**ITP HANDFORD TYPE 40 PIN ELECTRICAL CONNECTOR
FAILURE ANALYSIS (U)**

by
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Savannah River Technology Center

October 15, 1993

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SUBJECT DESCRIBERS

Hanford
Jumpers
Pins
Electrical
ITP
H-Area
Retention: Lifetime
WSRC-TR-93-510

ITP HANFORD TYPE 40 PIN ELECTRICAL CONNECTOR FAILURE ANALYSIS (U)

Summary

Corrosion products observed on the ITP Hanford Type 40 pin electrical connectors would be expected to adversely affect the power and control signals supplied to process equipment in the filter cell by the connectors. Corrosion products were consistent with those found on similar pins in DWPF. The recommendations based on the findings in this investigation are as follows:

- 1) Replace male and female rhodium plated pins with gold plated pins.
- 2) Replace the galvanized carbon steel spring on the male connector with a stainless steel spring.

electrical connector. The stains found on the Lexan blocks indicate that moisture was present and had drained out of the holes in the lexan plate. Use of a stainless steel spring would help eliminate this problem. Furthermore, capping the ends of the jumpers when they are removed will ensure that moisture and foreign material does not enter the jumper.

Pitting and corrosion of the rhodium/silver plated ITP 40 pin electrical connectors will result in degradation of current flow or signal quality due to excessive contact resistance. As corrosion of the connectors progresses total breakdown could result. Although some of the pins did not show significant signs of visible corrosion, corrosion of these pins is expected. The possibility of corrosive attack could be significantly reduced by using gold plated pins. Plating quality of the gold pins, which were inspected in the MTS Metallurgical Lab and are used in DWPF, is superior to the rhodium plating on the pins currently installed in ITP. In addition to gold's excellent corrosion resistance and electrical properties other advantages of gold are: 1) widely used in the plating industry, 2) easily plated, 3) use of established industry accepted plating procedures (Military Specifications) and 4) less expensive than rhodium.

The corrosion of the electrical connector pins from the DWPF canyon was resolved by replacing all the rhodium plated pins with gold plated pins. This recommendation was made by the DWPF Materials Committee and was based on evaluation the critical nature of the signals carried by the connector pins, safety and ALARA concerns, the expense of installing new pins following mercury and radioactive runs schedule, and difficulties involved in plating with rhodium. The issues in ITP are similar to those in DWPF. The plating specifications for the DWPF electrical connector pins are detailed in EES920113².

Recommendations

The following are recommendations based on the results of this investigation:

- 1) Replace male and female rhodium plated pins with gold plated pins.
- 2) Replace the galvanized carbon steel spring on the male connector with a stainless steel spring.
- 3) Install protective caps over Hanford connectors when jumpers are removed.

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References

1. K. J. Imrich, Corrosion Of Hanford Connector Pins From The DWPF Melter Jumpers (U), EES910214, Savannah River Site, Aiken, SC 29802 (November 1, 1991).
2. K. J. Imrich, Plating Recommendation And Acceptance Criteria For DWPF Hanford-Type 40 PIN Electrical Connectors (U), EES920113, Savannah River Site, Aiken, SC 29802 (May 6, 1992).

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Figure 1

Photograph of ITP Filter Cell Male And Female 40 Pin
Electrical Connector (Negative No. EE-52646-A)

Figure 2

Energy Dispersive X-Ray Analysis Of Green And White Deposits
 On Male Pin No.36

Figure 3

Energy Dispersive X-Ray Analysis Of Red Deposits On Male
 Pin No.36 And Spring (Spring Was Cleaned With Sand Paper)

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