CORROSION EVALUATION

R10848451

RDP-VSL-00004 (PTF)
Spent Resin Dewatering Moisture Separation Vessel

- Design Temperature (°F)(max/min): 300/-10
- Design Pressure (psig) (internal/external): 15/FV
- Location: Room P-0119

Contents of this document are Dangerous Waste Permit affecting

Operating conditions are as stated on attached Process Corrosion Data Sheet

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 general erosion allowance)

Process & Operations Limitations:

- None

Please note that source, special nuclear, and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA) are regulated at the U. S. Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts that pursuant to AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

Concurrence NA
C & T

REV	DATE	REASON FOR REVISION	PREPARER	CHECKER	MET	APPROVER
3	12/19/07	To correct Rev. C issued with incorrect page 5 of 6	DLAdler	RBDavis	NA	SWVail
2	11/1/07	Incorporate revised PCDS	DLAdler	RBDavis	NA	SWVail
1	3/8/06	Update wear allowance based on 24590-WTP-RPT-M-04-0008	DLAdler	HMKrafft	NA	SWVail
0	7/14/04	Initial Issue	DLAdler	JRDivine	APR	APRangus

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Corrosion Considerations:

Warm air is circulated by a blower to pick up moisture from the spent resin and is cooled and condensed in RDP-VSL-00004.

a General Corrosion
Hamner (1981) lists a corrosion rate for 304 (and 304L) in 2 M HNO_3 of less than 2 mpy. Davis (1994) states the corrosion rate for 304L in 12% HNO_3 will be less than about 1 mpy up to about 212°F.

In this system, the conditions are such that 304L stainless steel will be acceptable.

Conclusion:
Under normal conditions either 304L or 316L will be satisfactory.

b Pitting Corrosion
While chloride is known to cause pitting in acid and neutral solutions, with no chloride present in reportable concentrations, both 304L and 316L stainless steel are acceptable.

Conclusion:
The use of 304L or 316L is acceptable.

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

Conclusion:
Not expected 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 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 is expected to be satisfactory.

Conclusion:
At the normal operating environment, either 304L or 316L is acceptable.

e Crevice Corrosion
Comments under Pitting are generally applicable here.

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)
MIC is not considered a problem in this system.

Conclusion:
Not a concern.

h Fatigue/Corrosion Fatigue
Corrosion fatigue is not expected to be a concern. The pressures encountered are so low and the strength of the material is so comparatively high that corrosion fatigue is not a problem.

Conclusions
Not a concern.

i Vapor Phase Corrosion
Not expected in this system.

Conclusion:
Not considered to be a concern.

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j Erosion
Velocities in 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:
Erosion is 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
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
Vessel normally operates at low pH.

Conclusion:
Not applicable.

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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. C, *WTP Process Corrosion Data*
3. CCN 130177, Zapp, PE, 2000, *Material Corrosion and Plate-Out Test of Types 304L and 316L Stainless Steel*, WSRC-TR-2000-00434, Savannah River Site, Aiken, SC
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. Hamner, NE, 1981, *Corrosion Data Survey*, Metals Section, 5th Ed, NACE International, Houston, TX 77218
7. Sedriks, AJ, 1996, *Corrosion of Stainless Steels*, John Wiley & Sons, Inc., New York, NY 10158
8. Smith, H. D. and M. R. Elmore, 1992, Corrosion Studies of Carbon Steel under Impinging Jets of Simulated Slurries of Neutralized Current Acid Waste (NCAW) and Neutralized Cladding Removal Waste (NCRW), PNL-7816, Pacific Northwest Laboratory, Richland, Washington.

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. Jones, RH (Ed.), 1992, *Stress-Corrosion Cracking*, ASM International, Metals Park, OH 44073
5. 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
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

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Attachment to CCN 163061
Replaces Page A-45 of
24590-WP-RPT-PR-04-0001, Rev C
WTP Process Corrosion Data

PROCESS CORROSION DATA SHEET

Component(s) (Name/ID #) Spent resin slurry vessel (RDP-VSL-00002 A/B/C)
Spent resin dewatering moisture separation vessel (RDP-VSL-00004)

Facility PTF

In Black Cell? Yes (RDP-VSL-00002A/B/C only)

Chemicals	Unit[1]	Contract Max[2]		Non-Routine		Notes
		Leach	No leach	Leach	No Leach	
Aluminum	g/L					
Chloride	g/L					
Fluoride	g/L					
Iron	g/L					
Nitrate	g/L	6.0E+00	6.0E+00			
Nitrite	g/L					
Phosphate	g/L					
Sulfate	g/L					
Mercury	g/L					
Carbonate	g/L					
Undissolved solids	wt%					
Other (NaMnO4, Pb,...)	g/L					
Other	g/L					
pH	N/A					Note 4
Temperature	°F					Note 3, Assumption 1

List of Organic Species:

References

System Description: 24590-PTF-3YD-RDP-00001
Mass Balance Document: 24590-WTP-M4C-V11T-00005, Rev A
Normal Input Stream #: CXP19, CXP18, RDP01
Off Normal Input Stream # (e.g., overflow from other vessels): N/A
P&ID N/A
PFD: 24590-PTF-M5-V17T-00020
Technical Reports:

Notes:

1 Concentrations less than 1x 10^{-4} g/L do not need to be reported, list concentration values to three significant digits max
2. Data developed from a mass balance model which has constituents in the plant feed which are important to corrosion, adjusted to contract maximum values
3. For RDP-VSL-00002ABC: 50 °F to 123 °F (24590-WTP-RPT-ENG-07-007, Rev 0)
4 Minimum pH approximately 1

Assumptions:

1 For RDP-VSL-00004 123 °F maximum operating temperature based on maximum temperature in RDP-VSL-00002ABC, and given that there is no heating in the dewatering unit

4.10.2 Spent Resin Dewatering Moisture Separation Vessel (RDP-VSL-00004)

Routine Operations

The spent resin dewatering moisture separation vessel serves to collected liquid from spent resin dewatering operations performed by the vendor dewatering package (page 9, 24590-PTF-3YD-RDP-00001, Rev 0).

Non-Routine Operations that Could Affect Corrosion or Erosion

None identified.