-1
PRF-1
PRF-2
PRV-3
PRF-3
PRF-4
PRF-5
PRV-4
PRF-6
PRV-5
PRF-7
PRD-7
FLUSH SOURCE
PRD-1
PRV-2
PRV-6
SAMPLING PORT
PRD-2
PRV-8

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Bulk Storage Waste (Cyanide)

EXTERIOR TANK PIPE RACK	system	103	106
fill pipe end cap		CID-1	CID-2
fill pipe valve	CIV-1	CIV-2	CIV-3
drain pipe end cap	COD-4		
drain pipe valve	COV-4		
TANK TOP EQUIPMENT			
fill pipe valves		CIV-4	CIV-5
fill pipe flange		CIF-1	CIF-2
tank overflow flange		COF-2	COF-5
top hatch cover seal perimeter		CIF-3	CIF-6
mechanical level sensor flange		CIF-4	CIF-7
tank vent flange		COF-1	COF-4
electronic level sensor		CIF-5	CIF-8
TANK BOTTOM EQUIPMENT			
main drain pipe end cap	COD-1		
main drain pipe valve	COV-1		
tank overflow open end		COD-2	COD-3
bottom access cover seal		COF-3	COF-6
tank drain valve		COV-3	COV-2

HW TANK RECIRCULATION	system	103	106
recirc drain valve	CRV-1		
recirc drain sample port valve	CRV-2		
recirc drain sample port	CRD-1		
first recirc strainer	CRF-1		
second recirc strainer	CRF-2		
recirc drain valve	CRV-3		
recirc drain flex hose flanges	CRF-3		
ten air pump clamp fittings	CRF-4		
recirc fill flex hose flanges	CRF-5		
recirc fill valve	CRV-4		
three accumulator flanges	CRF-6		
recirc fill valve	CRV-5		
recirc fill sample port valve	CRV-6		
recirc fill sample port	CRD-2		
pressure gauge valve	CRV-7		
pressure gauge	CRF-7		
recirc fill valve	CRV-8		
recirc tank fill valve		CRV-11	CRV-9
recirc tank fill flange		CRF-9	CRF-8
recirc fill valve	CRV-10		
recirc drain valve	CRV-12		
recirc tank drain valve		CRV-13	CRV-15
recirc drain valve	CRV-14		

first letter C = Cyanide wastewater system

second letter:
I = input system
O = output system
R = recirculation system

third letter:
V = valve
F = fitting (flange, threads, etc)
D = drain (any device openable to atmosphere)

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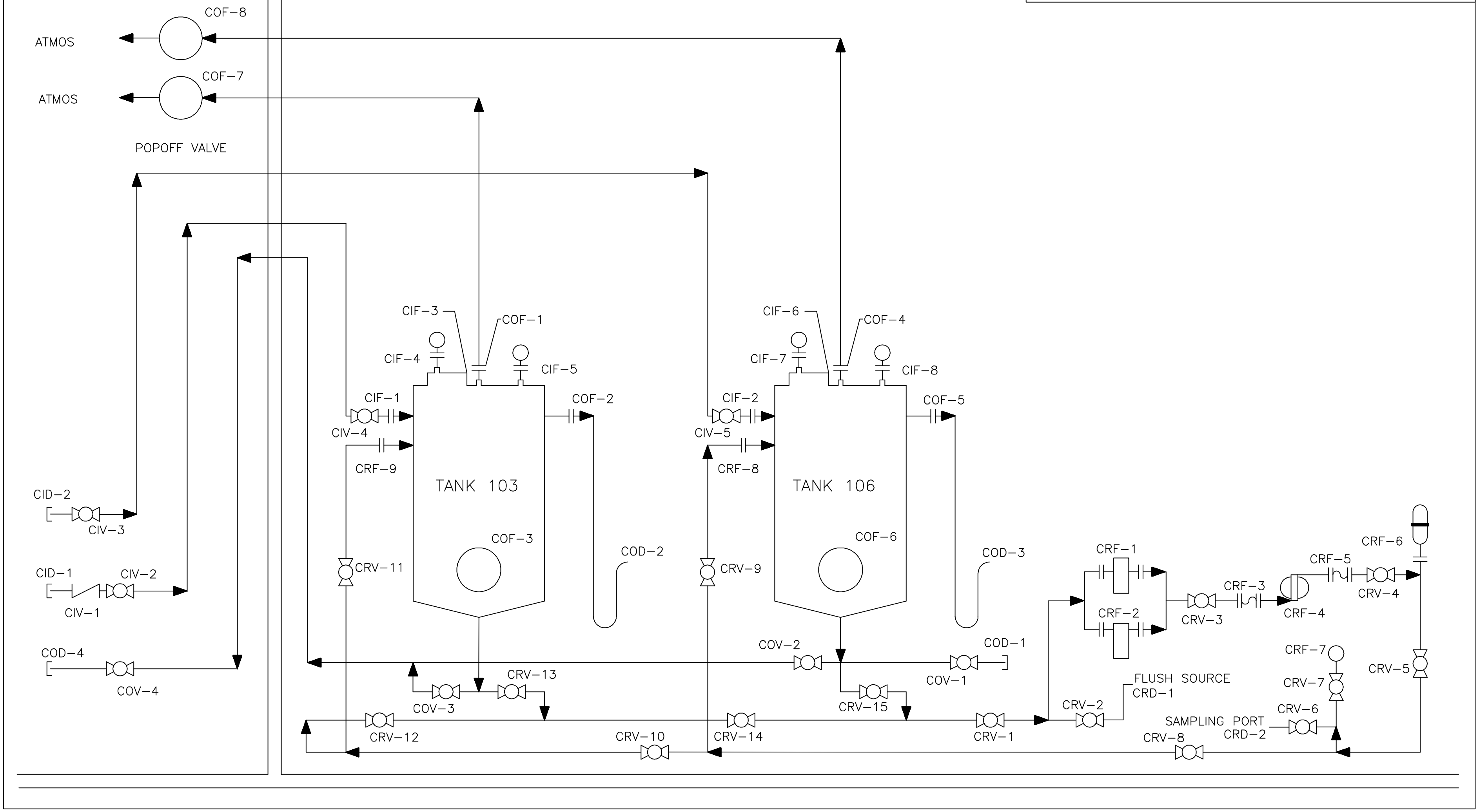
CYANIDE WASTEWATER STORAGE SYSTEM



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Bulk Storage Waste (Otto Fuel)							
EXTERIOR TANK PIPE RACK	system	104	105	**HW TANK RECIRCULATION**	system	104	105
fill pipe end cap	AID-1			recirc drain valve	ARV-1		
fill pipe valve	AIV-1			recirc drain sample port valve	ARV-2		
drain pipe end cap	AOD-8			recirc drain sample port	ARD-1		
drain pipe valve	AOV-10			first recirc strainer	ARF-1		
TANK TOP EQUIPMENT				second recirc strainer	ARF-2		
fill pipe valves		AIV-2	AIV-3	recirc drain flex hose flanges	ARF-3		
tank overflow flange		AOF-2	AOF-5	ten air pump clamp fittings	ARF-4		
top hatch cover seal perimeter		AIF-1	AIF-4	recirc fill flex hose flanges	ARF-5		
mechanical level sensor flange		AIF-2	AIF-5	three accumulator flanges	ARF-6		
tank vent flange		AOF-1	AOF-4	recirc fill sample port valve	ARV-3		
electronic level sensor		AIF-3	AIF-6	recirc fill sample port	ARD-2		
TANK BOTTOM EQUIPMENT				recirc fill valve	ARV-4		
main drain pipe end cap	AOD-1			recirc fill sample port valve	ARV-5		
main drain pipe valve	AOV-1			recirc fill sample port	ARD-3		
tank overflow open end		AOD-2	AOD-5	pressure gauge valve	ARV-6		
bottom access cover seal		AOF-3	AOF-6	pressure gauge	ARF-7		
first tank sample port valve		AOV-2	AOV-6	recirc tank fill valve		ARV-7	ARV-9
first tank sample port		AOD-3	AOD-6	recirc tank fill flange		ARF-8	ARF-9
second tank sample port valve		AOV-3	AOV-7	recirc fill valve	ARV-8		
second tank sample port		AOD-4	AOD-7	recirc drain valve	ARV-10		
tank drain valve		AOV-4	AOV-8	recirc tank drain valve		ARV-11	ARV-13
main drain pipe valve	AOV-5			recirc drain valve	ARV-12		
main drain pipe valve	AOV-9						
main drain flange	AOF-7						

first letter A = OF/Alcohol tank system

second letter:

I = input system

O = output system

R = recirculation system

third letter:

V = valve

F = fitting (flange, threads, etc)

D = drain (any device openable to atmosphere)

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OF II & ALCOHOL WASTEWATER STORAGE SYSTEM

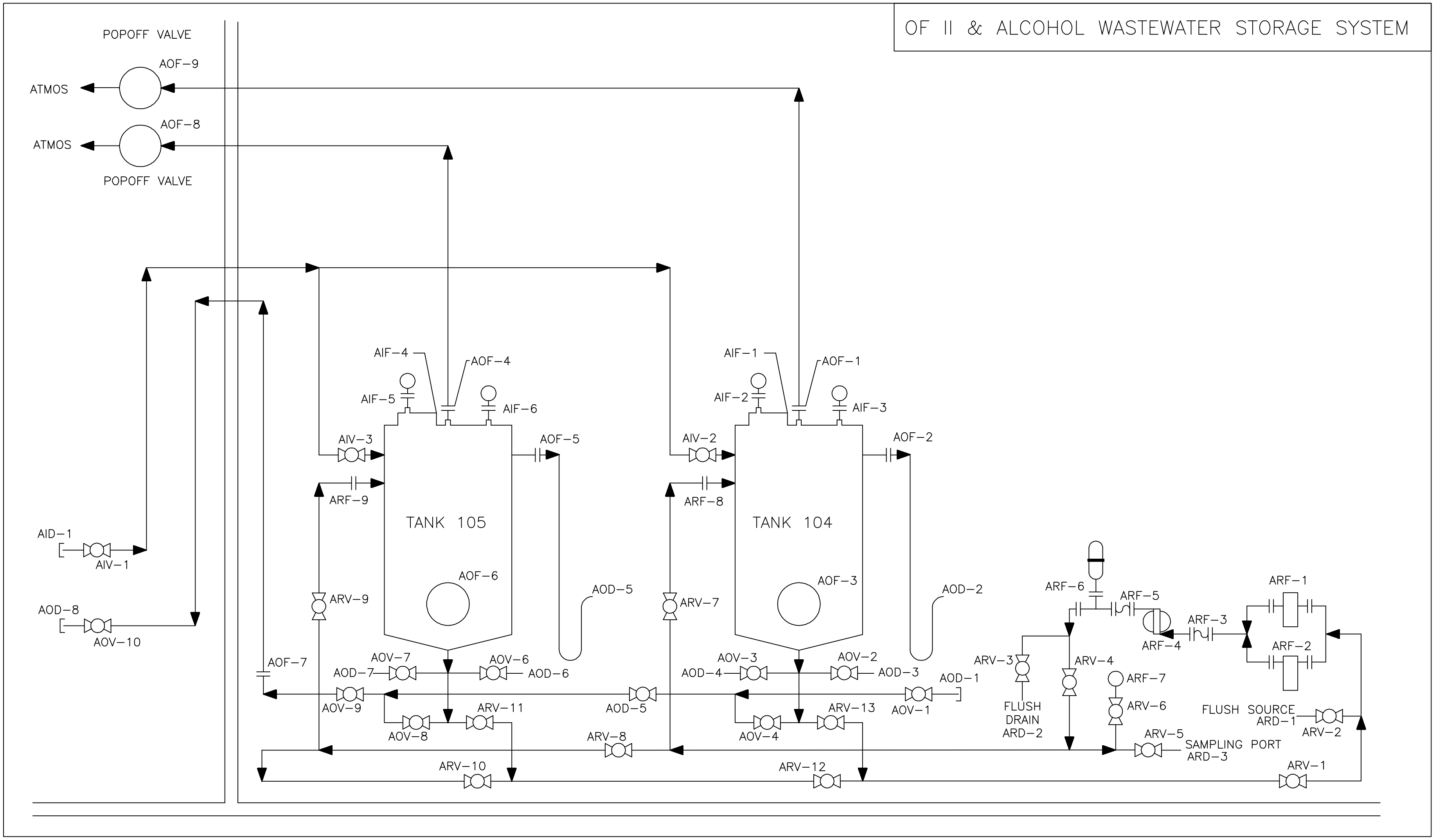

Figure 1. Outside waste tank fill pipe rack valves AIV-1, CIV-3 and end caps AID-1 and CID-2.

Two center pipes labeled ‘Cyanide Waste Water’ and ‘Otto Fuel II Wastewater’ are active.

Test perimeter of end caps, perimeter of flanges at either end of valve, valve center flange, and valve stem seal.

Figure 2. Outside waste tank drain pipe rack valve AOV-10 and end cap AOD-8.

Left pipe with black arrows on orange tape is active.

Test perimeter of end cap, perimeter of flanges at either end of valve, valve center flange, and valve stem seal.

Figure 3. Tank 104 fill pipe valve AIV-2.

Test perimeter of flanges at either end of valve, valve center flange, and valve stem seal.

Figure 4. Tank 104 overflow pipe flange AOF-2.

Test perimeter of overflow pipe flange.

Figure 5. Tank 104 vent flange AOF-1. Test perimeter of vent flange.

Figure 6. Tank 104 electronic level sensor AIF-3. Test perimeter of flange and two threaded fittings at base of sensor.

Figure 7. Tank 104 upper access hatch cover AIF-1. Test underside of entire hatch perimeter.

Figure 8. Tank 104 mechanical level sensor AIF-2. Test perimeter of flange.

Figure 9. Tank 105 fill pipe valve AIV-3.

Test perimeter of flanges at either end of valve, valve center flange, and valve stem seal.

Figure 10. Tank 105 overflow pipe flange AOF-5.

Test perimeter of overflow pipe flange.

Figure 11. Tank 105 vent flange AOF-4. Test perimeter of vent flange.

Figure 12. Tank 105 electronic level sensor AIF-6. Test perimeter of flange and two threaded fittings at base of sensor.

Figure 13. Tank 105 upper access hatch cover AIF-4. Test underside of entire hatch perimeter.

Figure 14. Tank 105 mechanical level sensor AIF-5. Test perimeter of flange.

Figure 15. Tank 106 fill pipe valve CIV-5 and flange CIF-2.

Test perimeter of flanges at either end of valve, valve center flange, valve stem seal, and perimeter of tank flange

Figure 16. Tank 106 overflow pipe flange COF-5.

Test perimeter of overflow pipe flange.

Figure 17. Tank 106 vent flange COF-4. Test perimeter of vent flange.

Figure 18. Tank 106 electronic level sensor CIF-8. Test perimeter of flange and two threaded fittings at base of sensor.

Figure 19. Tank 106 upper access hatch cover CIF-6. Test underside of entire hatch perimeter.

Figure 20. Tank 106 mechanical level sensor CIF-7. Test perimeter of flange.

Figure 21. Main drain pipe valve AOV-1 and end cap AOD-1. Test perimeter of cap, perimeter of flanges at either end of valve, valve stem seal, and perimeter of end cap.

Figure 22. Tank 104 drain valve AOD-2. Test perimeter of flanges at either end of valve and valve stem seal.

Figure 23. Tank 104 sample port valve AOV-3 and drain AOD-4. Test three threaded fittings and valve stem seal.

Figure 24. Tank 104 sample port valve AOV-2 and drain AOD-3. Test four threaded fittings and valve stem seal.

Figure 25. Tank 104 overflow end cap AOD-2.

Test perimeter of end cap.

Figure 26. Tank 105 overflow end cap AOD-5.

Test perimeter of end cap.

Figure 27. Tank 105 sample port valve AOV-7 and drain AOD-7. Test three threaded fittings and valve stem seal.

Figure 28. Tank 105 sample port valve AOV-6 and drain AOD-6. Test four threaded fittings and valve stem seal.

Figure 29. Tank 105 drain valve AOV-8. Test perimeter of flanges at either end of valve and valve stem seal.

Figure 30. Main drain pipe valve AOD-5. Test perimeter of flanges at either end of valve, valve center flange, and valve stem seal.

Figure 31. Main drain pipe valve AOV-9. Test perimeter of flanges at either end of valve, valve center flange, and valve stem seal.

Figure 32. Tank 106 drain valve COV-2. Test perimeter of flanges at either end of valve, valve center flange, and valve stem seal.

Figure 33. Tank 106 overflow cap COD-3.

Test perimeter of end cap.

Figure 34. Tank 104 bottom access cover AOF-3.

Test perimeter of seal.

Figure 35. Tank 105 bottom access cover AOF-6.

Test perimeter of seal.

Figure 36. Tank 106 bottom access cover COF-6.

Test perimeter of seal.

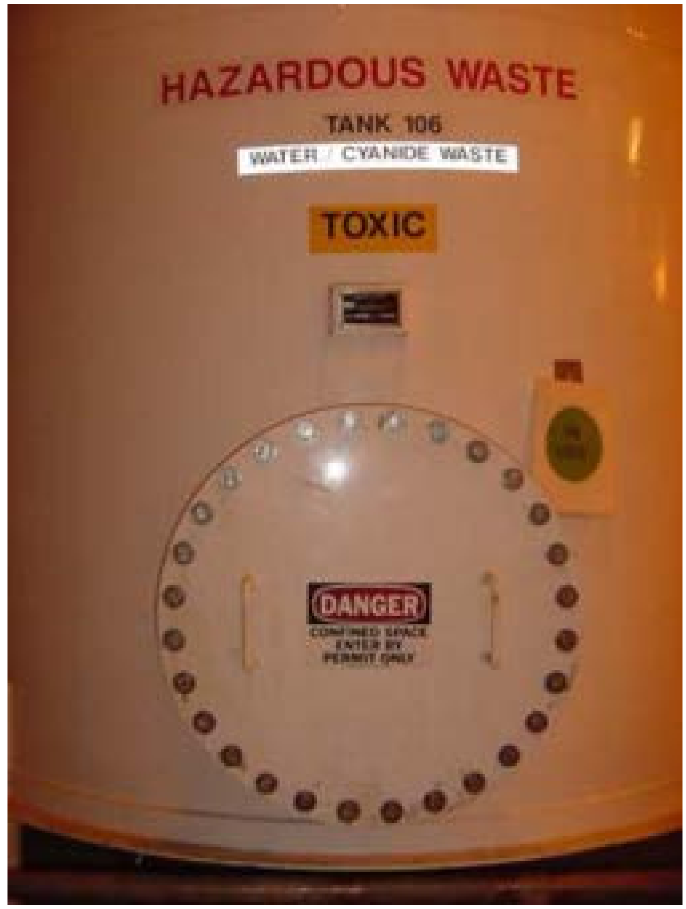

Figure 37. Backflush drain valve COV-1 and drain cap COD-1. Test perimeter of flanges at either end of valve, valve center flange, valve stem seal, and perimeter of end cap.

Figure 38. Tank 106 drain pipe flange (to be deleted in upgrade). Test perimeter of flange.

Figure 39. Backflush pipe flange (to be deleted in upgrade). Test perimeter of flange.

Figure 40. Backflush valve (to be deleted in upgrade). Test perimeter of flanges at either end of valve, valve center flange, and valve stem seal.

Figure 41. Backflush flex hose flange (to be deleted in upgrade). Test perimeter of flange.

Figure 42. Recirculation drain flex hose flange (to be deleted in upgrade). Test perimeter of flange.

Figure 43. Recirculation drain flex hose flange (to be deleted in upgrade). Test perimeter of flange.

Figure 44. Recirculation drain valve ARV-10. Test perimeter of flanges at either end of valve, valve center flange, and valve stem seal.

Figure 45. Tank 105 recirculation drain valve ARV-11. Test perimeter of flanges at either end of valve, valve center flange, and valve stem seal.

Figure 46. Recirculation drain valve ARV-12. Test perimeter of flanges at either end of valve, valve center flange, and valve stem seal.

Figure 47. Tank 104 recirculation drain valve ARV-13.

Test perimeter of flanges at either end of valve, valve center flange, and valve stem seal.

Figure 48. Recirculation drain valves ARV-1, sample port valve ARV-2 and drain sample port ARD-1.

Test perimeter of both ARV-1 flanges and threaded fittings, three ARV-2 threaded fittings, both valve stem seals, and sample port.

Figure 49. Strainers ARF-1 AND ARF-2, input.

Test perimeter of two unions and two threaded fittings.

.

Figure 50. Strainers ARF-1 AND ARF-2, output.

Test perimeter of two unions and two threaded fittings

Figure 51. Strainers ARF-1 AND ARF-2, caps.

Test perimeter of caps shown and threaded drains at the bottom of each canister (not shown).

Figure 52. Recirculation drainpipe flex fitting ARF-3.

Test perimeter of two flanges.

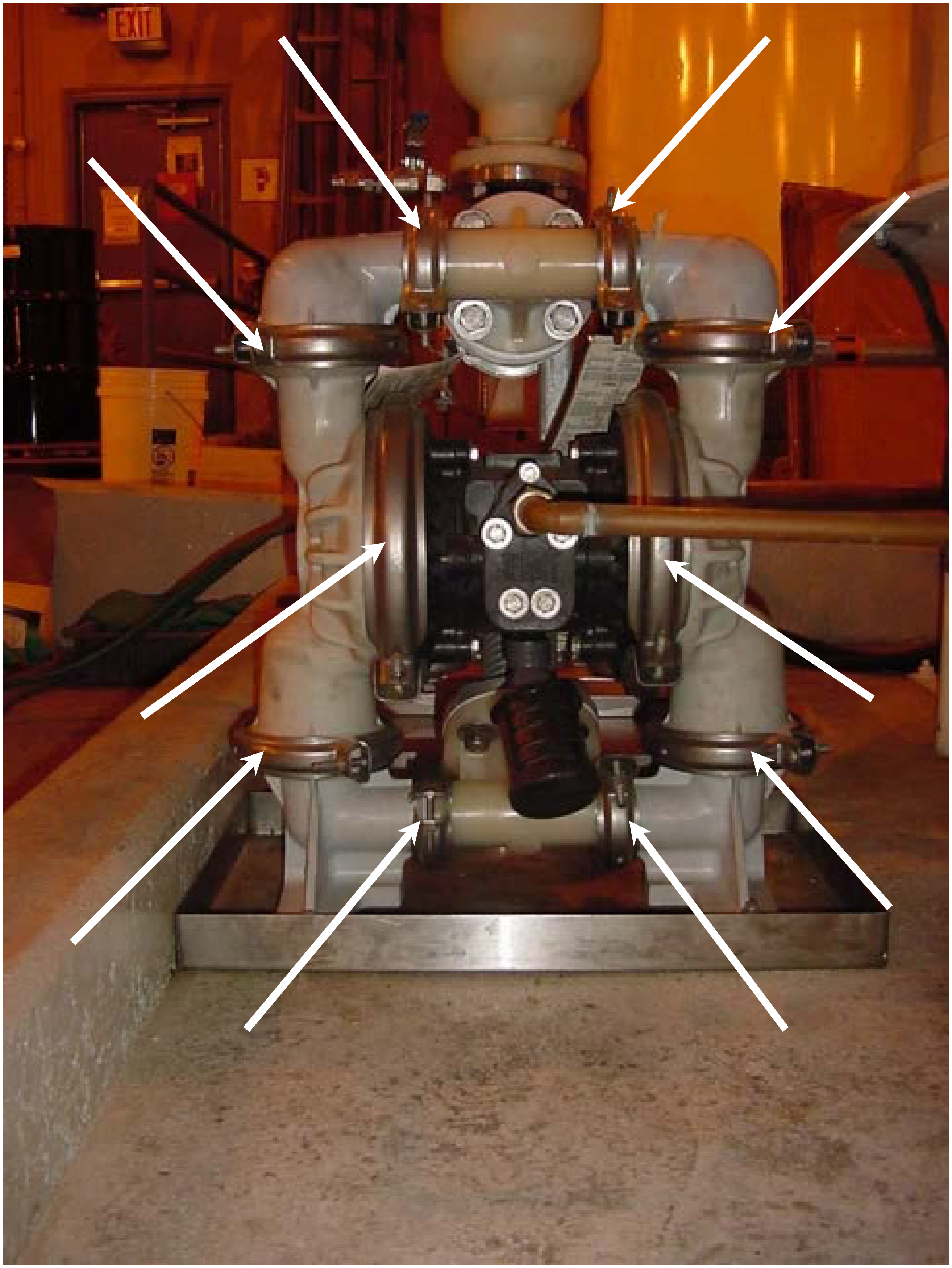

Figure 53. Recirculation pump ARF-4. Test perimeter of ten clamp fittings (see arrows).

Figure 54. Recirculation fill pipe flex fitting ARF-5. Test perimeter of two flanges.

Figure 55. Recirculation fill valve ARV-4, fill sample port valve ARV-3, and sample port ARD-2. Test perimeter of both ARV-4 flanges and threaded fittings, four ARV-3 threaded fittings, both valve stem seals and sample port.

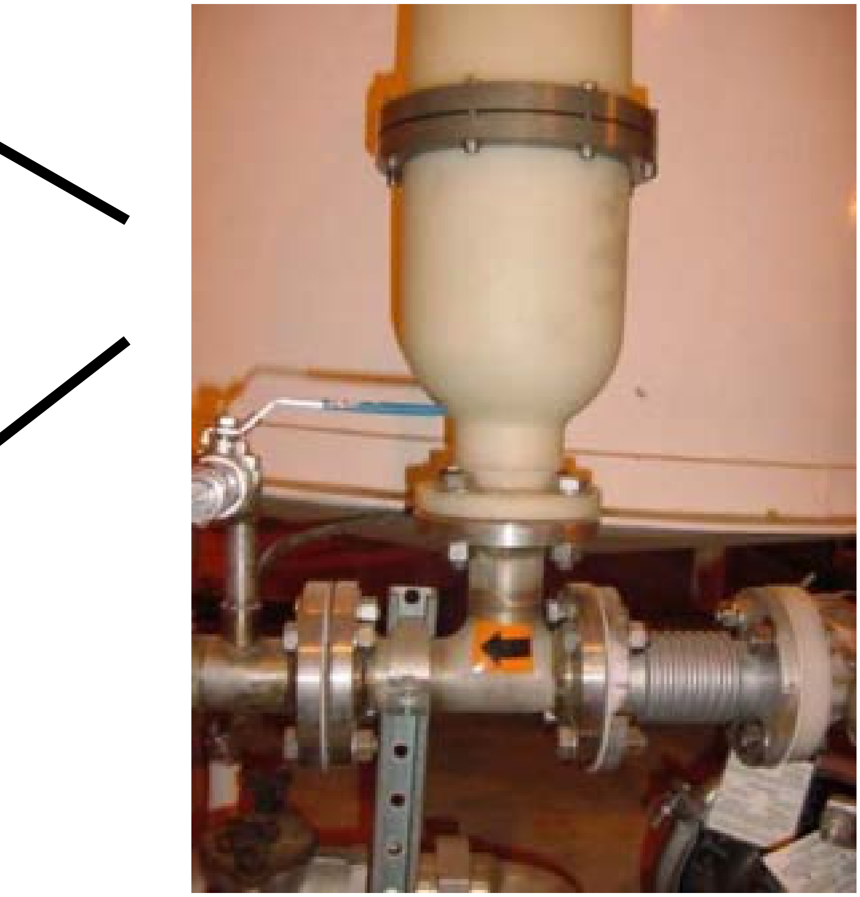

Figure 56. Accumulator ARF-6.

Test perimeter of three flanges (see arrows).

Figure 57. Recirculation fill pipe sampling port valve ARV-5, sample port ARD-3, pressure gage valve ARV-6, and pressure gauge ARF-7.

Test perimeter of three threaded fittings and valve stem seal of sampling port valve and end of sampling port.

Test perimeter of three threaded fittings for pressure gauge valve and pressure gauge, and valve stem seal.

Figure 58. Tank 104 recirculation fill valve ARV-7

Test perimeter of flanges at either end of valve, valve center flange, and valve stem seal.

Figure 59. Tank 104 recirculation fill pipe flange ARF-8.

Test perimeter of flange.

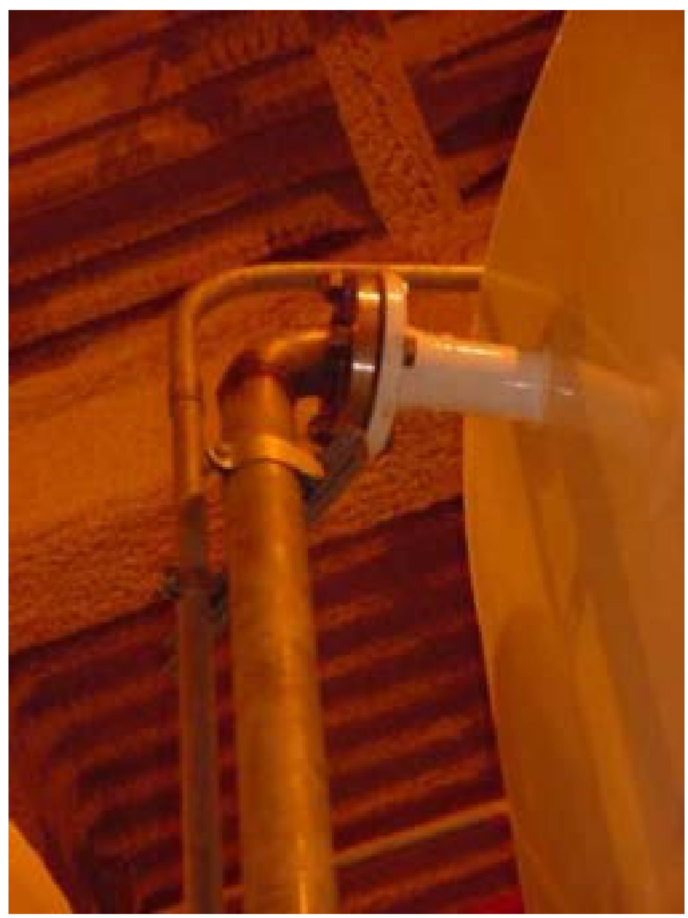

Figure 60. Recirculation fill valve ARV-8. Test perimeter of flanges at either end of valve, valve center flange, and valve stem seal.

Figure 61. Tank 105 recirculation fill valve ARV-9.

Test perimeter of flanges at either end of valve, valve center flange, and valve stem seal.

Figure 62. Tank 105 recirculation fill pipe flange ARF-9.

Test perimeter of flange.

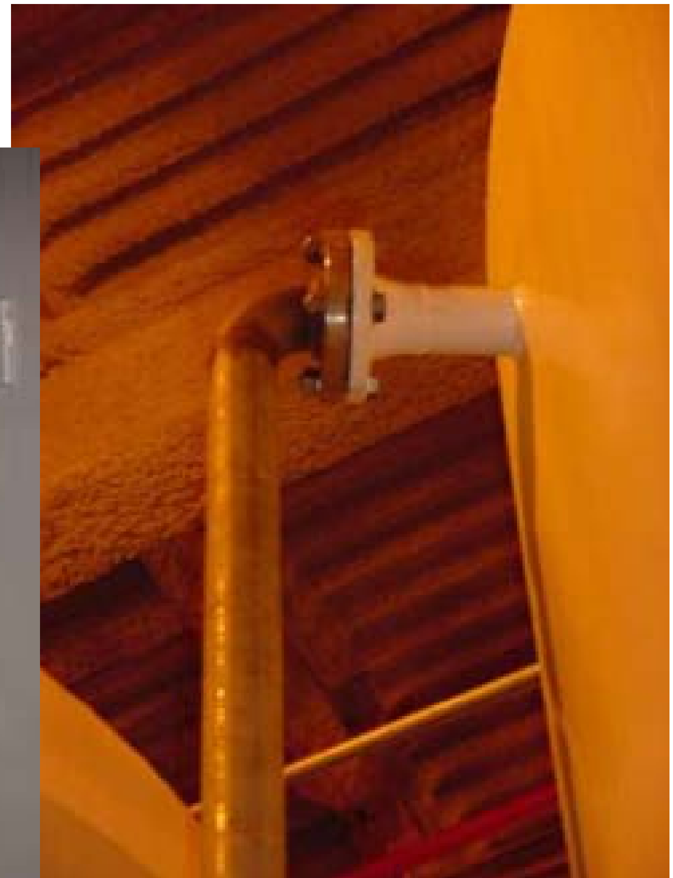

Figure 63. Tank 106 recirculation fill valve CRV-9.

Test perimeter of flanges at either end of valve, valve center flange, and valve stem seal.

Figure 64. Tank 106 recirculation fill pipe flange CRF-8.

Test perimeter of flange.

SECTION D

APPENDIX D12

SUBPART CC EQUIPMENT DETAILS

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Ensure that no wastes are introduced into or removed from the tanks during this operation.

Prior to disassembling and after reassembling the vents, sample the area under the pressure hood assembly and the suction port with the VOC meter as set forth in the VOC meter user's manual ,and method 21 in 40 CFR 60.

Figure 1. From left to right, vents POF7 (101), POF8 (102) and COF7 (103) located in the far northeast corner of the BLDG 1051 roof.

Figure 2. From left to right, vents AOF9 (105), COF8 (106) and AOF8 (104) located about 4 meters to the right of the Figure 1 vents on the BLDG 1051 roof. The pressure hood assembly is shown at the bottom right, the pressure screen is shown at the bottom left.

Figure 3. The pressure vent (right side in picture) cover and screen have been removed by detaching 4 wing nuts from the top. The suction vent (left side in picture) cover has been removed by releasing the hold-down wing nuts on both sides.

Ensure that the flat portions of the pistons are not warped causing a gap between the sealing surfaces and that there are no cracks in the flat portions of the pistons.

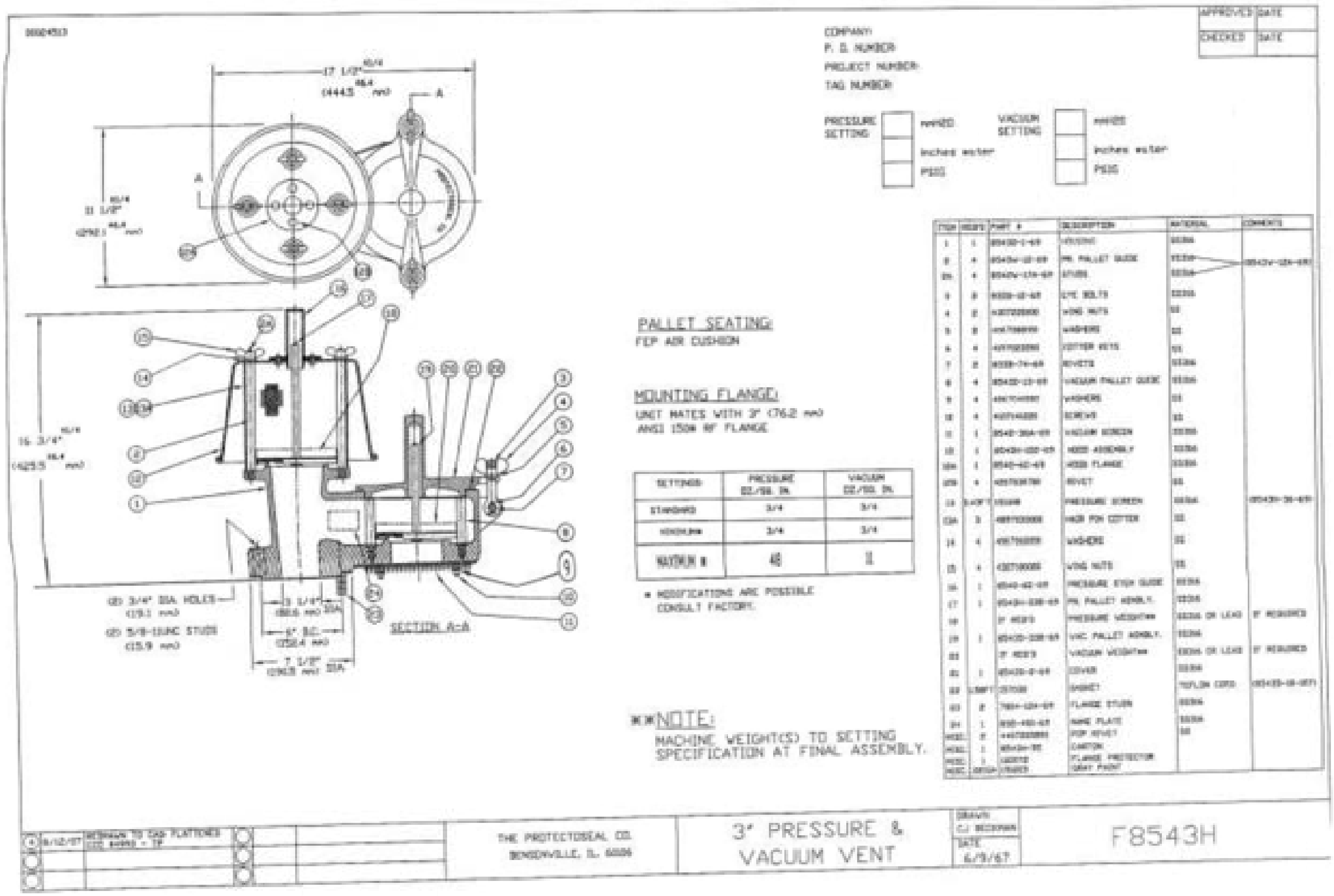

Figure 6. Pressure and vacuum vent parts diagram.