ADSORBER BED THERMOCOUPLE

TESTING RESULTS

Adsorber Bed Thermocouple Testing Results

During the course of the initial event, certain thermocouples appeared to provide erroneous temperature indications. These thermocouples were tested and replaced as necessary. All 24 thermocouples presently installed in the adsorber vessels were checked for proper calibration prior to their reinstallation in July 1986 following the extinguishment of the second combustion event.

Temperature element 2N64N0023A was tested by PNPP Metrology Lab personnel to verify the quality and reliability of the type of thermocouples installed in the Unit 1 Off-Gas System. The temperature element as described on GE drawing #174B9371, dated 11/4/71, with rev. level 6 on 10/11/79, is a type E chromel constantan with the following design specifications.

1. Class C pressure integrity 600 lb SS flange (ANSI B16.5) mount

2. Process fluid-air

3. Pressure - 350 psig

4. Temperature - 150°F

5. 18 AWG premium grade wire in ceramic insulation enclosed in 316 series stainless steel sheath 30" x 1/4"

6. Accuracy - special calibration required for ±1.0°F @ 75°F

On June 21, 1986 a functional test was performed on temperature element (2N64N0023A) against a fluke Digital Thermocouple Thermometer with its married probe, L70-R024P, (accuracy ±1.0°F). The data was obtained by using a sand bath which reaches approximately 900°F. The probes were wired together to avoid any temperature gradients. The data indicates that the temperature element had an error of <3°F.

DATA USING SAND BATH

Thermometer °F	TE °F	Error °F
69.2	69.2	0.0
211.3	209.3	2.0
393.5	391.0	2.5
701.2	698.6	2.6
886.0	884.6	1.4

Because of limits of the sand bath, the temperature element (2N64 N0023A) and the thermometer were taken to the CEI 20th St. Lab on June 25, 1986, where they have an ashing furnace. This furnace provides a stable temperature at any point up to approximately 2000°F. The procedure was to place sand within a clay cup that was about 6 inches in diameter into the furnace. The thermometer and the temperature element undergoing testing were inserted into the sand approximately 6-8 inches. The furnace was programmed for the various

temperatures desired until the test was completed. The measurements made June 21, 1986 were consistent with the data taken at 20th St. Lab in the same range. During the checks at the higher temperatures using the furnace, the probes were allowed to equalize in temperature for approx. 45-60 minutes per data point.

DATA USING ASHING FURNACE

Thermometer °F	TE °F	Error °F
508.10	507.60	0.50
698.30	697.60	0.70
888.80	887.10	1.70
1037.48	1034.96	2.52
1186.52	1183.10	3.42
1362.92	1357.70	5.22
1556.42	1548.14	8.28

Upon return to the PNPP Metrology Lab another test was performed to verify repeatability at the lower values. After being exposed to high temperatures for approximately 7 hours the following data was found.

OIL BATH

Thermometer °F	TE °F	Error °F
213.2	212.5	0.7

AMBIENT WATER BATH

Thermometer °F	TE °F	Error °F
71.1	71.0	0.1

The upper temperature limits for protected thermocouples can be between 1000 and 1832°F depending on the manufacturer and the gage of wire used. The nominal upper temperature range if a type E thermocouple is 1832°F and 1600°F for the sheath. (ISA, ANSI MC 96.1 "Temperature Measurement Thermocouples" August 1982, pg. 9 thru 43)

In conclusion, a thermocouple's characteristics may change after exposure to very high temperatures. But the results obtained from the research in the Metrology Lab provides a high degree of confidence that the thermocouples in question were manufactured well and responded properly, even at very high temperatures. Any uncertainty in the testing would stem from unwanted temperature gradients in the furnace or baths and the long sheath of the temperature element.