PLANT ITEM MATERIAL SELECTION DATA SHEET

CNP-EVAP-00001 (PTF)
Cs Evaporator Separator Vessel

ISSUED BY
RPP-WTP PDC

- Design Temperature (°F)(max/min): 250/40
- Design Pressure (psig) (internal/external): 50/15
- Location: incell

Note: Design pressure and temperature information is considered bounding and to be confirmed by Vendor.

Contents of this document are Dangerous Waste Permit affecting

Operating conditions are as stated on attached Process Corrosion Data Sheet

Operating Modes Considered:

- The vessel is at the normal operating pH and 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: UNS N06022

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

Process & Operations Limitations:

- None

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			
0	9/8/04	Issued for Permitting Use	DLA	JRD	APR

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Corrosion Considerations:

Vessel receives eluate from CNP-BRKPT-00002 and transfers the cesium concentrate to HLP-VSL-00029 or HLP-VSL-00027B via lute pot CNP-VSL-00002. Operating temperature range is 122 °F to 140 °F.

a General Corrosion
Davis (1994) states the corrosion rate for 304L in nitric acid will be less than about 0.1 mpy at the bulk temperatures. Normally, at these conditions, zirconium or titanium would be recommended, and a corrosion allowance of as much as 0.8 inches would be needed for a 40 y design life. However, the presence of fluoride will prevent the use of zirconium or titanium. C-22 has a corrosion rate of about 1 mpy in 5 % HNO_3 at boiling. In these solutions with <5 % HNO_3 and <1 % HCl, the corrosion rate will be smaller. The HF is complexed by the excess Al^{+++} and is expected to have little effect.

Conclusion:
In the presence of expected levels of halides, a high nickel alloy such as C-22 will be required. The standard corrosion allowance of 0.04 inch will be acceptable.

b Pitting Corrosion
With C-22, pitting is not expected to be a problem.

Conclusion:
No significant pitting is expected.

c End Grain Corrosion
Not believed to be applicable to this system.

Conclusion:
Not applicable to this system.

d Stress Corrosion Cracking
C-22 is not susceptible to stress corrosion cracking under these conditions.

Conclusion:
Not anticipated.

e Crevice Corrosion
See Pitting.

Conclusion:
See Pitting.

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

Conclusion:
Weld corrosion is not a concern in this system.

g Microbiologically Induced Corrosion (MIC)
The proposed operating conditions are not conducive for MIC.

Conclusion:
MIC is not considered a problem.

h Fatigue/Corrosion Fatigue
Corrosion fatigue is a not expected to be a concern.

Conclusions
Not expected to be a concern.

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i Vapor Phase Corrosion
A potential problem with condensing acids. C-22 is expected to be sufficiently resistant as to eliminate this concern.

Conclusion:
Not expected to be a concern.

j Erosion
There are no solids and the velocities are 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
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. B, *WTP Process Corrosion Data*
3. Davis, JR (Ed), 1994, *Stainless Steels*, In ASM Metals Handbook, ASM International, Metals Park, OH 44073

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. Agarwal, DC, *Nickel and Nickel Alloys*, In: Revie, WW, 2000. *Uhlig's Corrosion Handbook*, 2nd Edition, Wiley-Interscience, New York, NY 10158
3. 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
6. Jones, RH (Ed.), 1992, *Stress-Corrosion Cracking*, ASM International, Metals Park, OH 44073
7. Lustman, B and F Kerze (Editors), 1955, *The Metallurgy of Zirconium*, McGraw-Hill, New York, NY
8. 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
9. Sedriks, AJ, 1996, *Corrosion of Stainless Steels*, John Wiley & Sons, Inc., New York, NY 10158
10. Uhlig, HH, 1948, *Corrosion Handbook*, John Wiley & Sons, New York, NY 10158
11. Van Delinder, LS (Ed), 1984, *Corrosion Basics*, NACE International, Houston, TX 77084
12. Wilding, MW and BE Paige, 1976, *Survey on Corrosion of Metals and Alloys in Solutions Containing Nitric Acid*, ICP-1107, Idaho Chemical Programs, Idaho National Engineering Laboratory, Idaho Falls, ID

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PROCESS CORROSION DATA SHEET

Component(s) (Name/ID #) Cs evaporator separator vessel (CNP-EVAP-00001)
Cs concentrate reboiler (CNP-HX-00001)

Facility PTF

In Black Cell? Yes (CNP-EVAP-00001 only)

Chemicals	Unit[1]	Contract Max		Non-Routine		Notes
		Leach	No leach	Leach	No Leach	
Aluminum	g/l	1.38E+01	1.29E+01			
Chloride	g/l	5.29E+00	5.89E+00			
Fluoride	g/l	6.28E+00	7.02E+00			
Iron	g/l	1.01E+00	1.05E+00			
Nitrate	g/l	5.78E+02	5.80E+02			
Nitrite	g/l	2.93E+01	3.25E+01			
Phosphate	g/l	2.11E+01	2.30E+01			
Sulfate	g/l	1.12E+01	1.25E+01			
Mercury	g/l	1.72E-02	7.88E-03			
Carbonate	g/l	3.95E+01	4.03E+01			
Undissolved solids	wt%					
Other (NaMnO4, Pb,...)	g/l					
Other	g/l					
pH	N/A					Note 2
Temperature	°F					Note 3

List of Organic Species:

References

System Description: 24590-PTF-3YD-CNP-00001, Rev 0
Mass Balance Document: 24590-WTP-M4C-V11T-00005, Rev A
Normal Input Stream #: CNP02, CNP03,CNP12, CNP10,CNP20
Off Normal Input Stream # (e.g., overflow from other vessels): N/A
P&ID: N/A
PFD: 24590-PTF-M5-V17T-P0014, Rev 1
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. pH approximately 0.3 to 14. Operates primarily at acidic end, NaOH added prior to transfer out. Minimum pH based on 0.5 M nitric acid.
3. Tnormal operation 122 °F to 140 °F (24590-PTF-M5C-CNP-00001, Rev 0)

Assumptions:

Breakpot CNP-BRKT-00001 and CNP-VSL-00003 are for non-routine use and are normally empty. These vessels can receive a range of evaporator concentrate.

4.1.4 Cs Evaporator Separator Vessel (CNP-EVAP-00001), Cs Evaporator Concentrate Reboiler (CNP-HX-00001), and Eluate Contingency Storage Vessel (CNP-VSL-00003)

Routine Operations

Eluate from CNP-BRKPT-00002 is gravity-fed through a lute pot, CNP-VSL-00001, into the separator vessel, CNP-EVAP-00001. The Cs evaporator eluate lute pot, CNP-VSL-00001, provides a vacuum seal between CNP-BRKPT-00002 and the Cs evaporator separator vessel, CNP-EVAP-00001. The cesium concentrate is transferred from the Cs evaporator separator vessel using transfer ejectors to send it to vessel HLP-VSL-00028 or HLP-VSL-00027B in the HLP system.

Non-Routine Operations that Could Affect Corrosion/Erosion

If the HLP system cannot accept additional volume at the time of a required transfer, the eluate contingency storage vessel, CNP-VSL-00003, will receive the transfer.