PLANT ITEM MATERIAL SELECTION DATA SHEET

R10684975

TLP-VSL-00002 (PTF)
Treated LAW Evaporator Condensate Vessel

- Design Temperature (°F)(max/min): 150/49
- Design Pressure (psig): 15
- Location: outcell

ISSUED BY
RPP-WTP PDC

Contents of this document are Dangerous Waste Permit affecting

Operating conditions are as stated on attached Process Corrosion Data Sheet

Options Considered:

- Normal operating conditions
- Acid cleaning at normal temperature

Materials Considered:

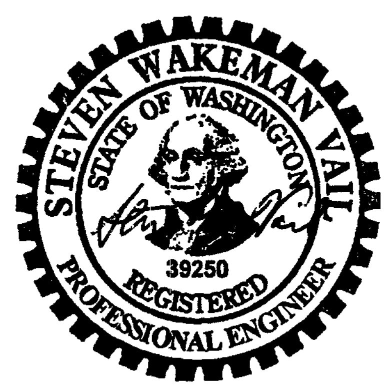
Material (UNS No.)	Relative Cost	Acceptable Material	Unacceptable Material
Carbon Steel	0.23		X
304L (S30403)	1.00	X	
316L (S31603)	1.18	X	
6% Mo (N08367/N08926)	7.64	X	
Alloy 22 (N06022)	11.4	X	
Ti-2 (R50400)	10.1		X

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



6/13/06

EXPIRES: 12/07/07

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This bound document contains a total of 6 sheets.

REV	DATE	REASON FOR REVISION	PREPARER	CHECKER	APPROVER
1	6/13/06	Issued for Permitting Use	[signature]	[signature]	[signature]
0	3/24/04	Issued for Permitting Use	DLA	JRD	APR

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Corrosion Considerations:

Vessel receives condensate from the condensers and demister vessel.

a General Corrosion
At the stated pH, temperature and halide concentrations, the corrosion rates will be small. Davis (1994) states the corrosion rate for 304L in pure NaOH will be less than about 1 mpy up to the proposed operating temperatures.

Conclusion:
At the normal operating temperature, either 304L or 316L will be sufficiently resistant to the waste solution with a probable general corrosion rate of less than 1 mpy. Based on the Savannah River experience with Hanford-like waste at higher temperatures, 304L is expected to be satisfactory to 300 °F.

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 10 ppm can lead to cracking under some conditions. Generally, as seen in Sedriks (1996) and Davis (1987), stress corrosion cracking does not usually occur below about 140 °F. However, Zapp's work (1998) indicates that with the high pH, cracking would be expected to occur only at temperatures well above the design temperature.

Conclusion:
With the stated normal operating conditions, 300 series stainless steels are expected to be acceptable.

e Crevice Corrosion
For the most part, the pitting discussion covers this area. It is assumed that the fluids will not be stagnant and no deposits are anticipated.

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 the location of the vessel in the process suggests little chance of the introduction of microbes.

Conclusion:
MIC is not expected to be a problem.

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

Conclusions:
Not considered to be a problem.

i Vapor Phase Corrosion
The vapor phase portion of the vessel will be spattered with solution and pitting or crevice corrosion may be a concern but wash rings are available for rinsing.

Conclusion:
Not considered to be a problem.

j Erosion
Velocities 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
Not expected to be applicable.

Conclusion:
Not a concern.

m Galvanic Corrosion
For the environment and the proposed alloys, there is not believed to be a concern.

Conclusion:
Not a concern.

n Cavitation
None expected.

Conclusion:
Not believed to be of concern.

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 for a limited period.

PLANT ITEM MATERIAL SELECTION DATA SHEET

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. 24590-QL-POA-MEVV-00001-14-00002, *Information - 60% Design - Equipment Design Condition*
4. Davis, JR (Ed), 1987, *Corrosion, Vol 13*, In "Metals Handbook", ASM International, Metals Park, OH 44073
5. Davis, JR (Ed), 1994, *Stainless Steels*, In ASM Metals Handbook, ASM International, Metals Park, OH 44073
6. Sedriks, AJ, 1996, *Corrosion of Stainless Steels*, John Wiley & Sons, Inc., New York, NY 10158
7. Zapp, PE, 1998, *Preliminary Assessment of Evaporator Materials of Construction*, BNF—003-98-0029, Rev 0, Westinghouse Savannah River Co., Inc for BNFL Inc.

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3. CCN 130172, Divine, JR, 1986, Letter to A.J. Diliberto, *Reports of Experimentation*, Battelle, Pacific Northwest Laboratories, Richland, WA 99352
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5. Agarwal, DC, *Nickel and Nickel Alloys*, In: Revie, WW, 2000. *Uhlig's Corrosion Handbook*, 2nd Edition, Wiley-Interscience, New York, NY 10158
6. Danielson, MJ & SG Pitman, 2000, *Corrosion Tests of 316L and Hastelloy C-22 in Simulated Tank Waste Solutions*, PNWD-3015 (BNFL-RPT-019, Rev 0), Pacific Northwest Laboratory, Richland WA
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9. 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
10. Phull, BS, WL Mathay, & RW Ross, 2000, *Corrosion Resistance of Duplex and 4-6% Mo-Containing Stainless Steels in FGD Scrubber Absorber Slurry Environments*, Presented at Corrosion 2000, Orlando, FL, March 26-31, 2000, NACE International, Houston TX 77218
11. Uhlig, HH, 1948, *Corrosion Handbook*, John Wiley & Sons, New York, NY 10158
12. Van Delinder, LS (Ed), 1984, *Corrosion Basics*, NACE International, Houston, TX 77084
13. Wilding, MW & BE Paige, 1976, *Survey on Corrosion of Metals and Alloys in Solutions Containing Nitric Acid*, ICP-1107, Idaho National Engineering Laboratory, Idaho Falls, ID

PLANT ITEM MATERIAL SELECTION DATA SHEET

24590-WTP-RPT-PR-04-0001, Rev. B
WTP Process Corrosion Data

PROCESS CORROSION DATA SHEET

Component(s) (Name/ID #) Treated LAW evaporator condensate vessel (TLP-VSL-00002)

Facility PTF

In Black Cell? No

Chemicals	Unit[1]	Contract Maximum		Non-Routine		Notes
		Leach	No leach	Leach	No Leach	
Aluminum	g/l	3.1E-02	3.3E-02			
Chloride	g/l	4.2E-02	5.4E-02			
Fluoride	g/l	9.2E-04	1.2E-03			
Iron	g/l	3.4E-03	4.1E-03			
Nitrate	g/l	5.7E-01	7.1E-01			
Nitrite	g/l	4.1E-02	5.2E-02			
Phosphate	g/l	7.1E-02	8.9E-02			
Sulfate	g/l	2.7E-02	3.4E-02			
Mercury	g/l	4.5E-04				
Carbonate	g/l	1.3E-01	1.6E-01			
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-TLP-00001, Rev 0
Mass Balance Document: 24590-WTP-M4C-V11T-00005, Rev A
Normal Input Stream #: TLP03
Off Normal Input Stream # (e.g., overflow from other vessels): FRP03, UFP08
P&ID: 24590-PTF-M6-TLP-P0002, Rev 0
PFD: 24590-PTF-M5-V17T-P0005, Rev 0
Technical Reports:

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 68 °F to 167 °F (24590-PTF-MVC-TLP-00002, Rev B)
3. pH approximately 11 to 12

Assumptions:

Note: Vendor submittal (24590-QL-POA-MEVV-00001-14-00002, Rev. 00C) updates operating temperature. Normal operating temperature is 104 °F.

24590-WTP-RPT-PR-04-0001, Rev. B
WTP Process Corrosion Data

4.13.4 Treated LAW Evaporator Condensate Vessel (TLP-VSL-00002)

Routine Operations

Condensate from the condensers and demister vessel all drain to a common condensate vessel, TLP-VSL-00002. As the condensate vessel fills, the treated LAW evaporator condensate pump recirculates condensate continuously back to the vessel with a portion recycled to the separator vessel for spraying the de-entrainment pads. When the condensate vessel is filled to its high level setpoint, the condensate is directed to the clean condensate tank RLD-TK-00006A/B.

The condensate draining from the primary condenser is monitored for radioactivity. The radiation monitor is located close to the condenser condensate outlet to allow a time lag before any contaminated condensate can reach the condensate vessel. This minimizes the possibility that contaminated condensate can be transferred to system RLD. In the event that the radiation monitor detects high activity, the evaporator is placed into reflux state and the condensate vessel is isolated so that a sample may be retrieved. A manual sampling point is located on the discharge side of the condensate pump. If the condensate is contaminated, it is redirected to the LAW SBS condensate receipt vessels (TLP-VSL-00009A/B) via valving and an evaporator shutdown can be initiated if necessary.

The vessel vent system draws air into the vapor space of the condensate vessel while removing gases. Vacuum control air is withdrawn from the system PVP vessel vent header. The condensate vessel overflows to PWD-VSL-00033.

Non-Routine Operations that Could Affect Corrosion/Erosion

None identified.