PLANT ITEM MATERIAL SELECTION DATA SHEET

R10672006

RLD-VSL-00164 (LAB)

Lab Area Sink Drain Collection Vessel (RLD C3 Vessel)

ISSUED BY
RPP-WTP PDC

- Design Temperature (°F)(max/min): 240/-20
- Design Pressure (psig) (max/min): 15/7
- Location: Lab

Operating conditions as stated on attached Material Selection Data Sheet

Options Considered:

- Vessel contains contaminated liquid effluent at normal operating temperatures less than 92°F.
- Mixing will be provided by pumps and eductors. Solid accumulation at bottom of vessel is anticipated. Wash rings are available for flushing.
- Dilute acid is available for cleaning vessel internals.

Materials Considered:

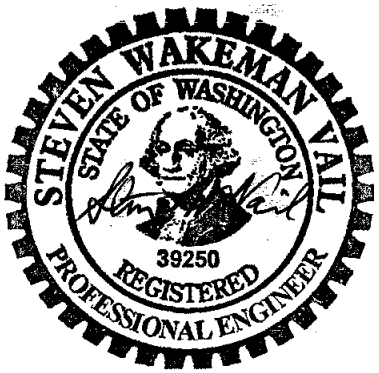
Material (UNS No.)	Relative Cost	Acceptable Material	Unacceptable Material
Carbon Steel	0.23		X
304L (S30403)	1.00		X
316L (S31603)	1.18		X
6% Mo (N08367/N08926)	7.64	X	
Alloy 22 (N06022)	11.4	X	
Ti-2 (R50400)	10.1		X

Recommended Material: UNS N08367 or N08926

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

Process & Operations Limitations:

- Develop flushing/rinsing procedure



4/18/04

EXPIRES: 12/07/07

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This bound document contains a total of 5 sheets.

REV	DATE	REASON FOR REVISION	PREPARER	CHECKER	APPROVER
1	4/18/04	Issued for Permitting Use	DLA	JRD	APR
0	3/4/04	Issued for Permitting Use			

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Corrosion Considerations:

a General Corrosion
In this vessel, the normal pH conditions and temperatures are such that 316L stainless steel would be acceptable if no chlorides are present. However, because of the of expected halide concentration, a 6% Mo alloy will be necessary.

Conclusion:
A 6% Mo alloy is recommended.

b Pitting Corrosion
Chloride is known to cause pitting in acid and neutral solutions. Under the stated conditions, for temperature and pH, a 6% Mo alloy or better is needed.

Conclusion:
Localized corrosion, such as pitting, is common and would be a serious concern at the expected halide levels. Under the stated conditions, 6% Mo is recommended.

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

Conclusion:
Not likely in 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. With the maximum fluid temperature stated at 92 °F and with a large concentration of chlorides, 316L is not recommended. A more resistant alloy such as 6% Mo alloys or better will be needed.

Conclusion:
A 6% Mo alloy or better is recommended.

e Crevice Corrosion
Non-negligible amounts of solids are expected to accumulate at the bottom of the vessel. With the proposed operating conditions, 304L and 316L are not acceptable. A 6% Mo alloy or better is recommended. In addition, see Pitting.

Conclusion:
A resistant alloy such as a 6% Mo is recommended.

f Corrosion at Welds
Other than pitting or crevice corrosion, 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 conditions are suitable for microbial growth. However, liquids received should either be treated or DIW so the possibility of infection is small.

Conclusion:
MIC is not considered a problem.

h Fatigue/Corrosion Fatigue
Not expected to be a concern.

Conclusions
Not believed to be a concern.

i Vapor Phase Corrosion
Vapor phase corrosion is not expected to be a concern.

Conclusion:
Not a concern.

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j Erosion
Velocities within the vessel are expected to be small. 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 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
None expected.

Conclusion:
Not a concern.

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

Conclusion:
Not applicable.

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References:

1. 24590-LAB-MVC-RLD-00002, Rev. A, *Material Selection Data Sheet*
2. 24590-WTP-RPT-M-04-0008, Rev. 2, *Evaluation Of Stainless Steel Wear Rates In WTP Waste Streams At Low Velocities*
3. Davis, JR (Ed), 1987, *Corrosion, Vol 13*, In "Metals Handbook", ASM International, Metals Park, OH 44073
4. Sedriks, AJ, 1996, *Corrosion of Stainless Steels*, John Wiley & Sons, Inc., New York, NY 10158

Bibliography:

1. Davis, JR (Ed), 1994, *Stainless Steels*, In ASM Metals Handbook, ASM International, Metals Park, OH 44073
2. Hamner, NE, 1981, *Corrosion Data Survey*, Metals Section, 5th Ed, NACE International, Houston, TX 77218
3. Jones, RH (Ed.), 1992, *Stress-Corrosion Cracking*, ASM International, Metals Park, OH 44073
4. 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
5. 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.
6. Uhlig, HH, 1948, *Corrosion Handbook*, John Wiley & Sons, New York, NY 10158
7. Van Delinder, LS (Ed), 1984, *Corrosion Basics*, NACE International, Houston, TX 77084

PLANT ITEM MATERIAL SELECTION DATA SHEET
OPERATING CONDITIONS

Materials Selection Data

Component (Name/ID) Radioactive Liquid Disposal Vessel (24590-LAB-MV-RLD-VSL-00164)
System RLD

Operations

Chemicals	Unit	Cold Startup	Normal Operation	Standby/Idle	Cleaning	Accident
		Note 1		Note 2		
Aluminum	g/l		1.51E-02			
Bromide	g/l		3.44E-06			
Chloride	g/l		1.88E+00			
Fluoride	g/l		1.62E-01			
Hydroxide	g/l		1.47E-01			
Iron	g/l		4.80E-03			
Nitrate	g/l		1.98E+00			
Nitrite	g/l		6.89E-03			
Phosphate	g/l		2.26E-03			
TOC[♆]	g/l		1.99E-01			
Sulfate	g/l		3.79E-01			
Undissolved solids	g/l		See comments (1)			
Particle size/hardness	μm (##)		NA			
Other ($NaMnO_4$, Hg, etc)	g/l		3.88E-06 (Hg)			
Carbonate	g/l		7.12E+00			
pH	-		6 to 8			
Dose rate -- β/γ (inside)	Rad		See comments (2)			
Temperature	°F		See comments (3)			
Velocity	fps		NA			
Vibration			NA			
Time of exposure	#		NA			

- % of total; ## - use Mho scale

Based on Calc. No. 24590-LAB-MVC-RLD-00002, Rev. A

Notes:
Note 1: Assume same as normal operations minus radionuclides.
Note 2: Same as normal operation.

Comments:
(1) Total Solids accumulation per month at the bottom of the C3 vessel (RLD-VSL-00164) = 0.20 in.
(2) Activity in C3 vessel: 137-Cs: 1.10E-07 Ci/gal and 90-Sr: 2.52E-06 Ci/gal.
(3) The minimum, normal, and maximum fluid temperatures will be approximately 50°F, 78°F, and 92°F, respectively.

☐ Black Cell

♆ List expected organic species: Potassium hydrogen phthalate, Ammonium hydrogen oxalate, Ethanol, Glacial acetic acid, Chloramine-T

☐ Flushing

Use maximum of 2 significant figures