24590-PTF-N1D-PVP-P0002
Rev. 1

R10684972

PLANT ITEM MATERIAL SELECTION DATA SHEET

PVP-VSL-00001 (PTF)
HEME Drain Collection Vessel

- Design Temperature (°F)(max/min): 200/40
- Design Pressure (psig) (internal/external): 15/FV
- Location: incell

ISSUED BY
RPP-WTP PDC

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Operating conditions are as stated on attached Process Corrosion Data Sheet

Options Considered:

- Vessel receives wash drains from PVP HEMEs
- Wash is acidic

Materials Considered:

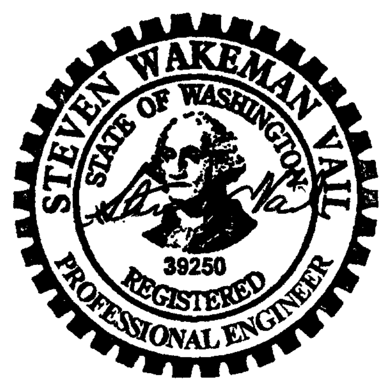
Material (UNS No.)	Relative Cost	Acceptable Material	Unacceptable Material
Carbon Steel	0.23		X
304L (S30403)	1.00	X	
316L (S31603)	1.18	X	
6% Mo (N08367/N08926)	7.64	X	
Alloy 22 (N06022)	11.4	X	
Ti-2 (R50400)	10.1		X

Recommended Material: 304 (max 0.030% C; dual certified)

Recommended Corrosion Allowance: 0.040 inch (includes 0.024 inch corrosion allowance and 0.004 inch erosion allowance)

Process & Operations Limitations:

- Develop rinsing/flushing procedure for acid and water



EXPIRES: 12/07/07

6/13/06

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This bound document contains a total of 6 sheets.

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Corrosion Considerations:

This vessel will be used to store HEME drain before transfer to the PWD system.

a General Corrosion
In this system, the normal pH conditions and temperatures are such that 304L stainless steel would be acceptable under the low chloride conditions.

It is anticipated that the contents of this vessel are generally alkaline; however, the possibility of acidic conditions due to acidic wash of the HEME elements exists. Hamner (1981) lists both 304L and 316L corrosion rates as < 2 mpy at temperatures up to 150°F. Based on estimates from Cole (1974), corrosion rates for 304L for all of the concentrations <4 M and at temperatures to boiling are expected to be less that 1 mpy. In about 6 M acid at 145°F, the corrosion rate is approximately 2 mpy.

Conclusion:
304L and 316L are expected to be sufficiently resistant with a probable general corrosion rate of less than 1 mpy under normal operating conditions.

b Pitting Corrosion
Pitting should not be a concern for 304L or 316L at the stated low-chloride conditions and stated temperature.

Conclusion:
Under normal conditions, 304L is expected to be satisfactory.

c End Grain Corrosion
End grain corrosion only occurs in metal with exposed end grains and in highly oxidizing acid conditions.

Conclusion:
Not applicable to this system.

d Stress Corrosion Cracking
The exact amount of chloride required to cause stress corrosion cracking is unknown In part this is because the amount varies with temperature, metal sensitization, and the environment. But it is also unknown because chloride tends to concentrate under heat transfer conditions, by evaporation, and electrochemically during a corrosion process. Hence, even as little as a few ppm can lead to cracking under some conditions. Generally, as seen in Sedriks (1996) and Davis (1987), chloride stress corrosion cracking does not usually occur below about 140°F. During the normal operations, either 304L or 316L are expected to be satisfactory.

Conclusion:
At the normal, stated, operating environment, 304L is recommended.

e Crevice Corrosion
See Pitting.

Conclusion:
See Pitting

f Corrosion at Welds
Corrosion at welds is not considered a problem in the proposed environment.

Conclusion:
Weld corrosion is not considered a problem for this system.

g Microbiologically Induced Corrosion (MIC)
The proposed operating temperatures are acceptable for microbial growth but there appears to be little chance of the introduction of microbes.

Conclusion:
MIC is not expected to be a problem.

h Fatigue/Corrosion Fatigue
Corrosion fatigue is not expected to be a problem in this vessel.

Conclusions
Not considered to be a problem.

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i Vapor Phase Corrosion
Not considered to be a concern in this vessel.

Conclusion:
Not a concern.

j Erosion
Velocities within the vessel are expected to be low. Erosion allowance of 0.004 inch for components with low solids content (< 2 wt%) at low velocities is based on 24590-WTP-RPT-M-04-0008.

Conclusion:
Not expected to be a concern.

k Galling of Moving Surfaces
Not applicable.

Conclusion:
Not applicable.

l Fretting/Wear
No contacting surfaces expected.

Conclusion:
Not applicable.

m Galvanic Corrosion
No dissimilar metals are present.

Conclusion:
Not applicable.

n Cavitation
Cavitation is usually encountered in high velocity fluids and not normally expected in vessels.

Conclusion:
Not applicable.

o Creep
The temperatures are too low to be a concern.

Conclusion:
Not applicable.

p Inadvertent Nitric Acid Addition
Higher chloride contents and higher temperatures usually require higher alloy materials. Nitrate ions inhibit the pitting and crevice corrosion of stainless alloys. Furthermore, nitric acid passivates these alloys; therefore, lower pH values brought about by increases in the nitric acid content of process fluid will not cause higher corrosion rates for these alloys. The upset condition that was most likely to occur is lowering of the pH of the vessel content by inadvertent addition of 0.5 M nitric acid. Lowering of pH may make a chloride-containing solution more likely to cause pitting of stainless alloys. Increasing the nitric acid content of the process fluid adds more of the pitting-inhibiting nitrate ion to the process fluid. In addition, adding the nitric acid solution to the stream will dilute the chloride content of the process fluid.

Conclusion:
The recommended materials will be able to withstand a plausible inadvertent addition of 0.5 M nitric acid.

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References:

1. 24590-WTP-RPT-M-04-0008, Rev. 2, *Evaluation Of Stainless Steel Wear Rates In WTP Waste Streams At Low Velocities*
2. 24590-WTP-RPT-PR-04-0001, Rev. B, *WTP Process Corrosion Data*
3. CCN 130176, Cole, HS, 1974, *Corrosion of Austenitic Stainless Steel Alloys Due to HNO_3 – HF Mixtures*, ICP-1036, Idaho Chemical Programs – Operations Office, Idaho Falls, ID
4. Davis, JR (Ed), 1987, *Corrosion, Vol 13*, In "Metals Handbook", ASM International, Metals Park, OH 44073
5. Hamner, NE, 1981, *Corrosion Data Survey*, Metals Section, 5th Ed, NACE International, Houston, TX 77218
6. Sedriks, AJ, 1996, *Corrosion of Stainless Steels*, John Wiley & Sons, Inc., New York, NY 10158

Bibliography:

1. CCN 130171, Ohl, PC to PG Johnson, Internal Memo, Westinghouse Hanford Co, *Technical Bases for Cl- and pH Limits for Liquid Waste Tank Cars*, MA: PCO:90/01, January 16, 1990.
2. CCN 130173, Dillon, CP (Nickel Development Institute), Personal Communication to J R Divine (ChemMet, Ltd., PC), 3 Feb 2000.
3. Agarwal, DC, *Nickel and Nickel Alloys*, In: Revie, WW, 2000. *Uhlig's Corrosion Handbook*, 2nd Edition, Wiley-Interscience, New York, NY 10158
4. Davis, JR (Ed), 1994, *Stainless Steels*, In ASM Metals Handbook, ASM International, Metals Park, OH 44073
5. Jones, RH (Ed.), 1992, *Stress-Corrosion Cracking*, ASM International, Metals Park, OH 44073
6. Koch, GH, 1995, *Localized Corrosion in Halides Other Than Chlorides*, MTI Pub No. 41, Materials Technology Institute of the Chemical Process Industries, Inc, St Louis, MO 63141
7. Uhlig, HH, 1948, *Corrosion Handbook*, John Wiley & Sons, New York, NY 10158
8. Van Delinder, LS (Ed), 1984, *Corrosion Basics*, NACE International, Houston, TX 77084

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WTP Process Corrosion Data

PROCESS CORROSION DATA SHEET

Component(s) (Name/ID #) PVP HEME (PVP-HEME-00001A/B/C); PVP HEME drains (PVP-VSL-00001)

Facility PTF

In Black Cell? yes (PVP-VSL-00001 only)

Chemicals	Unit[1]	Contract Max		Non-Routine		Notes
		Leach	No leach	Leach	No Leach	
Aluminum	g/l	5 04E-03	5 00E-03			
Chloride	g/l	2 06E-03	2 38E-03			
Fluoride	g/l	2 40E-03	2 79E-03			
Iron	g/l	3 79E-04	4 13E-04			
Nitrate	g/l	8 08E-02	9 12E-02			
Nitrite	g/l	2 42E-02	2 79E-02			
Phosphate	g/l	7 91E-03	8 96E-03			
Sulfate	g/l	4 22E-03	4 87E-03			
Mercury	g/l					
Carbonate	g/l	4 7E-02	5 1E-02			
Undissolved solids	wt%					
Other (NaMnO4, Pb,...)	g/l					
Other	g/l					
pH	N/A					Note 3
Temperature	°F					Note 2

List of Organic Species:

References

System Description 24590-PTF-3YD-PVP-00001, Rev A
Mass Balance Document 24590-WTP-M4C-V11T-00005, Rev A
Normal Input Stream # PVP06
Off Normal Input Stream # (e g , overflow from other vessels) N/A
P&ID N/A
PFD 24590-PTF-M5-V17T-P0021001, Rev 0
Technical Reports N/A

Notes:

1. Concentrations less than 1x 10^{-4} g/l do not need to be reported, list values to two significant digits max
2. T normal operation 59 °F to 113 °F, nominal 77 °F (24590-PTF-MVC-PVP-00010, Rev 0)
3. pH approximately 10 to 11

Assumptions:

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WTP Process Corrosion Data

4.8.2 Vessel Vent HEME (PVP-HEME-00001A/B/C); HEME Drain Collection Vessel (PVP-VSL-00001)

Routine Operations

The combined vessel vent exhaust stream will flow from the caustic scrubber outlet to the high-efficiency mist eliminators (HEMEs) for removal of mist. There will be three HEMEs. Two of these HEMEs are in service and one is available as an offline standby.

HEMEs are commonly used to remove fine aerosols and can exhibit high efficiencies even for submicron aerosols. They are passive devices with low maintenance requirements and high reliability. The HEMEs will protect the high-efficiency particulate air (HEPA) filters, located downstream of the HEMEs, in the PVV system from excessive loading and activity buildup.

Each HEME is a vertical cylindrical vessel in which the filter cartridge elements are arranged in a set of segmental vertical filter candles, which are supported at the top inside the vessel. There will be four filter cartridge elements installed for each candle. The vent stream will flow from the outside face of the filter cartridge elements to the inside. There will be a continuous atomizing spray of demineralized water at the inlet nozzle for each HEME to ensure the inlet gas stream is saturated. This will also help in draining of the solid particulates from the filter surface. An additional arrangement for intermittent washing of the filter elements will also be provided inside the HEME vessel, which will generally be used during the offline mode.

Various fibers and other construction materials for the HEME element can be selected for their resistance to gas constituents. It is likely that a fiberglass cartridge element will be used for this application. Due to some uncertainties in selection of the best available cartridge material, possible degradation over time, and the long design life for the facility, remote changeout capability for the filter cartridges from the HEMEs is provided.

The drain from each HEME will flow into the HEME drain collection vessel, PVP-VSL-00001, via the dip seal. The drain collection vessel will be used to store HEME drains before their transfer approximately twice a week, or on high level, to the PWD system. The HEME drain transfer pumps, PVP-PMP-00002A/B (one working and one standby), will be utilized for the recirculation and transfer of the HEME drain effluent to PWD vessel, PWD-VSL-00044.

Non-Routine Operations that Could Affect Corrosion/Erosion

None identified.