Sodium Hypochlorite and Bulk Chemical Storage Considerations:

A Tank Replacement Experience

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Willamette River Water Treatment Plant

Owner: City of Wilsonville OR

Operator: Veolia Water North America

Kevin Batridge
Project Manager

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Overview

- Introduction: Why replace a 5 year old NaOCl storage tank?
- Investigation: Situations surrounding the tank failure
- Evaluation: Inspections, repair alternatives
- Replacement decision: Budgeting, comparisons, selection
- Design changes, installation options
- Special Considerations: Site limitations, seismic requirements, future failures

Now for The Real Work

- Taking Delivery
- Installation
- Wet testing
- Lessons Learned
- Questions?

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Introduction

Why are we replacing a 5 year old NaOCl storage tank?

It was leaking, of course! The leak

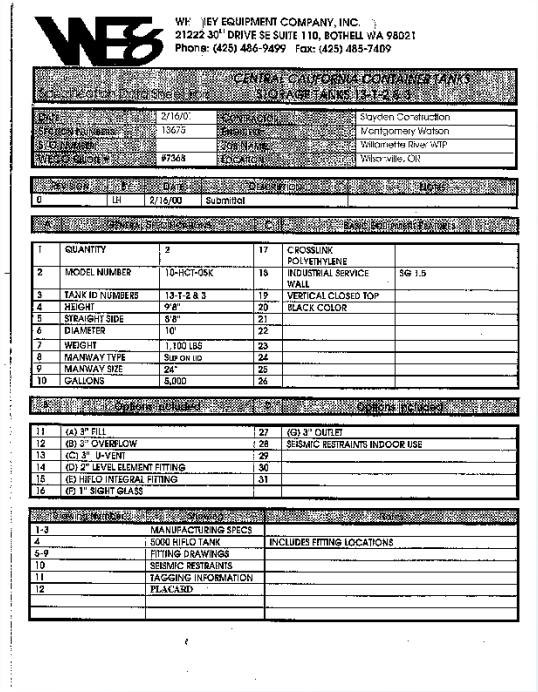
- Commissioned in April 2002 Plan view
- Two 5000 gallon, flat bottom HDXLPE from CenCal
- Leak first observed in September 2006
- Take it O.O.S. (hazardous fumes, corrosion damage)
- Let's inspect it! Wait a minute…

Investigation

- Oh yeah, it's a confined space!
- Retrieval challenges
- Rope ladder

- What about a warranty claim? Nope 1 year
- Where was Central California Container now?
- The leak is *where*?

Evaluation



WHITLEY EQUIPMENT COMPANY, INC.
21222 30th DRIVE SE SUITE 110, BOTHELL WA 98021
Phone: (425) 486-9499 Fax: (425) 485-7409

CENTRAL CALIFORNIA CONTAINER TANKS
STORAGE TANKS 13-T-2 & 3

DATE	2/16/00	CONTRACTOR	Stayden Construction
PROJECT NUMBER	13675	ENGINEER	Montgomery Watson
PROJECT NAME		SITE NAME	Willamette River WTP
WEC QUOTE #	#7368	LOCATION	Wilsonville, OR

REVISION	BY	DATE	DESCRIPTION	REMARKS
0	LH	2/16/00	Submittal	

1	QUANTITY	2	17	CROSSLINK POLYETHYLENE	
2	MODEL NUMBER	10-HCT-05K	18	INDUSTRIAL SERVICE WALL	SG 1.5
3	TANK ID NUMBERS	13-T-2 & 3	19	VERTICAL CLOSED TOP	
4	HEIGHT	9'8"	20	BLACK COLOR	
5	STRAIGHT SIDE	5'8"	21		
6	DIAMETER	10'	22		
7	WEIGHT	1,100 LBS	23		
8	MANWAY TYPE	Slip on lid	24		
9	MANWAY SIZE	24"	25		
10	GALLONS	5,000	26		

11	(A) 3" FILL	27	(G) 3" OUTLET
12	(B) 3" OVERFLOW	28	SEISMIC RESTRAINTS INDOOR USE
13	(C) 3" U-VENT	29	
14	(D) 2" LEVEL ELEMENT FITTING	30	
15	(E) HIFLO INTEGRAL FITTING	31	
16	(F) 1" SIGHT GLASS		

Item Number	Drawing	Notes
1-3	MANUFACTURING SPECS	
4	5000 HIFLO TANK	INCLUDES FITTING LOCATIONS
6-9	FITTING DRAWINGS	
10	SEISMIC RESTRAINTS	
11	TAGGING INFORMATION	
12	PLACARD	

- Why did it fail? 1.5 s.g. vs. 1.9 s.g. specification?
- HDXLPE: Was it the right material for the job? C C Chart
- Installation damage?
- Rigid vs. flexible connections?
- Can it be repaired? hot air welding, hastelloy bolts, liner

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Replacement Decision

- Preliminary pricing: PE ($15k) or FRP ($27k)
- Comparing PE alternatives
- Survey of peer experience
- Vendors represented: Snyder, Assman, PolyProcessing
- Tank size considerations
- Warranty options
- Installation contractor

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Design Changes

- Exterior sight gauge removed
- Reducing sidewall penetrations
- Locate ultrasonic level transmitter to tank center
- Install flexible connections
- Install p trap on overflow

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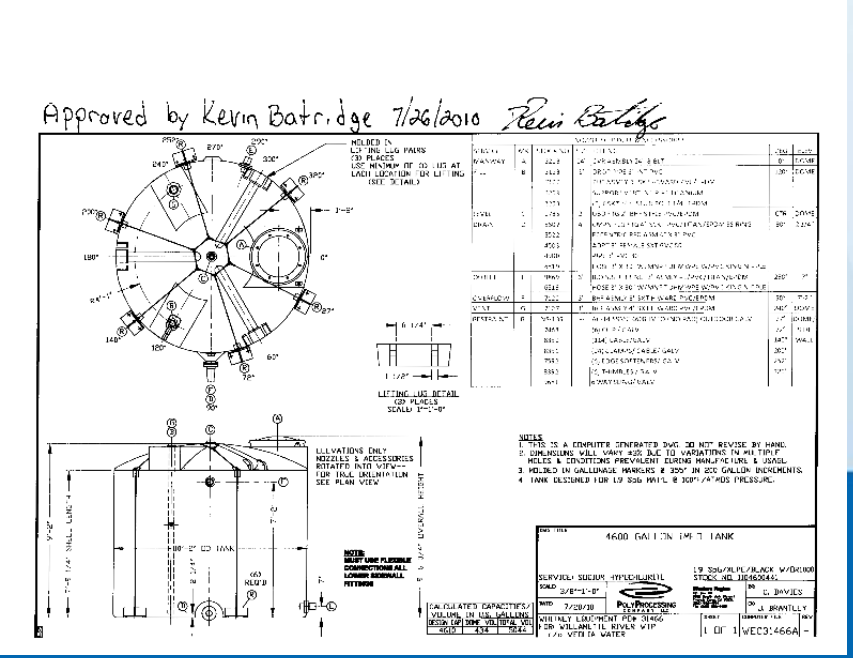
Special Considerations

- Seismic standards have changed since 2002 (2006 UBC)
- Manufacturers IMFO outlets only available at 90 deg and 270 deg
- Rotation to position access manway between roof trusses
- Position to place IMFO at notch in pad
- Flexible connection needed to replace rigid piping
- Encapsulated titanium bolts, viton gaskets

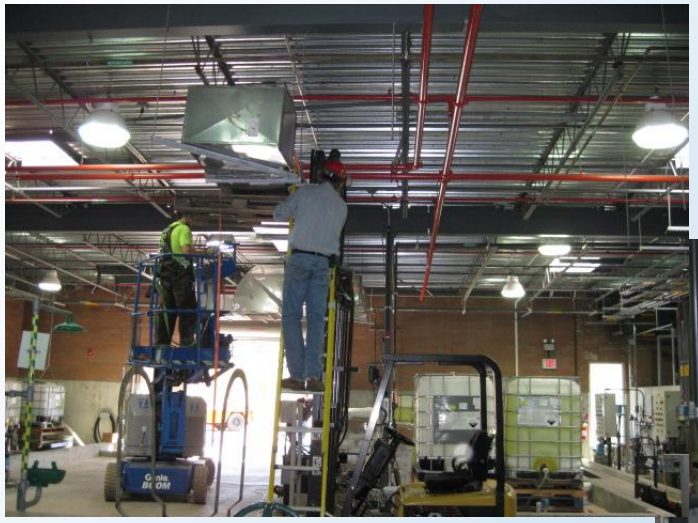


Taking Delivery

- Coordinating contractor with delivery
- Documenting shipping damage

Installation

- Both tanks removed to allow insertion of new tank
- Temporary totes used during the interim
- Measure (twice) the opening
- Etc…



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Wet Testing

- Plug all outlets and fill
- Check for leaks
- Make the repairs
- Etc…

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Lessons Learned

- Eliminate contamination
- Inspect and clean your bulk storage tanks regularly
- Provide ability to completely clean tank floor
- FRP tanks will also need regular inspection
- Provide for safe access and retrieval
- Use flexible couplings at fittings on lower tank half
- Design with tank replacement in mind
- Use the right solvent cement

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Questions?

- Contact Kevin Batridge
- 503 582 9655
- 503 703 6913

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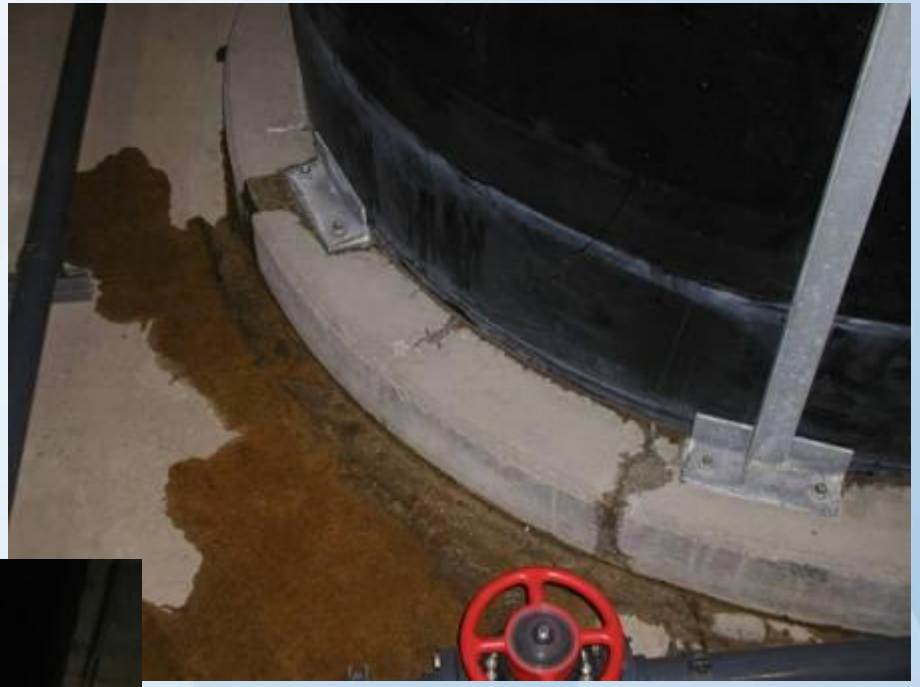
Where's the leak?

- Not at connections or penetrations
- Flat bottom tank
- Hazardous fumes, corrosion, crystals forming



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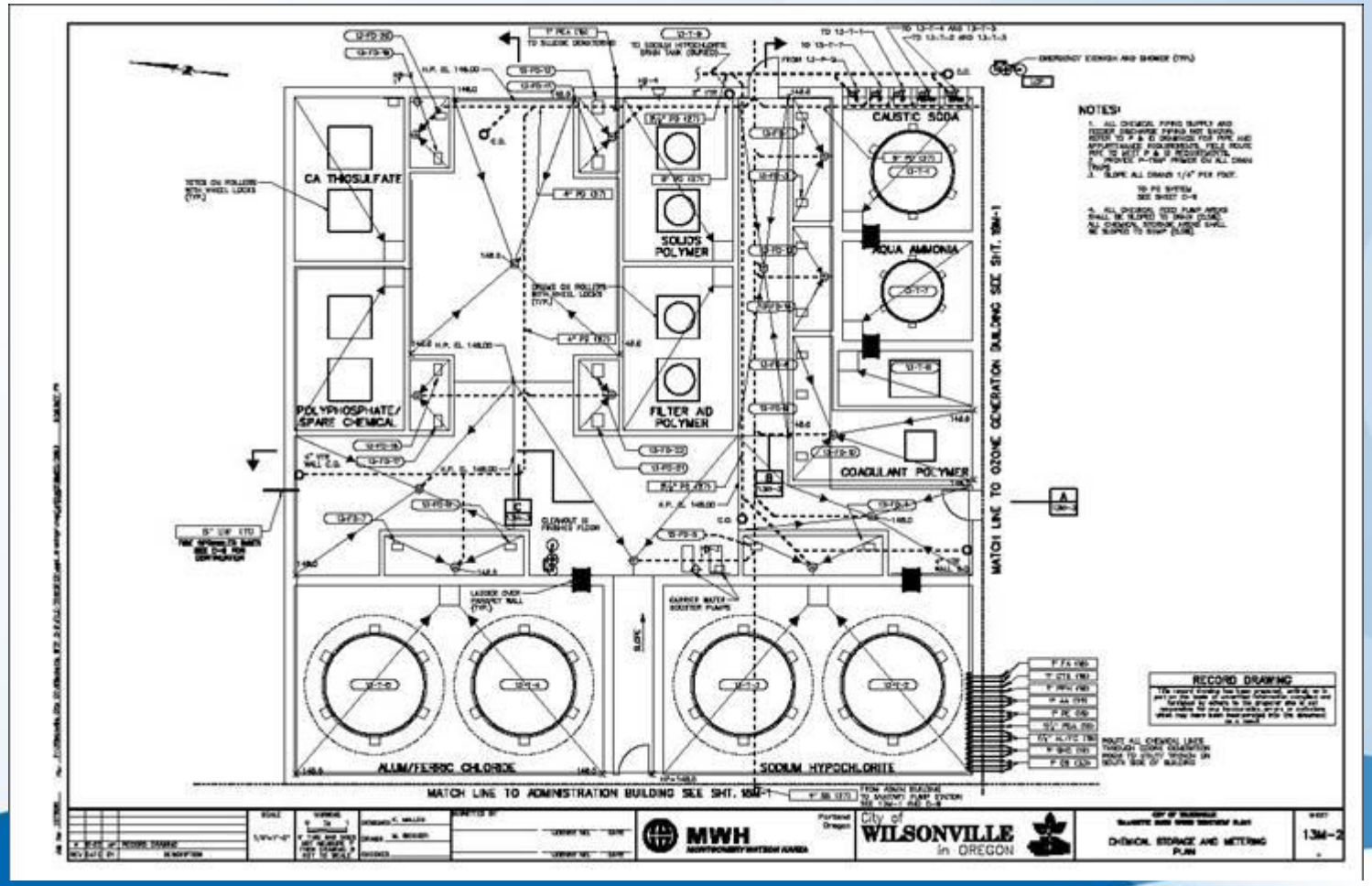
Really? 1 Year?

- CenCal closed, varying stories where they are now

Chemical Storage System

- Two tanks side by side
- Indoors, covered building
- Containment wall



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Chemical Compatibility Chart

- HDPE vs LDPE
- XL vs Linear
- PE is not allowed in EU!
- Why not FRP?

CAUTION!

The life of a tank is affected by the quality of the sodium hypochlorite stored. Tank owners are cautioned to **use high quality sodium hypochlorite** with low iron, nickel, and copper content. These metals contribute to the decomposition of the sodium hypochlorite and accelerate the oxidation and degradation of the tank.

SNYDER INDUSTRIES, INC.
THE ENGINEERED DIFFERENCE IN TANKS

November 2009

CHEMICAL RESISTANCE RECOMMENDATIONS

Chemical	Concentration	Resin	Design Info	Fitting Material	Gasket Material	Bolt Material
Acetic Acid	60	HDLPE & XLPE	1.5/600	PP/PVC	EPDM	316SS/Hastelloy/Titan.
Acetic Acid	80	HDLPE	1.9/600	PP	EPDM	316SS/Hastelloy/Titan.
Acrylic Emulsions	50	XLPE	1.9/600	PVC	EPDM	316SS
Aluminum Sulfate	50	HDLPE & XLPE	1.5/600	PVC	EPDM	316SS**/Hastelloy/Titan.
Ammonium Sulfate	40	HDLPE & XLPE	1.5/600	PVC	EPDM	316SS**/Hastelloy/Titan.
Calcium Carbonate	Saturated	HDLPE & XLPE	1.9/600	PVC	EPDM	316SS
Calcium Chloride	40	HDLPE & XLPE	1.5/600	PVC	EPDM	316SS**/Hastelloy/Titan.
DEF (Diesel Exhaust Fluid)	32.5	HDLPE & XLPE	1.35/600	PP/PVC	EPDM	316SS
Deionized Water <5 Megohm		HDLPE & XLPE	1.5/600	PVC	EPDM	316SS
Deionized Water >5 Megohm		HDLPE & XLPE	1.5/600	PVC	EPDM	316SS
Ethyl Alcohol	100	HDLPE & XLPE	1.5/600	PVC	EPDM	316SS
Ethylene Glycol	100	HDLPE & XLPE	1.9/600	PVC	EPDM	316SS
Ferric Chloride	50	HDLPE & XLPE	1.9/600	PVC	EPDM	Hastelloy/Titan.
Ferric Sulfate	60	HDLPE & XLPE	1.9/600	PVC	EPDM	316SS**/Hastelloy/Titan.
Ferrous Chloride	Saturated	HDLPE & XLPE	1.9/600	PVC	EPDM	Hastelloy/Titan.
Ferrous Sulfate	20	HDLPE & XLPE	1.5/600	PVC	EPDM	Hastelloy
Hydrochloric Acid	37	HDLPE	1.9/600	PVC	Viton	Hastelloy
Hydrofluoric Acid	48	HDLPE	1.9/600	PP/PVC	Viton	Hastelloy
Hydrofluosilicic Acid	26	HDLPE/XLPE*	1.9/600	PP/PVC	Viton	Hastelloy
Hydrogen Peroxide	50	HDLPE	1.9/600	PVC	Viton	316SS/Hastelloy/Titan.
Isopropyl Alcohol	100	HDLPE & XLPE	1.5/600	PVC	EPDM	316SS
Magnesium Chloride	30	HDLPE & XLPE	1.5/600	PVC	EPDM	316SS**/Hastelloy/Titan.
Methyl Alcohol	100	HDLPE & XLPE	1.5/600	PVC	EPDM	316SS
Motor Oil	100	HDLPE & XLPE	1.9/600	316SS	Viton	316SS
Phosphoric Acid	85	HDLPE	1.9/600	PVC	Viton	316SS
Phosphoric Acid	50	HDLPE	1.9/600	PVC	Viton	316SS
Polymers (Deposition)		XLPE	1.5/600	PVC	EPDM	316SS
Potable Water		HDLPE	1.5/600	PVC	EPDM	316SS
Potassium Carbonate	50	HDLPE & XLPE	1.9/600	PVC	EPDM	316SS
Potassium Hydroxide	Saturated	HDLPE & XLPE	1.9/600	PVC	EPDM	316SS
Sodium Carbonate	30	HDLPE & XLPE	1.5/600	PVC	EPDM	316SS**/Hastelloy/Titan.
Sodium Carbonate	Saturated	HDLPE & XLPE	1.9/600	PVC	EPDM	316SS**/Hastelloy/Titan.
Sodium Hydroxide	50	HDLPE & XLPE	1.9/600	PVC	EPDM	316SS
Sodium Hypochlorite-in(Non-UV)	<16.5	HDLPE	1.9/600	PVC	Viton	Titanium
Sodium Hypochlorite-out (UV)	<16.5	HDLPE #880059	1.9/600	PVC	Viton	Titanium
Sodium Hypochlorite-out (UV)	<16.5	HDLPE Insulated	1.9/600	PVC	Viton	Titanium
Sodium Thiosulfate	40	HDLPE & XLPE	1.9/600	PVC	EPDM	316SS
Sulfuric Acid	98	HDLPE #880046*	1.9/600	CPVC	Viton	Hastelloy
Sulfuric Acid	93	HDLPE #880046*	1.9/600	CPVC	Viton	Hastelloy
Surfactants		XLPE	1.5/600	PVC	EPDM	316SS
Urea Solution	50	HDLPE & XLPE	1.35/600	PP/PVC	EPDM	316SS
Water w/Ozone up to 10 PPM		HDLPE & XLPE	1.5/600	PVC	EPDM	316SS

Note: Ambient Temperature.
Chart applies to Industrial ASTM designed tanks.
*Chemical may cause tank material to discolor.
** 316SS may pit upon drying. Not recommended for SUMOs.
High purity chemical applications are limited to natural tank color or special hot compounded resins.
For chemicals or chemical blends not listed on the above chart, please contact Snyder Industries.

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