SAND2015-1620R

Abri Environmental Engineering, Inc.

Environmental Management and Compliance Consultants

Engineering Assessment and Certification of Integrity of the Building 943 Tank System

January 2015

Sandia National Laboratories/California

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Engineering Assessment and Certification of Integrity of the Building 943 Tank System

1. Background

This Engineering Assessment and Certification of Integrity of Building 943 (B943) Tank System has been prepared using the guidelines of 40 CFR 265.192(a) and 22 CCR 66265.192(a) for tank systems[*] that manage hazardous waste and have secondary containment. The regulations require that this assessment be completed and certified by an independent, qualified, California-registered professional engineer. This technical assessment has been reviewed by an independent, qualified, California-registered professional engineer, who has certified the tank system for the following:

- sufficient structural integrity,
- acceptability for storing of hazardous waste,
- compatibility with the waste, and
- suitability of tank and containment system design to achieve the requirements of the applicable regulations so they will not collapse, rupture, or fail.

Environmental Management Department at Sandia National Laboratory in Livermore, CA (SNL) will keep this document on file. Original hard copy documentation of the appendices and other relevant information for the tank system are also kept on file by SNL Environmental Management Department.

[*] *Tank system* is defined in 40 CFR 260.10 as "a (one) hazardous waste storage or treatment tank and its associated ancillary equipment and containment system." In the text of this report, *tank system* is used to include all the tanks and associated ancillary equipment.

2. Building 943 Tank System

The B943 tank system is located in a pit inside Building 943 of SNL. B943 houses a plating shop, which utilizes the B943 tank system to collect hazardous wastewater generated from rinsing activities within the building. The wastewater is transferred to a storage tank and evaporators outside the building. The storage tank and the evaporators outside the building are not a subject for this engineering assessment. This assessment covers the 280-gallon tank inside the building.

2.1 Description of the B943 Tank System

The B943 tank system consists of the following:

- A secondarily contained storage tank,
- Associated piping, pump, and other appurtenances.

The secondarily contained tank system consists of a 280-gallon tank, which has 275 gallons of usable capacity, within a 394-gallon secondary containment reservoir, see Figure 1. The tank is constructed of 0.25-inch high-density polyethylene (HDPE). A rectangular grid box made of galvanized tubular steel frame surrounds the tank.

Figure 1: B493 tank system

The tank is placed on a tank support made of 0.25-inch thick polyethylene measuring approximately 49 inches by 49 inches and 2 feet deep. The tank support is hollow and holes have been provided on the sidewalls so that it can be filled with liquid in case of a spill.

A pan made of 0.25-inch thick polyethylene provides secondary containment for the tank, see Figure 1. The secondary containment measures 62.75 inches by 62.75 inches on top, 57.25 inches by 57.25 inches at the bottom and 26 inches deep.

The tank receives wastewater from two sinks used in plating operations and two utility sinks in room 1234. The use of the utility sinks is under direct control of the operator and access to the area is controlled. The tank is gravity fed through 2-inch schedule 40 PVC from the plating line rinse sinks and 3-inch schedule 40 PVC from the utility sinks. The tank is equipped with a pump to transfer the wastewater through 1-inch schedule 80 PVC pipe.

The liquid level in the tank can be monitored through a digital display that is located on the ground level, see Figure 2. The capacity of the tank can never be exceeded since the water used in the process and utility sinks is fed through a closed loop system from the distillation system outside the building. The total capacity of the closed loop system is 250 gallons.

Figure 2: Wastewater volume digital display

The inlet and outlet pipes run in trenches in the floor, see Figure 3, to the pit, which measures approximately 25 ft by 25 ft and 12 ft deep and provides secondary containment for the pipes.

Figure 3: Piping system trench to the pit

3. General Use of the Tank System

The B943 tank system is used to collect wastewater before transferring to a storage tank located outside the building. Depending on the operations, the wastewater exhibits the characteristics of corrosivity and toxicity.

4. Design Standards

The B943 tank, manufactured by Schutz, consists of an outer cage and an inner container, see **appendix A**. The outer cage is a grid box made from tubular galvanized steel material. The inner container is made of 0.25-inch thick high-density polyethylene.

The secondary containment is manufactured by Eagle and is made of 0.25-inch thick polyethylene, See **appendix B**.

Table 1 lists the specifications of the tank and the secondary containment.

TABLE 1. Primary and Secondary Containment Specifications

Description	Specification
Tank Dimensions	48 inches L x 40 inches W x 46 inches H
Secondary Containment Dimensions	62.25 inches by 62.25 inches on top, 57.25 inches by 57.25 inches at the bottom and 26 inches H
Tank Maximum Capacity Operating Capacity	 280 gallons 250 gallons
Secondary Containment Maximum Capacity	 394 gallons
Material of Construction for the tank Outer Container Inner Container	 Galvanized Steel High Density Polyethylene
Material of Construction for the secondary containment	Polyethylene
Design Pressure Operating Pressure	Atmospheric Atmospheric

4.1 Seismic and Wind Restraints

The tank system has been provided with Zone 4 seismic restraints to prevent permanent displacement in any direction by lateral motion, overturning, or uplift equal to or greater than those recommended for a low-hazard facility, see Figures 4 and 5. The tank has also been designed and installed in accordance with DOE standard DOE-STD-1020-94, Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities.

Figure 4: Tank seismic restraints

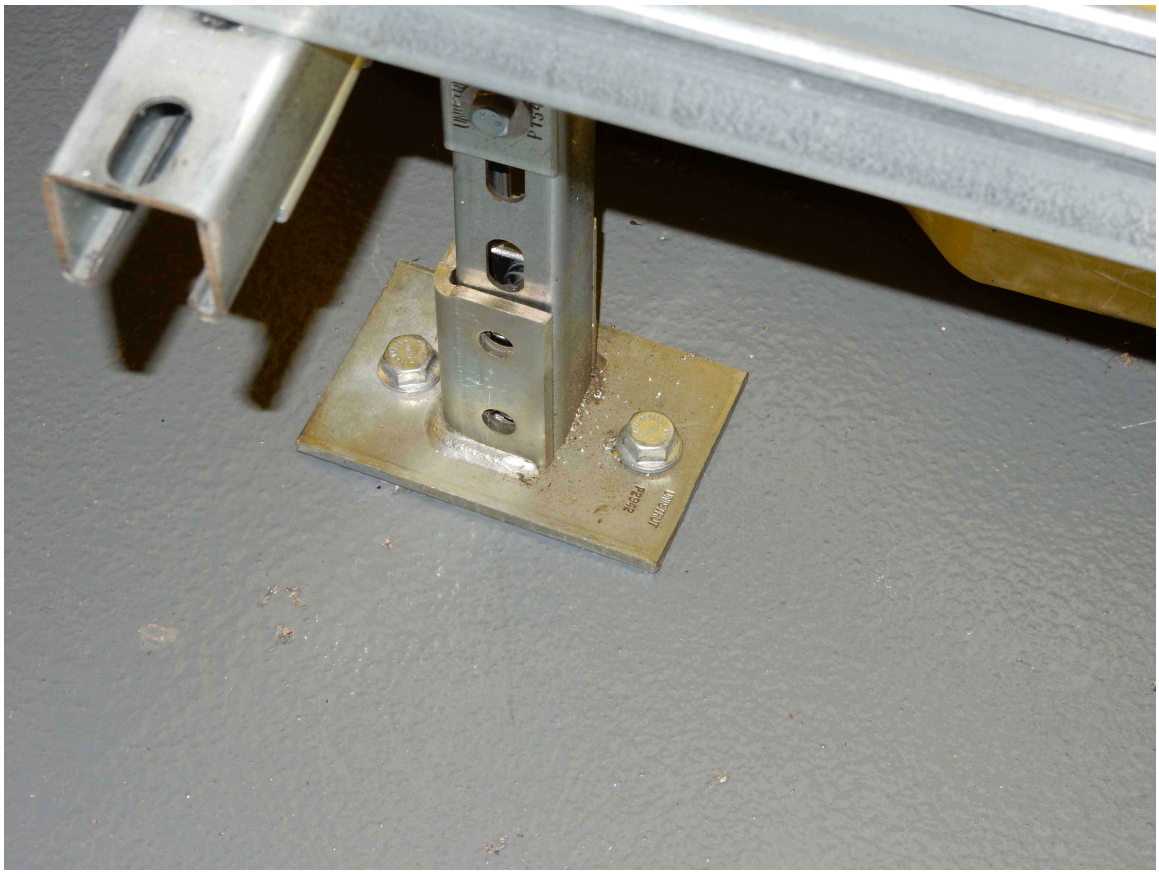


Figure 5: View of the mounting feet

Appendix B contains seismic analyses information and the seismic calculations. The analyses and calculations were performed and certified by SEMCO Consultants Inc.

4.2 Piping

The wastewater flows by gravity from two rinsing operations sinks and two utility sinks to the tank, from there it is pumped up to an elevation of approximately 12 feet, where it flows to the storage tank.

The tank is fed through 2-inch Schedule 40 PVC from the plating line rinse sinks and 3-inch schedule 40 PVC from the utility sinks. The wastewater is pumped through 1-inch schedule 80 PVC pipe to the storage located outside the building. Pipe clamps support the piping throughout, see figure 6.

Figure 6: Tank inlet piping

The piping system is designed so that any leak in the primary piping system that is secondarily contained will be captured in the epoxy-coated pit.

4.3 Pump

A manually operated variable speed pump, maximum capacity of 150 gallons/hour, is used to transfer the accumulated liquids to the storage tank outside. There is also a submersible pump in the pit that will be used to transfer any spills into the pit to the storage tank outside, see Figure 7.

Figure 7: Wastewater transfer pumps

4.4 Valves and Fittings

Two PVC ball valves are used to isolate the transfer pump and another is used to isolate the submersible pump. The gaskets and O-rings used in the system are Viton.

5. Hazardous Characteristics of Wastewater

Wastewater is generated as a result of parts cleaning operations in the plating shop. Sample analysis of the wastewater conducted in May 2013, see **Appendix C**, indicates pH of 2.04 and the heavy metals indicated in Table 2.

TABLE 2. Wastewater Characteristics

Contaminant	Concentration (Ug/L)
Copper	20
Lead	3.6
Nickel	1.7
Zinc	11

Depending on the operations, the waste could exhibit characteristic of toxicity as well as corrosivity.

Based upon the characteristics of the wastewater described above and the composition of the tank system materials, the wetted materials in the tank system are compatible with the waste stream.

6. Corrosion Protection Measures

Components of the tank system that come in contact with the waste stream are fabricated of corrosion-resistant materials, or are sufficiently protected from corrosion. The tank, pumps, piping, and ancillary equipment are made of materials that are resistant to chemical attack in this application. The estimated annual corrosion rate is negligible for the materials used in the tank system.

The tank is constructed of HDPV, which is compatible and chemically resistant to the waste stream.

The wastewater piping system associated with the tank system is made of PVC schedule 80, which is compatible and chemically resistant to the waste stream.

The valves used in the tank system are constructed of PVC; the gaskets and seals are made of Viton. These materials are compatible with and chemically resistant to the waste stream.

The components of the transfer pump that come in contact with the waste stream are constructed of PVDF or polypropylene, which is compatible with the waste stream.

7. Secondary Containment

A pan measuring 62.25 inches by 62.25 inches on top, 57.25 inches by 57.25 inches at the bottom and 26 inches high, provides secondary containment for the tank.

The following are the secondary containment calculations.

Volume of pan:

60 in (average) x 60 in (average) x 26 in = 93,600 cubic in = 54.2 cubic ft.

Displacement volume of tank stand walls:

52 in x 24 in x .25 in x 4 sides = 1,248 cubic in = 0.72 cubic ft.

Displacement volume of tank stand top:

52 in x 52 in x 0.25 in = 676 cubic in = 0.39 cubic ft.

Total displacement:

0.72 + 0.39 = 1.11 cubic ft.

Assume 1.5 cubic feet of total displacement for ribs on the secondary containment pan and the tank stand.

Total secondary containment capacity:

54.2 cubic ft. – 1.5 cubic ft. = 52.7 cubic ft.

52.7 cu ft. x 7.48 gal/cu feet = 394.20 Gallon

Considering maximum operating capacity of the tank is 250 gallon, and no capacity is required to contain a 24-hour, 25-year storm since the tank is located inside the building, the secondary containment capacity is more than adequate.

A pit measuring approximately 25 ft by 25 ft by 12 ft high provides secondary containment for the pipes, pump and other ancillary equipment.

According to the manufacturer's information the secondary containment pan, tank stand and the epoxy coating used on the pit floor and walls are chemically resistant to the waste stream.

8. Age of Tank System

All components of tank system are new. The tank system will be placed in service in January 2015.

9. Leak Test and Integrity Examination Results

A Professional Engineer inspected the tank system on November 19, 2014. No breaks, punctures, cracks or corrosion were found. No sign of degradation that could contribute to loss of integrity of the tank system was found.

The tank and the secondary containment were leak tested in November 2014 by SNL. The leak test procedures were in accordance with a process submitted to Alameda County in May 2011. Alameda County was the Certified Unified Program Agency at the time.

The test consisted of filling the tank and the secondary containment pan with clean water to 250-gallon capacity, the maximum capacity for the closed loop system. A ruler was taped to the side of the tank and the tank stand, for the secondary containment, to indicate the water level. The water level was checked after 24 hours. No change in water level was observed, see Figures 8 through 11. No leaks were detected. A representative of the Professional Engineer witnessed the starting water levels and levels after 24 hours.

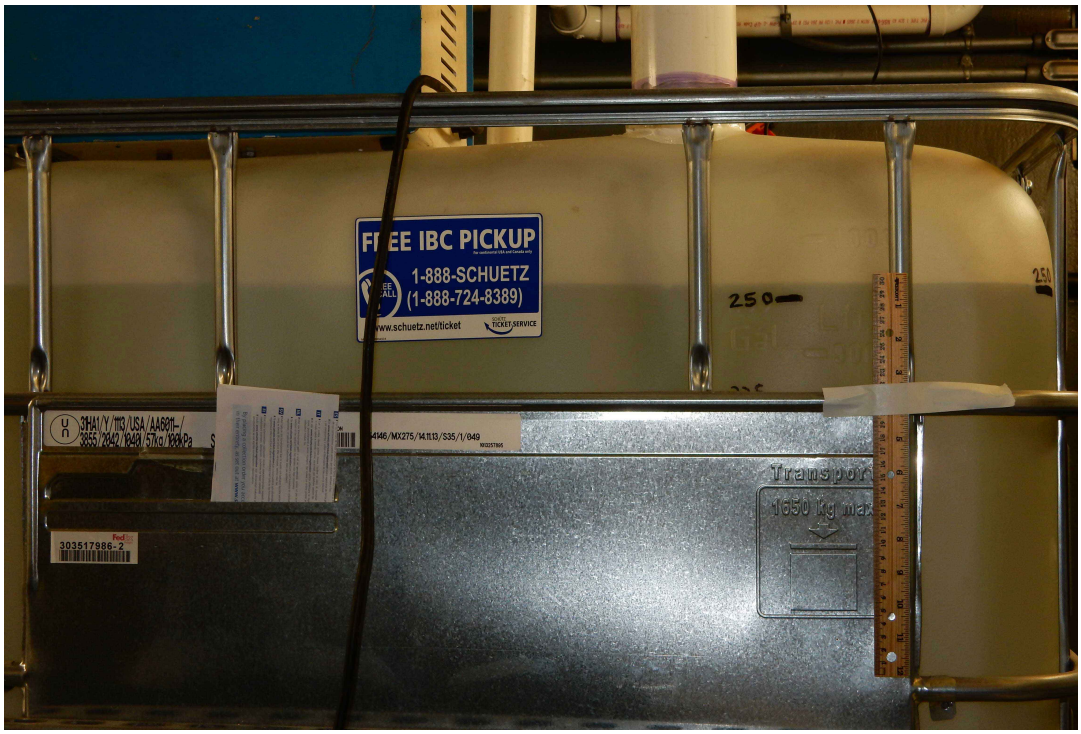


Figure 8: Tank water level on November 24

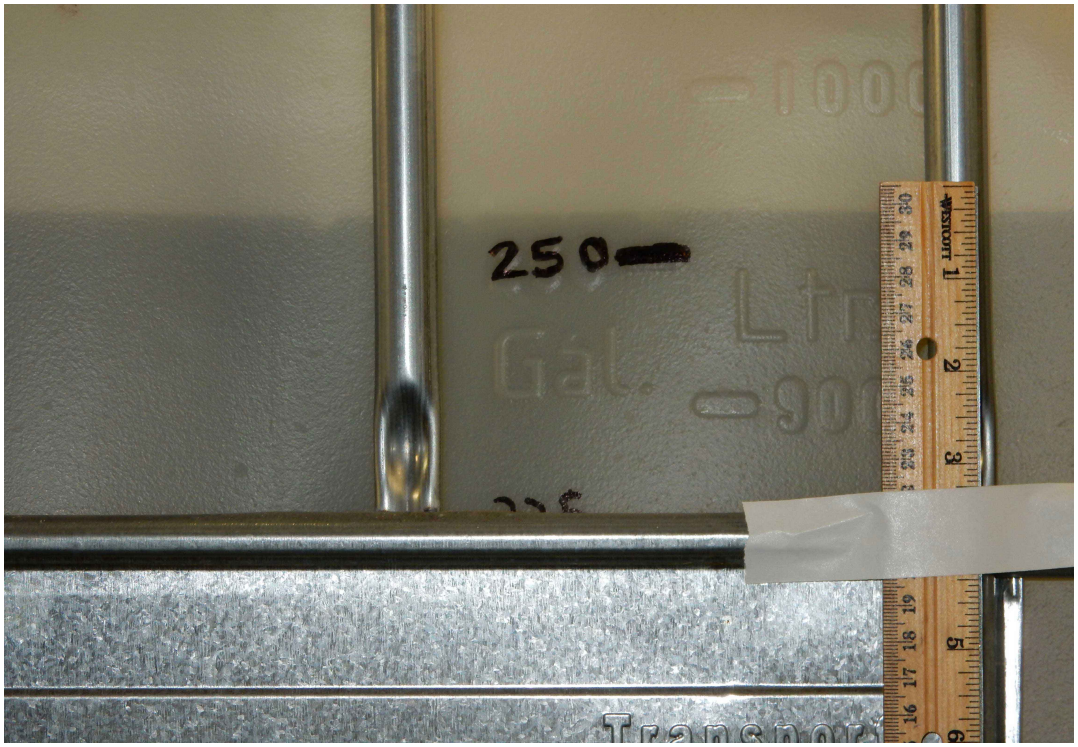


Figure 9: Tank water level after 24 hours on November 25

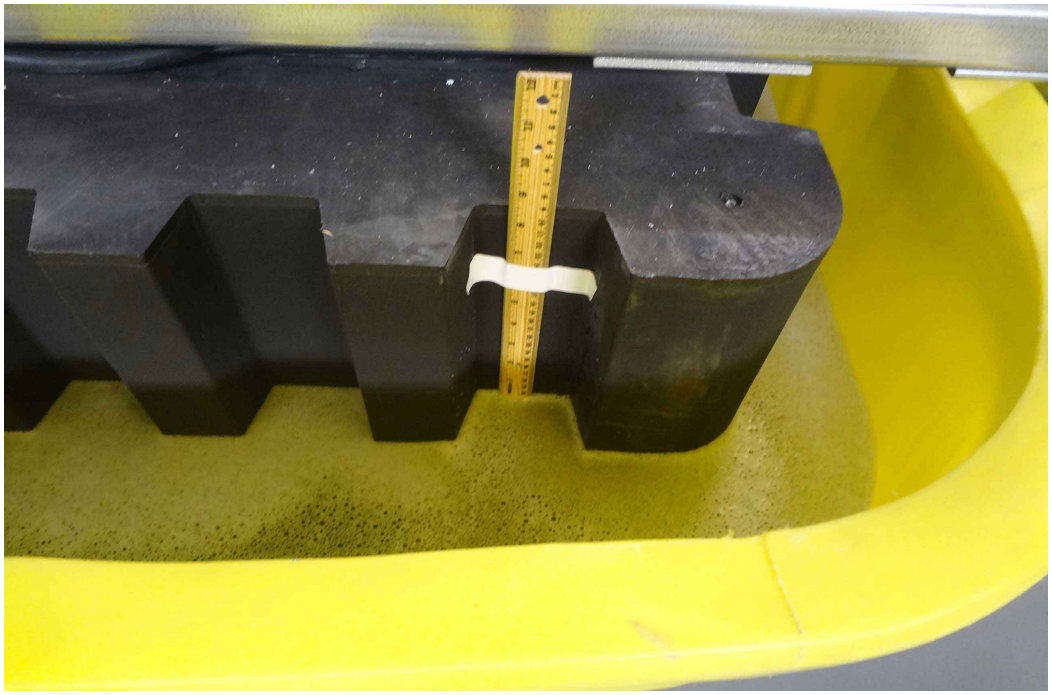


Figure 10: Secondary containment water level on November 25

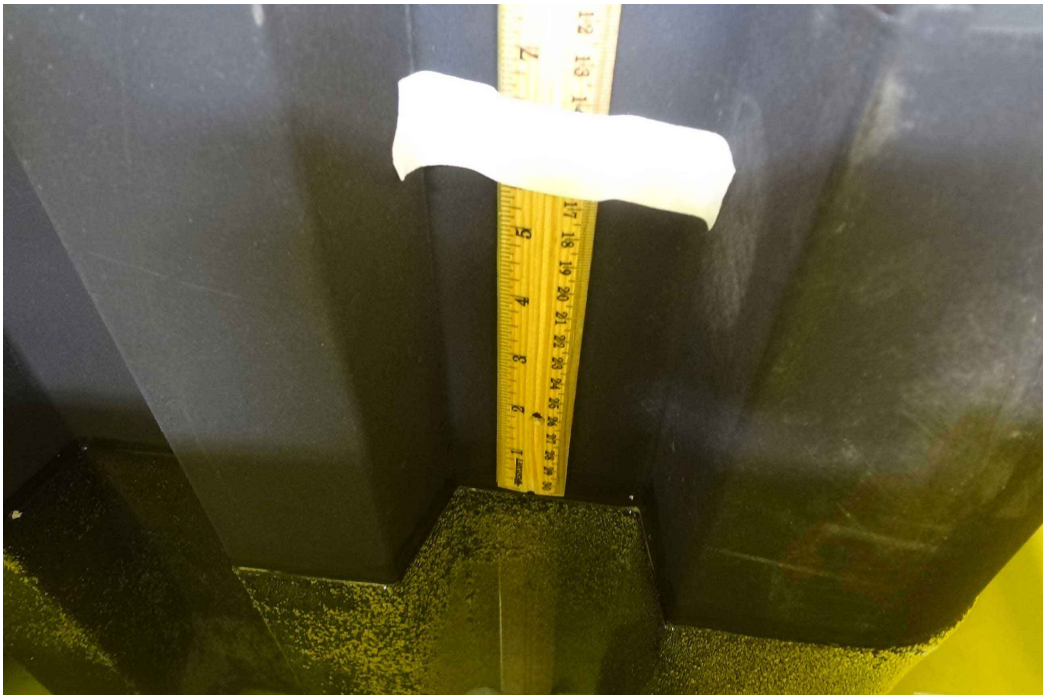
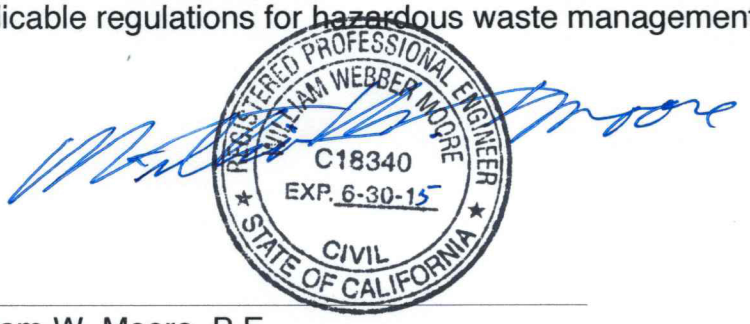


Figure 11: Secondary containment water level after 24 hours on November 26

10. Technical Certification of the B943 Tank System

As required by 40 CFR 265.192(a) and 22 CCR 66265.192(a), B943 tank system, has been found to have sufficient structural integrity and is acceptable for the transferring of hazardous waste as explained in Section 5 of this report. The tank and containment system are adequately designed to achieve the requirements of the applicable regulations. This certification is valid for five years only as long as the tank system is operated and maintained in accordance with applicable regulations for hazardous waste management tank systems.



William W. Moore, P.E.
California Civil Engineer, No. 18,340
Abri Environmental Engineering, Inc.

Jan. 14, 2015
Date

11. Certification of the B943 Tank System

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 be 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.

Laura Tidwell

1/22/15

Laura Tidwell, Manager
Environmental Management Department
Sandia National Laboratory

Date

12. References

1. *Code of Federal Regulations*, Title 40, Part 265 Subpart J, 265.190 through 265.196.

2. *California Code of Regulations*, Title 22, Sections 66265.190 through 66265.196.

3. DOE-STD-1020-94, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities.* Department Of Energy.

Appendix A

B943 Tank, Secondary Containment Pan and Tank Support Specifications

Packaging - Specification

container for transport

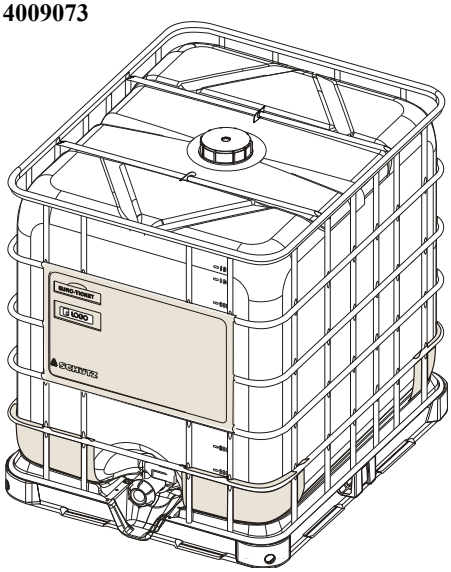
SCHÜTZ

MX 275 UN / nat / 6" Natural, TP gasket
Butterfly valve, EPDM gasket, 2" male NPS, 3pc , steel frame pallet
2 plates, ticket

SCHÜTZ
200 Aspen Hill Road
North Branch, NJ 08876

Date: July 14, 2014

Material number MX 4009073



Technical data:

Rated volume:	275	gal
Overflow volume:	280	gal
Length:	48	in
Width:	40	in
Height with pallet:	46	in
Filling opening:	6	in
Discharge opening:	2	in
Fork opening - height	3.5	in
Label plate:	2	piece
Corner Protector:	4	piece
Weight: approx	128	lbs

Nominal Specifications

Tank Specifications

Packaging - Specification

container for transport

SCHÜTZ

MX 275 UN / nat / 6" Natural, TP gasket
Butterfly valve, EPDM gasket, 2" male NPS, 3pc , steel frame pallet
2 plates, ticket

SCHÜTZ
200 Aspen Hill Road
North Branch, NJ 08876

Date: July 14, 2014

Material number MX 4009073

Construction:

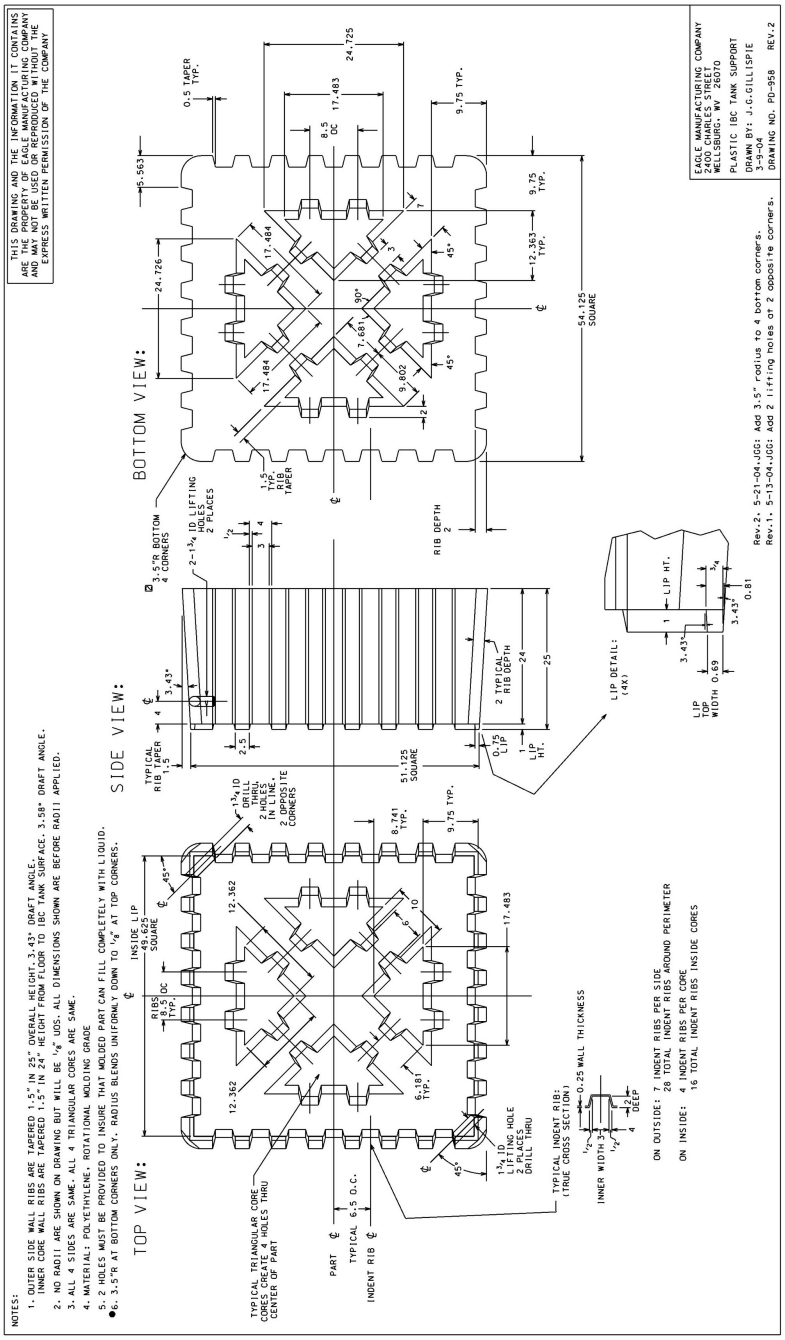
Outer Container:	Rectangular grid box made from tubular steel material, with bottom plate, closed with tie-bar, label plate with Schütz-Ticket on front side, additional label plate on the back side.	
Material:	Grid / Bottom Plate:	Steel, galvanized against corrosion
	Corner Protector:	4 pieces made of HDPE, black
Inner Container:	Rectangular blow molded tank of high density polyethylene (HDPE), with filling opening (6") in the middle of the top section. Valve opening in front section.	
Material:	High Density Polyethylene - natural	
Filling Opening:	Filling opening 6" with external thread, closed with natural screw cap.	
Material:	Screw cap 6":	HDPE, natural
	O-ring gasket:	TPE
	G2-plug:	NA
	O-ring 2"-plug:	NA
	Tamper seal cap	NA
Discharge Opening:	Butterfly valve, EPDM gaskets, 2" male NPS outlet, 3 pc dust cap.	
Material:	Housing butterfly valve:	HDPE
	Disk inside valve:	Polypropylene
	Flat gasket::	EPDM
	Disk gasket::	ETFE (generic Teflon)
	Screw cap :	HDPE
Pallet:	**Steel frame pallet** (1000 x 1200 mm), 4-way entry	
Material:	Galvanized steel tube	
Colorant:	Heavy-metal free	
Delivery:	Ready for filling, clean	
UN-Marking:	UN 31 HA1 / Y / USA / SCHUTZ	

Customer Acceptance Signature: _____ Date: _____

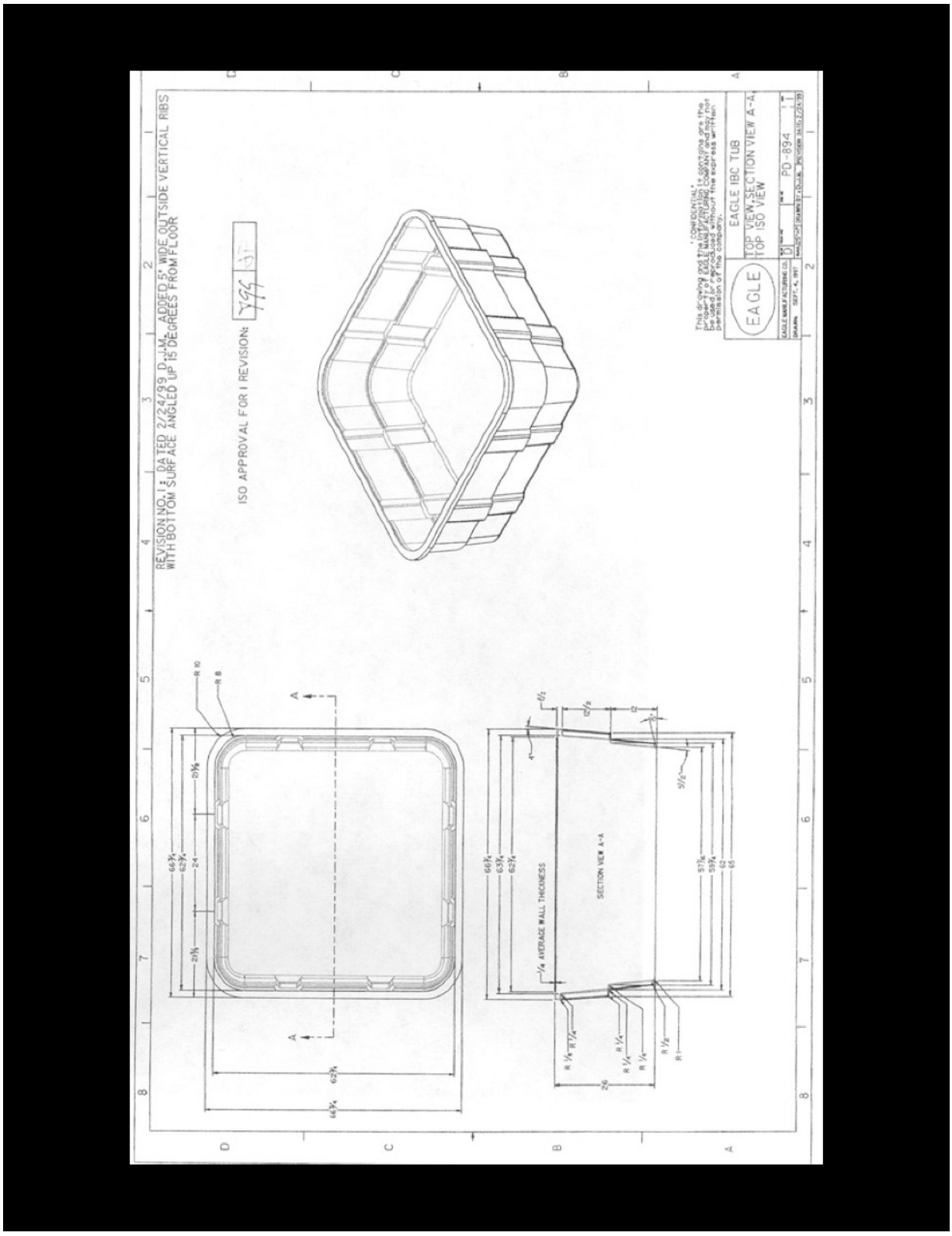
Company name:_____

Nominal Specifications

Tank Specifications



Tank Stand Specifications



Secondary Containment Pan Specifications

Appendix B

Seismic Analysis

(180250
2.3)

SEMCO Consultants Inc.
37762 Los Arboles Dr.
Fremont, CA

CALCULATION NO.:
REVISION NO.:

STRUCTURAL CALCULATIONS REPORT
FOR
C943 Lab Equipment

REVIEWED
CITY OF LIVERMORE
BUILDING DIVISION
AUG 15 2014
BY: STEVEN PIERSON

CLIENT NAME: Sandia
CLIENT ADDRESS: 7011 East Ave.
Livermore, Ca.

SAN140043
PROJECT NO.
PLANCHECK BUILD

PREPARED BY: Richard A. Strand, P.E.

DATE: 8/4/14

REFERENCES

1. 2013 CALIFORNIA BUILDING CODE
2. 2005 TIMBER CONSTRUCTION MANUAL
3. SIMPSON STRONG-TIE CATALOG #C-2013/2014
4. BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE (ACI-318-11)
5. SOILS REPORT:

Seismic Parameters
LAT: 37.6798
LONG: -121.71
S_{DS}: 1.13
S_{D1}: .62

APPROVED BY

JOB COPY
PROJECT NUMBER SAN140043

Packaging - Specification

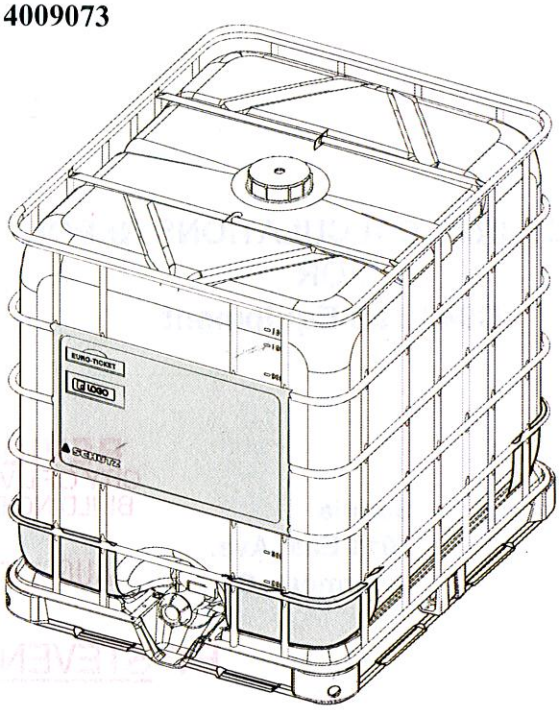
container for transport

SCHÜTZ

MX 275 UN / nat / 6" Natural, TP gasket
Butterfly valve, EPDM gasket, 2" male NPS, 3pc , steel frame pallet
2 plates, ticket

SCHÜTZ
200 Aspen Hill Road
North Branch, NJ 08876

Material number **MX 4009073**



Technical data:

Rated volume:	275	gal
Overflow volume:	280	gal
Length:	48	in
Width:	40	in
Height with pallet:	46	in
Filling opening:	6	in
Discharge opening:	2	in
Fork opening - height	3.5	in
Label plate:	2	piece
Corner Protector:	4	piece
Weight: approx	128	lbs

Nominal Specifications

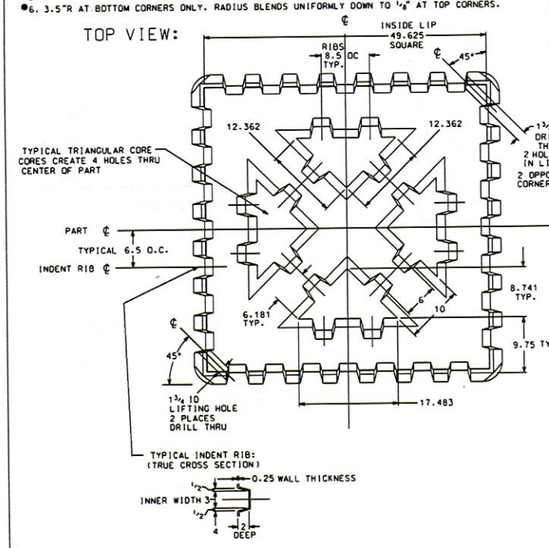
JOB COPY
PROJECT NUMBER

THIS DRAWING AND THE INFORMATION IT CONTAINS ARE THE PROPERTY OF EAGLE MANUFACTURING COMPANY AND MAY NOT BE USED OR REPRODUCED WITHOUT THE EXPRESS WRITTEN PERMISSION OF THE COMPANY

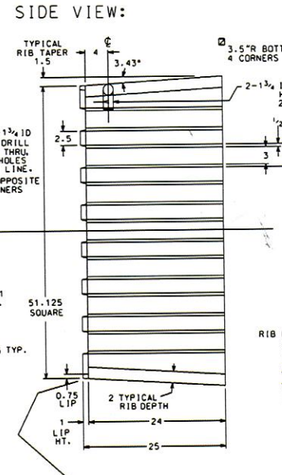
NOTES:

1. OUTER SIDE WALL RIBS ARE TAPERED 1.5" IN 25" OVERALL HEIGHT. 3.43° DRAFT ANGLE.
   INNER CORE WALL RIBS ARE TAPERED 1.5" IN 24" HEIGHT FROM FLOOR TO IBC TANK SURFACE. 3.58° DRAFT ANGLE.
2. NO RADII ARE SHOWN ON DRAWING BUT WILL BE 1/8" UOS. ALL DIMENSIONS SHOWN ARE BEFORE RADII APPLIED.
3. ALL 4 SIDES ARE SAME. ALL 4 TRIANGULAR CORES ARE SAME.
4. MATERIAL: POLYETHYLENE. ROTATIONAL MOLDING GRADE
5. 2 HOLES MUST BE PROVIDED TO INSURE THAT MOLDED PART CAN FILL COMPLETELY WITH LIQUID.
6. 3.5"R AT BOTTOM CORNERS ONLY. RADIUS BLENDS UNIFORMLY DOWN TO 1/8" AT TOP CORNERS.

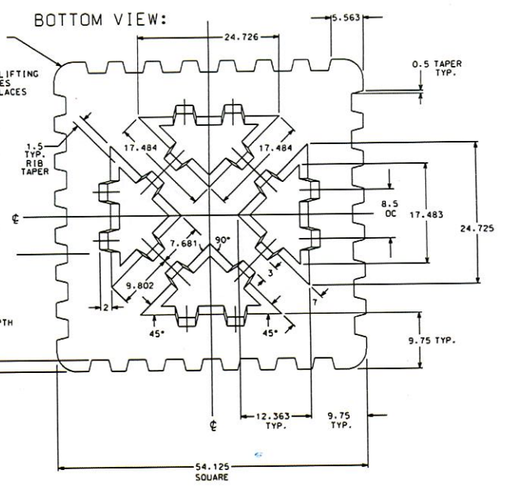
TOP VIEW:



SIDE VIEW:



BOTTOM VIEW:

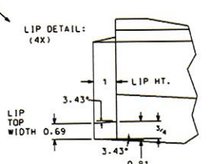


TYPICAL INDENT RIB:
(TRUE CROSS SECTION)

ON OUTSIDE: 7 INDENT RIBS PER SIDE
28 TOTAL INDENT RIBS AROUND PERIMETER

ON INSIDE: 4 INDENT RIBS PER CORE
16 TOTAL INDENT RIBS INSIDE CORES

LIP DETAIL:
(4X)

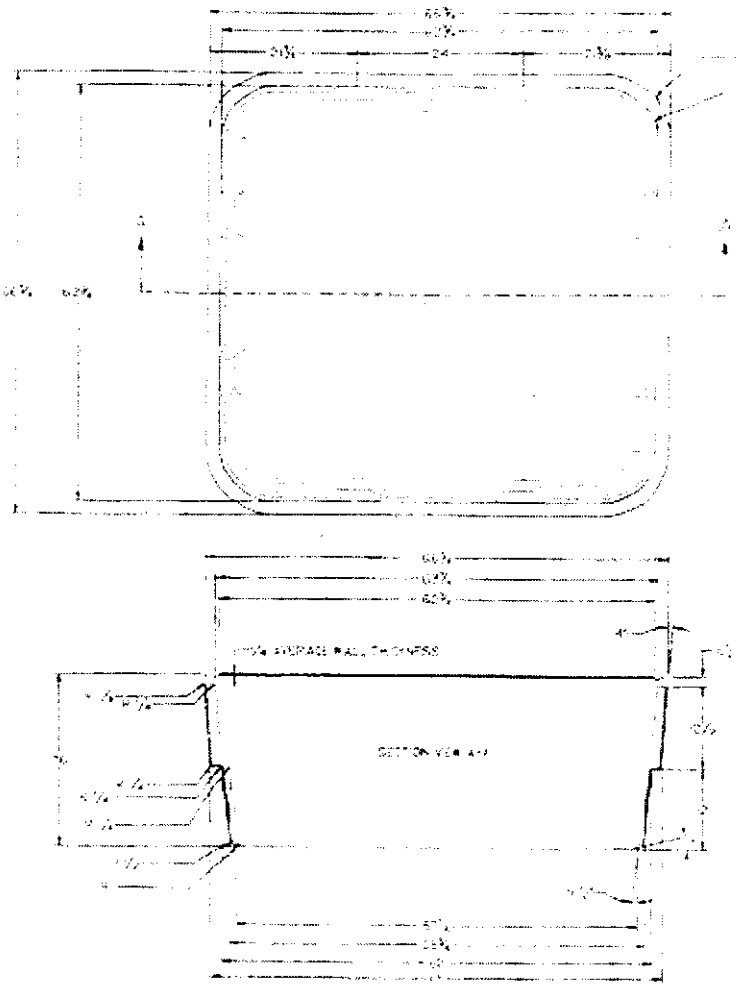


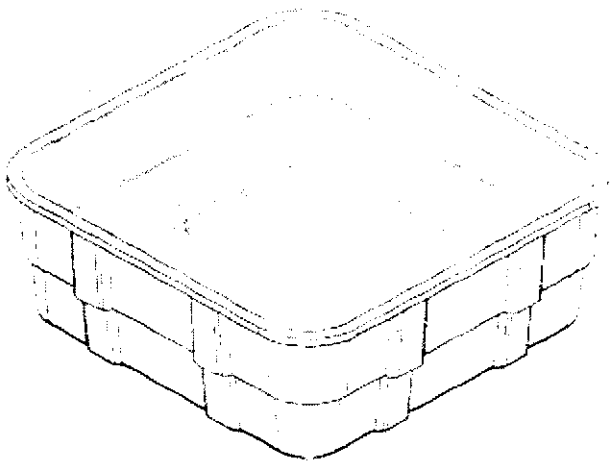
Rev.2. 5-21-04.JGG: Add 3.5" radius to 4 bottom corners.
Rev.1. 5-13-04.JGG: Add 2 lifting holes at 2 opposite corners.

EAGLE MANUFACTURING COMPANY
2400 CHARLES STREET
WELLSBURG, WV 26070

PLASTIC IBC TANK SUPPORT

DRAWN BY: J.G.GILLISPIE
3-9-04
DRAWING NO. PD-958 REV.2





PROJECT	B943 Lab Renovation	By :	R. Strand
PRODUCT	Storage Tank	Date :	8/5/2014
CLIENT		Job #:	
DESIGN DATA		S.O. #:	

EQUIPMENT SPEC:

A36 Mild Steel : f'_y = 36,000 psi

Weight: 2422.0 lbs — Tank & Fluid
Height: 6.00 ft
Width: 3.33 ft
Length: 4.00 ft

Seismic Design Information:

Lat:	37.679795
Long:	-121.71077
Site Class:	"D"
Fa =	1.50
Fv =	1.00
S_{DS}=	1.13
S_{D1} =	0.62
+/- .2$S_{DS}W_p$=	545.0 lbs

Seismic Base Shear

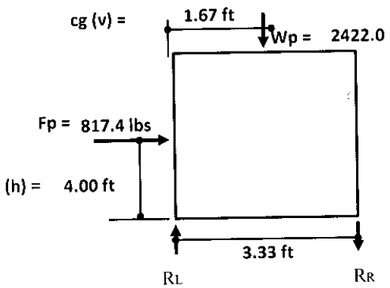
ap = 1.00 — z = 0.00 ft
Ip = 1.00 — h = 25.00 ft
Rp = 2.50 — cg (v) = 1.67 ft
cg (h) = 4.00 ft

Min. Fp = .30*S_{DS} Wp Ip = 0.34 Wp — **Governs**

Max. Fp = 1.6*S_{DS} Wp Ip = 1.80 Wp

Fp = .40*apS_{DS} Wp Ip(1+2(z/h)/Rp = 0.18 Wp

Fp = 817.4 lbs



Check Overturning

R_R Values
- Fp right to left
  - Uplift:-Fp* cg(h)+(W+.2S_{DS})*cg(v)/width = 506.0 lbs — No Uplift
  - Uplift: -Fp* cg(h)+(W-.2S_{DS})*cg(v)/width = -40.5 lbs — Uplift
- Fp left to right
  - Uplift:Fp* cg(h)+(W+.2S_{DS})*cg(v)/width = 2469.8 lbs — No Uplift
  - Uplift: Fp* cg(h)+(W-.2S_{DS})*cg(v)/width = 1923.2 lbs — No Uplift

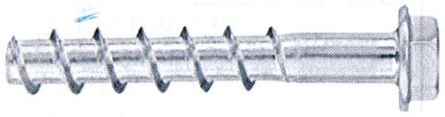
R_L Values
- Fp right to left
  - Uplift: -Fp* cg(h)+(W+.2S_{DS})*(width-cg(v))/width = 497.1 lbs — No Uplift
  - Uplift:-Fp* cg(h)+(W-.2S_{DS})*(width-cg(v))/width = -46.2 lbs — Uplift
- Fp left to right
  - Uplift:Fp* cg(h)+(W+.2S_{DS})*(width-cg(v))/width = 2460.9 lbs — No Uplift
  - Uplift:Fp* cg(h)+(W-.2S_{DS})*(width-cg(v))/width = 1917.6 lbs — No Uplift

Equipment anchroage load		Ωo	Factor Load
V_{bolt}=	204.4 lbs (4 Bolts)	2.5	510.9 lbs
Ubolt=	-23.1 lbs (2 Bolts)	2.5	-57.7 lbs

Company:		Page:	1
Specifier:		Project:	Sandia
Address:		Sub-Project I Pos. No.:	943 Lab Tank
Phone I Fax:	|	Date:	7/26/2014
E-Mail:			

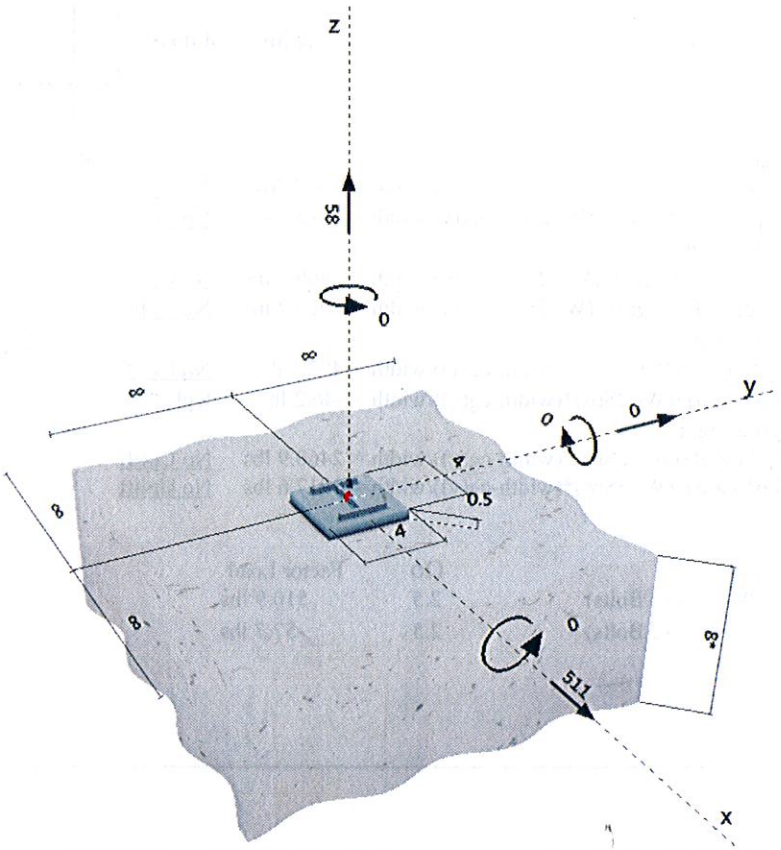
Specifier's comments:

1 Input data



Anchor type and diameter:	**KWIK HUS-EZ (KH-EZ) 3/8 (2 1/2)**
Effective embedment depth:	$h_{ef,act}$ = 1.860 in., h_{nom} = 2.500 in.
Material:	Carbon Steel
Evaluation Service Report:	ESR-3027
Issued I Valid:	3/1/2014 | 12/1/2015
Proof:	design method ACI 318-11 / Mech.
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.500 in.
Anchor plate:	l_x x l_y x t = 4.000 in. x 4.000 in. x 0.500 in.; (Recommended plate thickness: not calculated)
Profile:	S shape (AISC); (L x W x T x FT) = 3.000 in. x 2.330 in. x 0.170 in. x 0.260 in.
Base material:	cracked concrete, 3000, f_c' = 3000 psi; h = 8.000 in.
Installation:	hammer drilled hole, installation condition: dry
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	Tension load: yes (D.3.3.4.3 (d)) Shear load: yes (D.3.3.5.3 (c))

Geometry [in.] & Loading [lb, in.lb]



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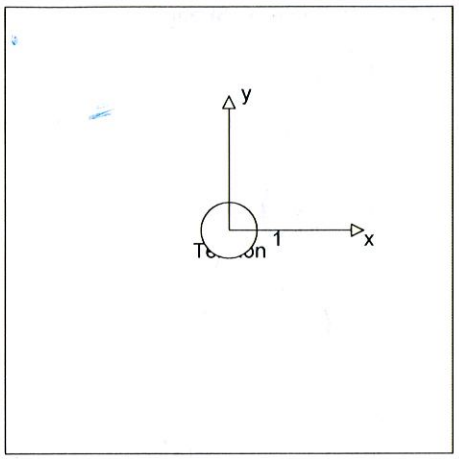
Specifier:
Address:
Phone I Fax: |
E-Mail:

Page: 2
Project: Sandia
Sub-Project I Pos. No.: 943 Lab Tank
Date: 7/26/2014

2 Load case/Resulting anchor forces

Load case: Design loads



Anchor reactions [lb]
Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	58	511	511	0

max. concrete compressive strain: - [‰]
max. concrete compressive stress: - [psi]
resulting tension force in (x/y)=(0.000/0.000): 58 [lb]
resulting compression force in (x/y)=(0.000/0.000): 0 [lb]

3 Tension load

	Load N_{ua} [lb]	Capacity ϕN_n [lb]	Utilization $\beta_N = N_{ua}/\phi N_n$	Status
Steel Strength*	58	6718	1	OK
Pullout Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Strength**	58	1151	6	OK

* anchor having the highest loading **anchor group (anchors in tension)

3.1 Steel Strength

N_{sa} = ESR value refer to ICC-ES ESR-3027
$\phi N_{steel} \geq N_{ua}$ ACI 318-11 Table D.4.1.1

Variables

n	$A_{se,N}$ [in.^{2}]	f_{uta} [psi]
1	0.09	120300

Calculations

N_{sa} [lb]
10335

Results

N_{sa} [lb]	ϕ_{steel}	$\phi_{nonductile}$	ϕN_{sa} [lb]	N_{ua} [lb]
10335	0.650	1.000	6718	58

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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3.2 Concrete Breakout Strength

$N_{cb} = \left(\frac{A_{Nc}}{A_{Nc0}}\right) \psi_{ed,N}\, \psi_{c,N}\, \psi_{cp,N}\, N_b$ ACI 318-11 Eq. (D-3)

$\phi\, N_{cb} \geq N_{ua}$ ACI 318-11 Table D.4.1.1

A_{Nc} see ACI 318-11, Part D.5.2.1, Fig. RD.5.2.1(b)

$A_{Nc0} = 9\, h_{ef}^2$ ACI 318-11 Eq. (D-5)

$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2\, e'_N}{3\, h_{ef}}}\right) \leq 1.0$ ACI 318-11 Eq. (D-8)

$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}}\right) \leq 1.0$ ACI 318-11 Eq. (D-10)

$\psi_{cp,N} = \text{MAX}\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}}\right) \leq 1.0$ ACI 318-11 Eq. (D-12)

$N_b = k_c\, \lambda_a \sqrt{f'_c}\, h_{ef}^{1.5}$ ACI 318-11 Eq. (D-6)

Variables

h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]	$\psi_{c,N}$
1.860	0.000	0.000	∞	1.000

c_{ac} [in.]	k_c	λ_a	f'_c [psi]
2.920	17	1.000	3000

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
31.14	31.14	1.000	1.000	1.000	1.000	2362

Results

N_{cb} [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	$\phi\, N_{cb}$ [lb]	N_{ua} [lb]
2362	0.650	0.750	1.000	1151	58

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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E-Mail:

Page: 4
Project: Sandia
Sub-Project I Pos. No.: 943 Lab Tank
Date: 7/26/2014

4 Shear load

	Load V_{ua} [lb]	Capacity ϕV_n [lb]	Utilization $\beta_V = V_{ua}/\phi V_n$	Status
Steel Strength*	511	1867	28	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength**	511	1653	31	OK
Concrete edge failure in direction **	N/A	N/A	N/A	N/A

* anchor having the highest loading **anchor group (relevant anchors)

4.1 Steel Strength

$V_{sa,eq}$ = ESR value refer to ICC-ES ESR-3027
$\phi V_{steel} \geq V_{ua}$ ACI 318-11 Table D.4.1.1

Variables

n	$A_{se,V}$ [in.^{2}]	f_{uta} [psi]
1	0.09	120300

Calculations

$V_{sa,eq}$ [lb]
3111

Results

$V_{sa,eq}$ [lb]	ϕ_{steel}	$\phi_{nonductile}$	ϕV_{sa} [lb]	V_{ua} [lb]
3111	0.600	1.000	1867	511

4.2 Pryout Strength

$V_{cp} = k_{cp}\left[\left(\frac{A_{Nc}}{A_{Nc0}}\right)\psi_{ed,N}\,\psi_{c,N}\,\psi_{cp,N}\,N_b\right]$ ACI 318-11 Eq. (D-40)

$\phi V_{cp} \geq V_{ua}$ ACI 318-11 Table D.4.1.1

A_{Nc} see ACI 318-11, Part D.5.2.1, Fig. RD.5.2.1(b)

$A_{Nc0} = 9 h_{ef}^2$ ACI 318-11 Eq. (D-5)

$\psi_{ec,N} = \left(\frac{1}{1+\frac{2\,e_N}{3\,h_{ef}}}\right) \leq 1.0$ ACI 318-11 Eq. (D-8)

$\psi_{ed,N} = 0.7 + 0.3\left(\frac{c_{a,min}}{1.5h_{ef}}\right) \leq 1.0$ ACI 318-11 Eq. (D-10)

$\psi_{cp,N} = MAX\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5h_{ef}}{c_{ac}}\right) \leq 1.0$ ACI 318-11 Eq. (D-12)

$N_b = k_c\,\lambda_a\sqrt{f'_c}\,h_{ef}^{1.5}$ ACI 318-11 Eq. (D-6)

Variables

k_{cp}	h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]
1	1.860	0.000	0.000	∞

$\psi_{c,N}$	c_{ac} [in.]	k_c	λ_a	f'_c [psi]
1.000	2.920	17	1.000	3000

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
31.14	31.14	1.000	1.000	1.000	1.000	2362

Results

V_{cp} [lb]	$\phi_{concrete}$	$\phi_{seismic}$	$\phi_{nonductile}$	ϕV_{cp} [lb]	V_{ua} [lb]
2362	0.700	1.000	1.000	1653	511

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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Company:
Specifier:
Address:
Phone I Fax:
E-Mail:

5 Combined tension and shear loads

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.050	0.309	5/3	15	OK

$\beta_{NV} = \beta_N^{\zeta} + \beta_V^{\zeta} <= 1$

6 Warnings

- Load re-distributions on the anchors due to elastic deformations of the anchor plate are not considered. The anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the loading!
- Condition A applies when supplementary reinforcement is used. The Φ factor is increased for non-steel Design Strengths except Pullout Strength and Pryout strength. Condition B applies when supplementary reinforcement is not used and for Pullout Strength and Pryout Strength. Refer to your local standard.
- Refer to the manufacturer's product literature for cleaning and installation instructions.
- Checking the transfer of loads into the base material and the shear resistance are required in accordance with ACI 318 or the relevant standard!
- An anchor design approach for structures assigned to Seismic Design Category C, D, E or F is given in ACI 318-11 Appendix D, Part D.3.3.4.3 (a) that requires the governing design strength of an anchor or group of anchors be limited by ductile steel failure. If this is NOT the case, the connection design (tension) shall satisfy the provisions of Part D.3.3.4.3 (b), Part D.3.3.4.3 (c), or Part D.3.3.4.3 (d). The connection design (shear) shall satisfy the provisions of Part D.3.3.5.3 (a), Part D.3.3.5.3 (b), or Part D.3.3.5.3 (c).
- Part D.3.3.4.3 (b) / part D.3.3.5.3 (a) requires that the attachment the anchors are connecting to the structure be designed to undergo ductile yielding at a load level corresponding to anchor forces no greater than the controlling design strength. Part D.3.3.4.3 (c) / part D.3.3.5.3 (b) waives the ductility requirements and requires that the anchors shall be designed for the maximum tension / shear that can be transmitted to the anchors by a non-yielding attachment. Part D.3.3.4.3 (d) / part D.3.3.5.3 (c) waives the ductility requirements and requires the design strength of the anchors to equal or exceed the maximum tension / shear obtained from design load combinations that include E, with E increased by Ω_0.
- Hilti post-installed anchors shall be installed in accordance with the Hilti Manufacturer's Printed Installation Instructions (MPII). Reference ACI 318-11, Part D.9.1

Fastening meets the design criteria!

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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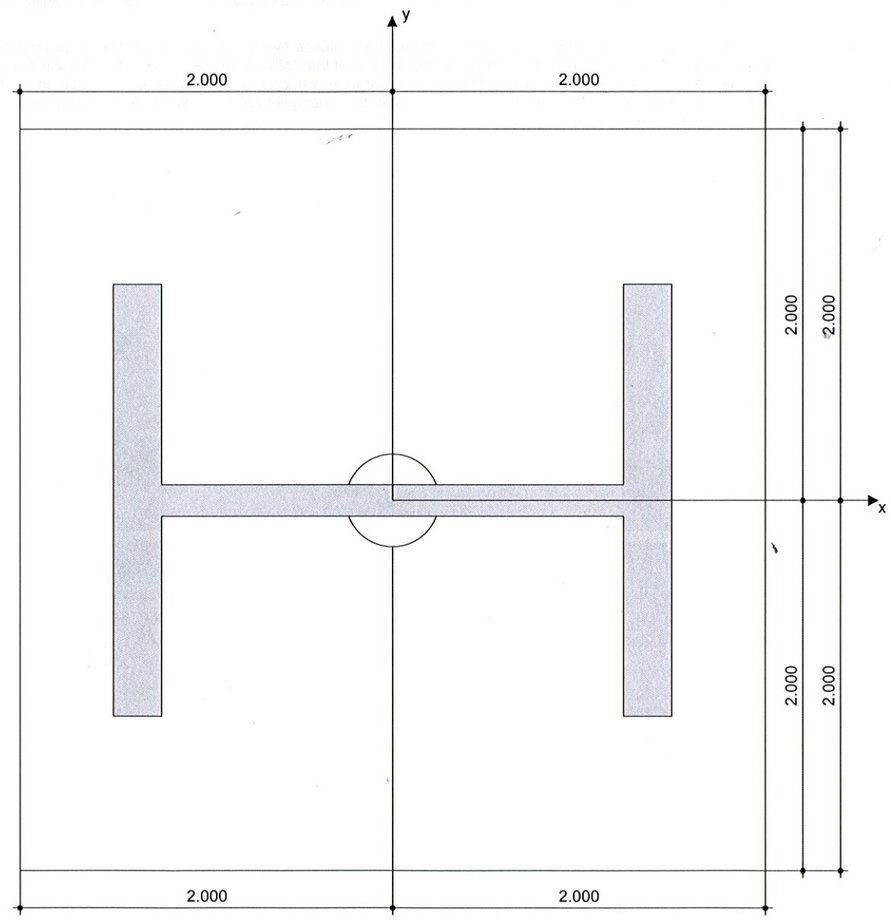
Company:
Specifier:
Address:
Phone I Fax:
E-Mail:

7 Installation data

Anchor plate, steel: -
Profile: S shape (AISC); 3.000 x 2.330 x 0.170 x 0.260 in.
Hole diameter in the fixture: d_f = 0.500 in.
Plate thickness (input): 0.500 in.
Recommended plate thickness: not calculated
Anchor type and diameter: KWIK HUS-EZ (KH-EZ) 3/8 (2 1/2)
Installation torque: 480.001 in.lb
Hole diameter in the base material: 0.375 in.
Hole depth in the base material: 2.750 in.
Minimum thickness of the base material: 4.000 in.
Cleaning: Manual cleaning of the drilled hole according to instructions for use is required.



Coordinates Anchor in.

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	0.000	0.000	-	-	-	-

Input data and results must be checked for agreement with the existing conditions and for plausibility!
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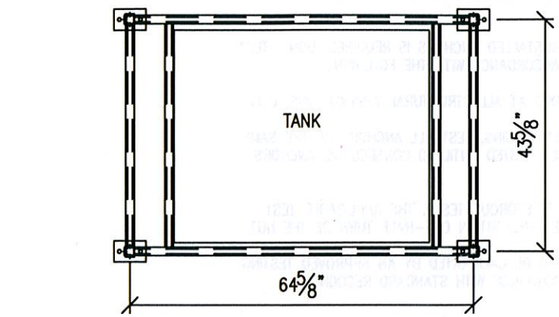
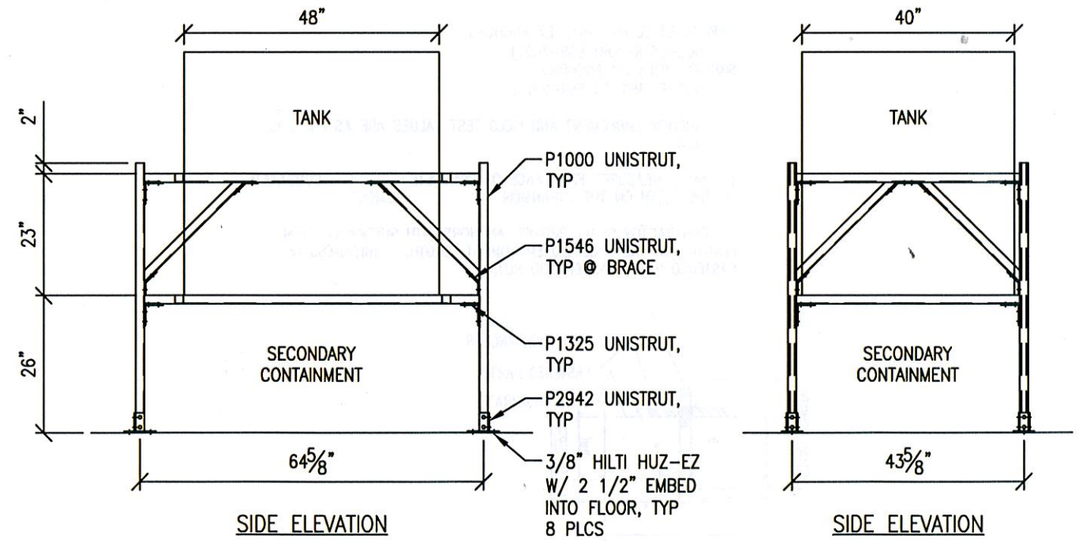


PLAN VIEW



SIDE ELEVATION

SIDE ELEVATION

A. POST-INSTALLED ANCHORS IN CONCRETE

1. POST-INSTALLED ANCHORS INCLUDE SCREW AND EXPANSION ANCHORS.
2. INSTALL POST-INSTALLED ANCHORS IN ACCORDANCE WITH THE APPLICABLE ICC-ES REPORT AND THE MANUFACTURER'S RECOMMENDATIONS.
3. USE CARE AND CAUTION TO AVOID CUTTING OR DAMAGING EXISTING REINFORCING BARS.
4. SPECIAL INSPECTION IS REQUIRED FOR ALL POST-INSTALLED ANCHOR INSTALLATIONS, UON.
5. FIELD TESTING OF POST-INSTALLED ANCHORS IS REQUIRED, UON. TEST INSTALLED ANCHORS IN ACCORDANCE WITH THE FOLLOWING:
   a. TEST 50% OF ANCHORS AT ALL STRUCTURAL APPLICATIONS, UON.
   b. IF ANY ANCHOR FAILS TESTING, TEST ALL ANCHORS OF THE SAME TYPE NOT PREVIOUSLY TESTED UNTIL 20 CONSECUTIVE ANCHORS PASS.
   c. FIELD TESTS SHALL BE ETORQUE TESTS. THE APPLICABLE TEST TORQUE MUST BE REACHED WITHIN ONE-HALF TURN OF THE NUT.
   d. TEST EQUIPMENT IS TO BE CALIBRATED BY AN APPROVED TESTING LABORATORY IN ACCORDANCE WITH STANDARD RECOGNIZED PROCEDURES.

B. SCREW ANCHORS

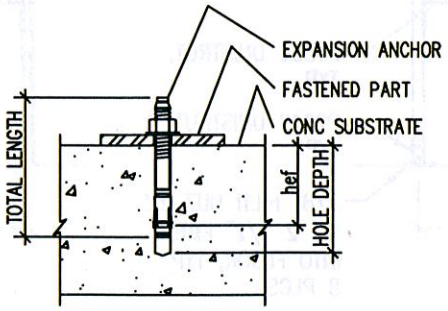
a. SCREW ANCHORS SHALL BE:

1. CARBON STEEL HILTI HUC-EZ ANCHORS (ICC-ES REPORT ESR-3027).
2. SIMPSON TITEN HD ANCHORS (ICC-ES REPORT ESR-2713)

b. ANCHOR EMBEDMENT AND FIELD TEST VALUES ARE AS FOLLOWS, UON:

c. hef IS MEASURED FROM FACE OF CONCRETE SUBSTRATE TO THE TEETH ON THE EXPANSION ELEMENT.

d. CONTRACTOR SHALL PROVIDE ANCHORS WITH SUFFICIENT TOTAL LENGTH FOR THE SPECIFIED EMBEDMENT LENGTH, THICKNESS OF FASTENED PART, WASHER AND NUT.



ANCHOR DIAMETER	hef	MINIMUM HOLE DEPTH	TORQUE TEST TEST VALUE (FT-LBS)
3/8"	2 1/2"	2 3/4"	25
1/2"	3"	3 1/4"	45

Appendix C

Wastewater Sample Analysis

McCampbell Analytical, Inc.
"When Quality Counts"

1534 Willow Pass Road, Pittsburg, CA 94565-1701
Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Analytical Report

Sandia National Laboratories	Client Project ID: 943 PBR Samples	Date Sampled: 05/30/13
		Date Received: 05/31/13
PO Box 969 MS9902 (Waste Mgmt. Prog.)	Client Contact: Laura Tidwell	Date Reported: 06/05/13
Livermore, CA 94551-0969	Client P.O.: #1045541	Date Completed: 06/05/13

WorkOrder: 1305966

June 06, 2013

Dear Laura:

Enclosed within are:

1) The results of the **3** analyzed samples from your project: **943 PBR Samples,**
2) QC data for the above samples, and
3) A copy of the chain of custody.

All analyses were completed satisfactorily and all QC samples were found to be within our control limits.

If you have any questions or concerns, please feel free to give me a call. Thank you for choosing McCampbell Analytical Laboratories for your analytical needs.

Best regards,

Angela Rydelius
Laboratory Manager
McCampbell Analytical, Inc.

The analytical results relate only to the items tested.

McCampbell Analytical, Inc.

1534 Willow Pass Rd. / Pittsburg, Ca. 94565-1701
www.mccampbell.com / main@mccampbell.com
Telephone: (877) 252-9262 / Fax: (925) 252-9269

130 59 66

CHAIN OF CUSTODY RECORD

TURN AROUND TIME: RUSH ☐ 24 HR ☐ 48 HR ☐ 72 HR ☐ 5 DAY ☐ 10 DAY ☒

GeoTracker EDF ☐ PDF ☐ EDD ☐ Write On (DW) ☐ EQuIS ☐

Effluent Sample Requiring "J" flag ☐ **UST Clean Up Fund Project** ☐; **Claim #**_____

Report To: Laura Tidwell	**Bill To:** Janet Harris
Company: Sandia National Lab	Sandia Laboratories
PO Box 969, MS 9962	Attn: Accounts Payable
Livermore, CA 94550	**E-Mail:** ltidwel@sandia.gov
Tele: (925) 294-6635	**Fax:** ( )
Project #:	**Project Name:** 943 PBR Samples
Project Location: 943	**Purchase Order#** 1045541
Sampler Signature: Laura Tidwell	

SAMPLE ID	Location/ Field Point Name	SAMPLING Date	SAMPLING Time	# Containers	MATRIX: Ground Water	Waste Water	Drinking Water	Sea Water	Soil	Air	Sludge	Other	METHOD PRESERVED: HCL	HNO_3	Other	BTEX & TPH as Gas (8021/ 8015 or 8260) / MTBE	TPH as Diesel (8015)	Total Petroleum Oil & Grease (1664 / 5520 E/B&F)	Total Petroleum Hydrocarbons (418.1)	MTBE / BTEX ONLY (EPA 8260/ 8021)	EPA 505/ 608 / 8081 (Cl Pesticides)	EPA 608 / 8082 PCB's ; Aroclors / Congeners	EPA 507 / 8141 (NP Pesticides)	EPA 515 / 8151 (Acidic Cl Herbicides)	EPA 524.2 / 624 / 8260 (VOC's)	EPA 525.2 / 625 / 8270 (SVOCs)	EPA 8270 SIM / 8310 (PAHs / PNAs)	CAM 17 Metals (200.7 / 200.8 / 6010 / 6020)	LUFT 5 Metals (200.7 / 200.8 / 6010 / 6020)	Metals (200.7 / 200.8 / 6010 / 6020)	Filter sample for DISSOLVED metals analysis	pH	Inorganic Anions		
6C80	943	5/30	3:20pm	1		X																					X				X	X		
6C81	943	5/30	3:34pm	1		X																					X				X	X		
6C82	943	5/30	3:45pm	1		X																					X				X	X		

**MAI clients MUST disclose any dangerous chemicals known to be present in their submitted samples in concentrations that may cause immediate harm or serious future health endangerment as a result of brief, gloved, open air, sample handling by MAI staff. Non-disclosure incurs an immediate $250 surcharge and the client is subject to full legal liability for harm suffered. Thank you for your understanding and for allowing us to work safely.

Relinquished By:	Date:	Time:	Received By:
Laura Tidwell	5/30/13	5:05pm	
Relinquished By:	Date:	Time:	Received By:
	5/31	1700	
Relinquished By:	Date:	Time:	Received By:

ICE/T 10.8
GOOD CONDITION_____
HEAD SPACE ABSENT_____
DECHLORINATED IN LAB_____
APPROPRIATE CONTAINERS_____
PRESERVED IN LAB_____

VOAS O&G METALS OTHER HAZARDOUS:
PRESERVATION_____ pH<2_____

COMMENTS:

McCampbell Analytical, Inc.
1534 Willow Pass Rd
Pittsburg, CA 94565-1701
(925) 252-9262

CHAIN-OF-CUSTODY RECORD

WorkOrder: 1305966 **ClientCode: SNLW**

☐ WaterTrax ☐ WriteOn ☐ EDF ☐ Excel ☒ EQuIS ☑ Email ☐ HardCopy ☐ ThirdParty ☐ J-flag

Report to:

Laura Tidwell
Sandia National Laboratories
PO Box 969 MS9902 (Waste Mgmt. Prog.)
Livermore, CA 94551-0969
(925) 294-4506 FAX: 925-294-3320

Email: ltidwel@sandia.gov
cc:
PO:
ProjectNo: 943 PBR Samples

Bill to:

Accounts Payable
Sandia National Laboratories
P.O. Box 5800 MS1385
Albuquerque, NM 87185
SEND HARDCOPY

Requested TAT: 5 days
Date Received: 05/31/2013
Date Printed: 05/31/2013

Lab ID	Client ID	Matrix	Collection Date	Hold	Requested Tests (See legend below)											
					1	2	3	4	5	6	7	8	9	10	11	12
1305966-001	6080	Water	5/30/2013 15:00	☐			A									
1305966-002	6081	Water	5/30/2013 15:30	☐		A										
1305966-003	6082	Water	5/30/2013 15:45	☐	A											

Test Legend:

1	300_1_W	2	CAM17(T)MS_W	3	PH_W	4		5	
6		7		8		9		10	
11		12							

Prepared by: Zoraida Cortez

Comments:

NOTE: Soil samples are discarded 60 days after results are reported unless other arrangements are made (Water samples are 30 days).
Hazardous samples will be returned to client or disposed of at client expense.

McCampbell Analytical, Inc.
"When Quality Counts"

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Toll Free Telephone: (877) 252-9262 / Fax: (925) 252-9269
http://www.mccampbell.com / E-mail: main@mccampbell.com

Sample Receipt Checklist

Client Name: **Sandia National Laboratories**
Date and Time Received: **5/31/2013 5:27:40 PM**

Project Name: **943 PBR Samples**
LogIn Reviewed by: Zoraida Cortez

WorkOrder N°: **1305966** Matrix: Water
Carrier: David Valles (MAI Courier)

Chain of Custody (COC) Information

Chain of custody present?	Yes ☑	No ☐
Chain of custody signed when relinquished and received?	Yes ☑	No ☐
Chain of custody agrees with sample labels?	Yes ☑	No ☐
Sample IDs noted by Client on COC?	Yes ☑	No ☐
Date and Time of collection noted by Client on COC?	Yes ☑	No ☐
Sampler's name noted on COC?	Yes ☑	No ☐

Sample Receipt Information

Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	NA ☑
Shipping container/cooler in good condition?	Yes ☑	No ☐	
Samples in proper containers/bottles?	Yes ☑	No ☐	
Sample containers intact?	Yes ☑	No ☐	
Sufficient sample volume for indicated test?	Yes ☑	No ☐	

Sample Preservation and Hold Time (HT) Information

All samples received within holding time?	Yes ☐	No ☑	
Container/Temp Blank temperature	Cooler Temp: 10.8°C		NA ☐
Water - VOA vials have zero headspace / no bubbles?	Yes ☐	No ☐	No VOA vials submitted ☑
Sample labels checked for correct preservation?	Yes ☑	No ☐	
Metal - pH acceptable upon receipt (pH<2)?	Yes ☑	No ☐	NA ☐
Samples Received on Ice?	Yes ☑	No ☐	

(Ice Type: WET ICE)

** NOTE: If the "No" box is checked, see comments below.*

Comments: pH was received out of hold time.

McCampbell Analytical, Inc.
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Sandia National Laboratories PO Box 969 MS9902 (Waste Mgmt. Prog.) Livermore, CA 94551-0969	Client Project ID: 943 PBR Samples	Date Sampled: 05/30/13
		Date Received: 05/31/13
	Client Contact: Laura Tidwell	Date Extracted: 06/01/13-06/03/13
	Client P.O.: #1045541	Date Analyzed: 06/01/13-06/03/13

Inorganic Anions by IC*

Extraction Method: E300.1 | Analytical Method: E300.1 | Work Order: 1305966

					Reporting Limit for DF =1	
Lab ID	1305966-003A					
Client ID	6082					
Matrix	W					
DF	1				S	W
Compound	**Concentration**				ug/kg	mg/L
Bromide	0.19				NA	0.1
Chloride	ND				NA	0.1
Fluoride	ND				NA	0.1
Nitrate as N	18				NA	0.1
Nitrate as $NO3^-$	82				NA	0.45
Nitrite as N	ND				NA	0.1
Phosphate as P	ND				NA	0.1
Sulfate	0.21				NA	0.1
Surrogate Recoveries (%)						
%SS:	115					
Comments						

* water samples are reported in mg/L, soil/sludge/solid samples in mg/kg, wipe samples in mg/wipe, product/oil/non-aqueous liquid samples in mg/L.

* [Nitrate as $NO3^-$] = 4.4268 x [Nitrate as N]

means surrogate diluted out of range or surrogate coelutes with another peak; N/A means surrogate not applicable to this analysis; %SS = Percent Recovery of Surrogate Standard; DF = Dilution Factor

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Sandia National Laboratories	Client Project ID: 943 PBR Samples	Date Sampled: 05/30/13
		Date Received 05/31/13
PO Box 969 MS9902 (Waste Mgmt. Prog.)	Client Contact: Laura Tidwell	Date Extracted 05/31/13
Livermore, CA 94551-0969	Client P.O.: #1045541	Date Analyzed 06/05/13

CAM / CCR 17 Metals*

						Reporting Limit for DF =1; ND means not detected above the reporting limit	
Lab ID	1305966-002A						
Client ID	6081						
Matrix	W					S	W
Extraction Type	TOTAL					mg/kg	µg/L

ICP-MS Metals, Concentration*

Analytical Method: E200.8 Extraction Method: E200.8 Work Order: 1305966

Dilution Factor	1					1	1
Antimony	ND					NA	0.5
Arsenic	ND					NA	0.5
Barium	ND					NA	5.0
Beryllium	ND					NA	0.5
Cadmium	ND					NA	0.25
Chromium	ND					NA	0.5
Cobalt	ND					NA	0.5
Copper	20					NA	0.5
Lead	3.6					NA	0.5
Mercury	ND					NA	0.025
Molybdenum	ND					NA	0.5
Nickel	1.7					NA	0.5
Selenium	ND					NA	0.5
Silver	ND					NA	0.19
Thallium	ND					NA	0.5
Vanadium	ND					NA	0.5
Zinc	11					NA	5.0
%SS:	110						
Comments							

*water samples are reported in µg/L, product/oil/non-aqueous liquid samples and all TCLP / STLC / DISTLC / SPLP extracts are reported in mg/L, soil/sludge/solid samples in mg/kg, wipe samples in µg/wipe, filter samples in µg/filter.

means surrogate diluted out of range; ND means not detected above the reporting limit/method detection limit; N/A means not applicable to this sample or instrument; %SS = Percent Recovery of Surrogate Standard; DF = Dilution Factor

TOTAL = Hot acid digestion of a representative sample aliquot.
TRM = Total recoverable metals is the "direct analysis" of a sample aliquot taken from its acid-preserved container.
DISS = Dissolved metals by direct analysis of 0.45 µm filtered and acidified sample.

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Sandia National Laboratories	Client Project ID: 943 PBR Samples	Date Sampled: 05/30/13
		Date Received: 05/31/13
PO Box 969 MS9902 (Waste Mgmt. Prog.)	Client Contact: Laura Tidwell	Date Extracted: 05/31/13
Livermore, CA 94551-0969	Client P.O.: #1045541	Date Analyzed: 05/31/13

pH*

Analytical Method: SM4500H+B — Work Order: 1305966

Lab ID	Client ID	Matrix	pH	DF	Comments
1305966-001A	6080	W	2.04 @ 23.9°C	1	

Method Accuracy and Reporting Units			
	W	±0.05, pH units @ °C	
	S	NA	

* According the formal method, this is "field test" with a 15 minute Hold Time. However, as this is unrealistically short for commercial environmental analysis, MAI has designated a 24 hour hold time for aqueous samples.

DF = Dilution Factor

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QC SUMMARY REPORT FOR E300.1

W.O. Sample Matrix: Water | QC Matrix: Water | BatchID: 77915 | WorkOrder: 1305966

EPA Method: E300.1 **Extraction: E300.1** **Spiked Sample ID: 1305966-003a**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	Acceptance Criteria (%)		
	mg/L	mg/L	% Rec.	% Rec.	% RPD	% Rec.	MS / MSD	RPD	LCS
Bromide	0.19	1	153, F1	160, F1	4.11	114	85 - 115	15	85 - 115
Chloride	ND	1	114	110	3.25	109	85 - 115	15	85 - 115
Fluoride	ND	1	146, F1	145, F1	0.769	107	85 - 115	15	85 - 115
Nitrate as N	18	1	130, F1	132, F1	0.11	104	85 - 115	15	85 - 115
Nitrate as $NO3^-$	82	4.4	131, F1	133, F1	0.11	105	85 - 115	15	85 - 115
Nitrite as N	ND	1	66.7, F1	58.1, F1	13.7	99.4	85 - 115	15	85 - 115
Phosphate as P	ND	1	106	113	6.43	113	85 - 115	15	85 - 115
Sulfate	0.21	1	159, F1	155, F1	2.09	115	85 - 115	15	85 - 115
%SS:	115	0.10	113	113	0	101	90 - 115	10	90 - 115

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:
NONE

F1 = MS/MSD recovery was out of acceptance criteria; LCS validated the prep batch.

BATCH 77915 SUMMARY

Lab ID	Date Sampled	Date Extracted	Date Analyzed	Lab ID	Date Sampled	Date Extracted	Date Analyzed
1305966-003A	05/30/13 3:45 PM	06/01/13	06/01/13 9:12 AM	1305966-003A	05/30/13 3:45 PM	06/03/13	06/03/13 4:35 PM

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not applicable to this method.

surrogate diluted out of range or surrogate coelutes with another peak.

NR = analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or analyte content.

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QA/QC Officer

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QC SUMMARY REPORT FOR E200.8

W.O. Sample Matrix: Water | QC Matrix: Water | BatchID: 77864 | WorkOrder: 1305966

EPA Method: E200.8 | **Extraction: E200.8** | **Spiked Sample ID: 1305930-004A**

Analyte	Sample	Spiked	MS	MSD	MS-MSD	LCS	Acceptance Criteria (%)		
	µg/L	µg/L	% Rec.	% Rec.	% RPD	% Rec.	MS / MSD	RPD	LCS
Antimony	1.3	50	92.1	94.6	2.54	92.1	70 - 130	20	85 - 115
Arsenic	1.5	50	97.8	96.6	1.22	96.9	70 - 130	20	85 - 115
Barium	ND	500	97.1	99.5	2.39	97.9	70 - 130	20	85 - 115
Beryllium	ND	50	94.3	95.8	1.56	96.1	70 - 130	20	85 - 115
Cadmium	1.8	50	94.9	97.1	2.15	95.8	70 - 130	20	85 - 115
Chromium	30	50	93.4	95.4	1.35	97.8	70 - 130	20	85 - 115
Cobalt	ND	50	95	96.5	1.52	97.4	70 - 130	20	85 - 115
Copper	11	50	94	96	1.73	97.7	70 - 130	20	85 - 115
Lead	ND	50	96.2	98.2	2.05	96.8	70 - 130	20	85 - 115
Mercury	0.11	1.25	123	125	1.99	99	70 - 130	20	85 - 115
Molybdenum	7.8	50	95.7	97.8	1.87	95.2	70 - 130	20	85 - 115
Nickel	2.7	50	92.7	96.9	4.17	96.8	70 - 130	20	85 - 115
Selenium	2.5	50	95.6	98.1	2.39	96.8	70 - 130	20	85 - 115
Silver	0.38	50	93.3	95.6	2.44	96	70 - 130	20	85 - 115
T m	ND	50	95	98.3	3.37	96.6	70 - 130	20	85 - 115
.um	2.2	50	95.5	97.3	1.85	97.1	70 - 130	20	85 - 115
Zinc	13	500	94.7	97.7	2.99	97.9	70 - 130	20	85 - 115
%SS:	99	750	97	100	2.47	99	70 - 130	20	70 - 130

All target compounds in the Method Blank of this extraction batch were ND less than the method RL with the following exceptions:
NONE

BATCH 77864 SUMMARY

Lab ID	Date Sampled	Date Extracted	Date Analyzed	Lab ID	Date Sampled	Date Extracted	Date Analyzed
1305966-002A	05/30/13 3:30 PM	05/31/13	06/05/13 1:30 AM				

MS = Matrix Spike; MSD = Matrix Spike Duplicate; LCS = Laboratory Control Sample; LCSD = Laboratory Control Sample Duplicate; RPD = Relative Percent Deviation.

% Recovery = 100 * (MS-Sample) / (Amount Spiked); RPD = 100 * (MS - MSD) / ((MS + MSD) / 2).

MS / MSD spike recoveries and / or %RPD may fall outside of laboratory acceptance criteria due to one or more of the following reasons: a) the sample is inhomogenous AND contains significant concentrations of analyte relative to the amount spiked, or b) the spiked sample's matrix interferes with the spike recovery.

N/A = not applicable to this method.

N ix interference and/or analyte concentration in sample exceeds spike amount for soil matrix or exceeds 2x spike amount for water matrix or sample diluted due to high matrix or content.

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QC SUMMARY REPORT FOR WET CHEMISTRY TESTS

Test Method: SM4500H+B (pH) **Matrix:** W **WorkOrder:** 1305966

Method Name: SM4500H+B			Units: ±, pH units @ °C			BatchID: 77891
Lab ID	Sample	DF	Dup / Ser. Dil.	DF	Precision	Acceptance Criteria
1305966-001A	2.04 @ 23.9°C	1	2.03 @ 23.9°C	1	0.01	0.05

BATCH 77891 SUMMARY

Lab ID	Date Sampled	Date Extracted	Date Analyzed	Lab ID	Date Sampled	Date Extracted	Date Analyzed
1305966-001A	05/30/13 3:00 PM	05/31/13	05/31/13 8:24 PM				

Dup = Duplicate; Ser. Dil. = Serial Dilution; MS = Matrix Spike; RD = Relative Difference; RPD = Relative Percent Deviation.

Precision = Absolute Value (Sample - Duplicate)

RPD = 100 * (Sample - Duplicate) / [(Sample + Duplicate) / 2]

%RPD is calculated using results of up to 10 significant figures, however the reported results are rounded to 2 or 3 significant figures. Therefore there may be a slight discrepancy between the %RPD displayed above and %RPD calculated using the reported results. MAI considers %RPD based upon more significant figures to be more accurate.

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