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**INSTRUMENT AIR DEW POINT REQUIREMENTS - 108 PLK
(U)**

by

Fairchild

Westinghouse Savannah River Company
Savannah River Site
Aiken, South Carolina 29808

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TECHNICAL REPORT

**INSTRUMENT AIR DEW POINT
REQUIREMENTS - 108-P, L, K (U)**

Reactor Engineering Department
Field Support Group
WSRC-TR-94-096
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Officer: P.N. Fairchild, Sr. Eng. A.
(Name and Title)
Date: 6/28/94

Instrument Air Dew Point Requirements - 108-P, L, K (U)

BY

Peter N. Fairchild
March 30, 1994

P.N. Fairchild
Peter N. Fairchild, Design Authority Engineer

Date: 6/28/94

Dick W.
Technical Reviewer

Date: 6-28-94

Richard C. Lewis
R. C. Lewis, Field Support Manager

Date: 7/8/94

D.W. Freeman
D.W. Freeman, RSE Manager

Date: 7/21/94

D.B. Rankin
D. B. Rankin, Reactor Engineering Manager

Date: 7/26/94

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Introduction

The 108 Building dew point analyzers measure dew point at atmospheric pressure. Existing 108 Roundsheets state the maximum dew point temperature shall be less than -50°F . After repeatedly failing to maintain a -50°F dew point temperature Reactor Engineering researched the basis for the existing limit. This report documents the results of the study and provides technical justification for a new maximum dew point temperature of -35°F at atmospheric pressure as read by the 108 building dew point analyzers.

Discussion

All instrument air is dried by the 108 air dryers to ensure the air is adequately conditioned. Drying the air minimizes corrosion and protects the instrument air system against freeze damage. The 108 building dew point analyzers verify the air is dried adequately by measuring the water vapor pressure of the instrument air at the outlet of each 108 instrument air dryer. The analyzer then displays the corresponding dew point temperature based on moisture content. The dew point temperature is the temperature at which the air sampled, at a given pressure, would be fully saturated with water vapor if the air were cooled to that temperature. Thus, if the air temperature falls below the dew point temperature condensation will occur in the instrument air piping.

The SRS K Production Reactor SAR, Chapter 9.3.1.2, states the air dryers are capable of drying 500 SCFM of air at 125 psig to a dew point of -15°F . This is consistent with the Original Equipment Manufacturer (OEM) performance rating. A -15°F dew point temperature at 125 psig is equivalent to -50°F at atmospheric pressure, the stated maximum dew point in the 108 roundsheets. Since the equipment performance rating is established at near optimal conditions a more practical approach is to define a maximum dew point temperature in the 108 buildings at a temperature that will adequately protect the system against condensate accumulation. The SRS Engineering Guide for Instrument Air Systems (Reference 1) recommends maintaining the dew point temperature at line pressure at 18°F below the lowest expected ambient temperature. The Engineering Guide specifies using Chapter 24 of the 1989 ASHRAE Fundamentals Handbook to establish the lowest expected ambient temperature. Using this guideline, the maximum dew point temperature required is 2°F at line pressure or -35°F at atmospheric pressure. This limit is based on the 99 percent minimum expected temperature of 20°F . Typically the instrument air (IA) header is maintained between 100-108 psig therefore a line pressure of 104 psig shall be the line pressure used to establish a Plant Operating Specification (POS) limit for maximum dew point temperature. Accumulation of moisture will not occur unless the instrument air temperature falls below 2°F from exposure to outside ambient conditions. Most of the instrument air distribution piping and components that use instrument air are located inside the 105 buildings and are protected from outside air exposure. For components that are exposed to outside conditions administrative freeze protection measures will verify the instrument air lines are water free any time the outside temperature falls below 40°F . Statistically there is a 0 percent chance the outside temperature will fall below 6°F based on regional temperature data. Furthermore, since the components most susceptible to freeze damage are administratively protected at temperatures below 40°F , specifying the maximum dew point limit at $\leq -35^{\circ}\text{F}$ at atmospheric pressure will provide adequate protection for the IA systems in 105 K, L and P Areas.

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While reviewing the K Reactor Safety Analysis Report (SAR), Plant Operating Specifications and operating procedures another problem was noted. The K Reactor SAR, Section 9.3.1.5, Instrumentation Requirements, inaccurately describes the CCR alarm point. The SAR is describing CCR alarm VR-531, Instrument Air Dew Point High and indicates this alarm is received when the 108 building IA dew point temperature is $> -50^{\circ}\text{F}$. Alarm plate VR-531 is set to annunciate at 18% of the recorder scale. When this alarm is received in the CCR the 108 dew point is equal to $+10^{\circ}\text{F}$ at line pressure or -30°F at atmospheric pressure. There are two problems noted based on this finding. 1) The SAR needs a revision to correct the stated alarm point and 2) DPSOL 105-VR-531-K, Figure 1, Dew point Conversion Chart, inaccurately converts the line pressure dew point reading from the dew point recorder to the appropriate dew point temperature at atmospheric pressure. A Procedure Revision Request (Reference 3) to correct Figure 1, submitted in June of 1993, has not been incorporated.

Recommendations

Based on the above discussion Reactor Engineering recommends the following:

- 1) The dew point temperature for the instrument air systems in the 105 K, L and P buildings shall be maintained at $\leq -35^{\circ}\text{F}$ at atmospheric pressure. The dew point analyzers in the 108 buildings shall be used to verify the dew point temperature is less than or equal to -35°F to meet requirements of Reactor Division Administrative Manual, RD-1, RDP 2.17, K Reactor Plant Operating Specifications (U).
- 2) The operating procedures for the instrument air systems shall be revised accordingly to alert the operator prior to exceeding the maximum dew point if line pressure is at a maximum 120 psig as reflected in the SAR. Each of the affected documents listed below shall be revised to reflect a normal dew point range of $\leq -38^{\circ}\text{F}$ at atmospheric pressure: This limit is calculated in the same manner as the P.O.S. limit using a pressure ratio of 9.1633 as a result of the 120 psig maximum header pressure.

DPSOL 105-0000-K, 105 "K" Lay-up Rounds.
DPSOL 105-0000-L, 105 "L" Lay-up Rounds.
DPSOL 105-0000-P, 105 "P" Lay-up Rounds.
DPSOL 108-1566-K, Compressed Air System Log.
DPSOL 108-1566-L, Compressed Air System Log.
DPSOL 108-1566-P, Compressed Air System Log.
DPSOL 108-1568-K, Instrument Air Dryer Operation.
- 3) A SAR Revision Request shall be submitted to change the K Reactor SAR, Section 9.3.1.5, Instrumentation Requirements. Section 9.3.1.5 shall state, "Monitors in the instrument line activate an alarm in the CCR when the dew point, as read in the 108 buildings, is higher than -30°F ."
- 4) DPSOL 105-VR-531-K shall be revised to correct Figure 1 to reflect an accurate conversion from line pressure to atmospheric dew point. Once the procedure change is implemented

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the procedure will accurately reflect that when the Dew Point High Alarm (VR-531) is received at 18 percent of the recorder scale, the dew point temperature at line pressure is + 10 °F or -30 °F at atmospheric pressure as sensed in the 108 buildings.

References

- 1) SRS Engineering Guides, Document 15983-05-G, Instrument Air System, Revision 0, 4/30/93.
- 2) Calculation Sheet M-CLC-G-00208, Rev.0, Peter N. Fairchild, 6/21/94.
- 3) Procedure Request 93-0228, DPSOL 105-VR-531-K, Rev. 1, H.D. Kane, 6/4/93.

List of Figures and Tables

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