CORROSION EVALUATION

PJV-DMST-00002A/B/C (PTF)
PJV Demister

- Design Temperature (°F)(max/min): 140/40
- Design Pressure (psig) (internal/external): 15/FV
- Location: PT Filter Cave; Room P-0335

Contents of this document are Dangerous Waste Permit affecting

Operating conditions are as stated on attached Process Corrosion Data Sheet

Options Considered:

- Vessels are not designed to be replaceable during the life of the PT facility.
- Remote change-out of the demister cartridge is provided

Materials Considered:

Material (UNS No.)	Acceptable Material	Unacceptable Material
Type 304L (S30403)	X	
Type 316L (S31603)	X	
6% Mo (N08367/N08926)	X	
Hastelloy® C-22® (N06022)	X	
Inconel 625 (UNS N06625)	X	

Recommended Material: Containment –Type 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:

- The demister pad will be rinsed as necessary based on an increased d/p across the pad. Rinsing will limit buildup of solids and thus minimize corrosion.

Concurrence Operations

REV	DATE	REASON FOR REVISION	PREPARER	CHECKER	MET	APPROVER
0	6/3/10	Initial Issue	DLAdler	DMitchell	RBDavis	SWVail

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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 the 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.

This bound document contains a total of 7 sheets.

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Corrosion Considerations:

The demisters are used to remove fine aerosols and mist.

a General Corrosion
Corrosion rates in dilute caustic and water are less than 1 mpy and likely much less.

Conclusion:
Type 304L and type 316L are both expected to be sufficiently resistant with a probable general corrosion rate of less than 1 mpy at up to 200°F.

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

Conclusion:
Under normal conditions, type 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, type 304L and type 316L are both expected to be satisfactory.

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

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 stainless steel 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
Fretting/wear is not anticipated due to the lack of moving parts.

Conclusion:
Not a concern.

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
No acid is anticipated but all alloys are sufficiently resistant to nitric acid.

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-PTF-MVC-10-00003, Rev. 00C, *PTF Vessel Cyclic Datasheet Inputs*
2. 24590-WTP-RPT-M-04-0008, Rev. 2, *Evaluation Of Stainless Steel Wear Rates In WTP Waste Streams At Low Velocities*
3. 24590-WTP-RPT-PR-04-0001, Rev. CB, *WTP Process Corrosion Data*
4. Davis, JR (Ed), 1987, *Corrosion, Vol 13*, In "Metals Handbook", ASM International, Metals Park, OH 44073
5. Sedriks, AJ, 1996, *Corrosion of Stainless Steels*, John Wiley & Sons, Inc., New York, NY 10158

Bibliography:

1. 24590-PTF-MVD-PJV-00004, *Mechanical Data Sheet for 24590-PTF-MV-PJV-DMST-00002A/B/C - Demister*
2. 24590-PTF-M6-PJV-00002, *P&ID - PTF Pulse Jet Ventilation System Inlet Header To Demister Outlet*
3. Agarwal, DC, *Nickel and Nickel Alloys*, In: Revie, WW, 2000. *Uhlig's Corrosion Handbook*, 2nd Edition, Wiley-Interscience, New York, NY 10158
4. 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
5. Davis, JR (Ed), 1994, *Stainless Steels*, In ASM Metals Handbook, ASM International, Metals Park, OH 44073
6. Dillon, CP (Nickel Development Institute), Personal Communication to J R Divine (ChemMet, Ltd., PC), 3 Feb 2000.
7. Hamner, NE, 1981, *Corrosion Data Survey*, Metals Section, 5th Ed, NACE International, Houston, TX 77218
8. Jones, RH (Ed.), 1992, *Stress-Corrosion Cracking*, ASM International, Metals Park, OH 44073
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. 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.
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

CORROSION EVALUATION

24590-WTP-RPT-PR-04-0001, Rev. 0CB
WTP Process Corrosion Data

PROCESS CORROSION DATA SHEETS

Component(s) (Name/ID #) PJV drain collection vessel (PJV-VSL-00002);
PJV demister (PJV-DMST-00002A/B/C)

Facility PTF

In Black Cell? Yes (vessel only)

Chemicals	Unit[1]	Contract Max[2]		Non-Routine		Notes
		Leach	No leach	Leach	No Leach	
Aluminum	g/L	9.77E-04	9.37E-04			
Chloride	g/L	4.31E-04	4.63E-04			
Fluoride	g/L	4.88E-04	5.24E-04			
Iron	g/L					
Nitrate	g/L	7.06E-03	7.49E-03			
Nitrite	g/L	2.23E-03	2.39E-03			
Phosphate	g/L	1.60E-03	1.69E-03			
Sulfate	g/L	8.58E-04	9.20E-04			
Mercury	g/L					
Carbonate	g/L	2.70E-03	2.79E-03			
Undissolved solids	wt%					
Other (NaMnO4, Pb,...)	g/L					
Other	g/L					
pH	N/A					Note 4
Temperature	°F					Note 3

List of Organic Species:

References

System Description: 24590-PTF-3YD-PJV-00001
Mass Balance Document: 24590-WTP-M4C-V11T-00005, Rev A
Normal Input Stream #: PJV04, PJV07, PJV09, demister drains
Off Normal Input Stream # (e.g., overflow from other vessels): N/A
P&ID: N/A
PFD: 24590-PTF-M5-V17T-00021002
Technical Reports: N/A

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. T operation: 59 °F minimum, 77 °F normal, 113 °F maximum (24590-PTF-MVC-PJV-00008, Rev 0, sheet 5)
4. pH will be nominally 9 to 10 but could get as low as 7

Assumptions:

* Referenced calc 24590-PTF-MVC-PJV-00006 has been cancelled. 24590-PTF-MVC-10-00003 assumes operating temperatures 80 °F (normal) and 115 °F (maximum).

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4.7.1.1 Demisters

Routine Operations

The demisters are passive devices used to remove fine aerosols and mist. They have medium removal efficiencies for sub-micron aerosols.

Non-Routine Operations that Could Affect Corrosion or Erosion

Remote changeout of the demister cartridges is provided. Demisters may need to be sprayed down with demineralized water to remove collected solids.