DUKE COGEMA
STONE & WEBSTER

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

12 March 2004
DCS-NRC-000165

Subject: Docket Number 070-03098
Duke Cogema Stone & Webster
Mixed Oxide (MOX) Fuel Fabrication Facility
Response to Request for Additional Information – DSER Open Item AP-03 (Titanium Fires)

References:
1) A. Persinko (NRC) to J. Giitter (NRC) Memorandum, January 13, 2004 and February 4, 2004, *Summary of Phone Calls with the Applicant: Chemical Safety Open Items for the Mixed Oxide Fuel Fabrication Facility,* dated 06 February 2004

2) P. S. Hastings (DCS) letter to Document Control Desk (NRC), DCS-NRC-0000162, *Response to Request for Additional Information – DSER Open Items MP-01 ($UO_2$) and AP-03 (Titanium Fires),* dated 10 October 2003

3) P.S. Hastings (DCS) letter to Document Control Desk (NRC), DCS-NRC-0000150, *Construction Authorization Request Change Pages and Revised Response to AP-03*, dated 28 July 2003

As discussed in the phone calls of January and February 2004 (Reference 1), Duke COGEMA Stone & Webster (DCS) encloses an amended response (with respect to References 2 and 3) to Open Item AP-03.

If I can provide any additional information, please feel free to contact me at (980) 373-7820.

Sincerely,

Peter S. Hastings, P.E.
Manager, Licensing and Safety Analysis

PSH:KLA:gdh

Enclosure 1: DSER Open Item Response to AP-03

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**Open Item AP-03 Titanium Fires**

**The applicant's hazard and accident analysis did not include events involving titanium, such as titanium fires. Accident events should be evaluated and PSSCs identified as necessary. This applies to the dissolution unit (DSER Section 11.2.1.3.4)**

**Clarification:**

> **The following is excerpted from the 6 February 2004 memorandum from A. Persinko (NRC) to J. Giitter (NRC), regarding the January and February 2004 telephone conversations between DCS and NRC:**
>
> > **In response to an NRC inquiry, DCS is reconsidering a portion of its October 10, 2003 design basis description (see DCS letter DCS-NRC-000162, ADAMS accession number ML032880402) for the prevention of titanium fires in electrolyzers. DCS anticipates that it will revise its previous design basis description and submit the revision to the NRC for review.**

**Reply:**

As discussed in the phone conversations referenced above, DCS is providing the following update to the design basis information for the electrolyzer. In addition, there have been several letters transmitted to the NRC regarding the electrolyzer and the postulated titanium fire, therefore, for ease of review, DCS has included a compilation of PSSCs for the electrolyzer in the table below.

In response to the 6 February 2004 letter referenced above, DCS hereby identifies the guide sleeves in the electrolyzer as a PSSC. Insulation material used as guide sleeves between the Anode and the Titanium shell will be identified during the ISA process and will be capable of withstanding the environmental conditions associated with being submerged in the electrolyzer fluid. If appropriate, a maintenance/change out frequency will be established. This is in accordance with CAR section 5.4.3, pg 5.4-10 (repeated below):

"...In a subsequent step, the adequacy of the IROFS to perform their intended safety function is evaluated through an analysis whose objectives are to: ..."

3. "Document that the specific conditions presented by the process will not compromise the ability of the specified controls to perform their intended safety function."

"To meet these objectives, DCS will include (as appropriate) the following during these evaluations:

- Environmental design considerations (such as temperature, chemical effects, humidity, pressure, radiation fluence, etc. that might be imposed on specific systems, structures, or components under normal, off-normal, and accident conditions). Equipment qualification (EQ) requirements will also be discussed as needed."

As stated above, for ease of review, the PSSCs for the electrolyzer are restated in the table below.

| PSSC | Reference Letter |
|---|---|
| Administrative controls associated with isolation of power to the electrolyzer when the electrolyzer is drained | DCS-NRC-000150, dated 28 July 2003 |
| The sintered silicon nitride barrier<br>• Physically separates the cathode from the anode in the nitric acid solution by serving as a dielectric barrier | DCS-NRC-000162, dated 10 Oct 2003 |
| Polytetrafluoroethylene insulator (PTFE)<br>• Provides insulation/separation between the cathode and anode structures<br>• Provides insulation/separation between the anode and the ground | DCS-NRC-000162, dated 10 Oct 2003 |
| Guide Sleeves<br>• Insulation material used as guide sleeves between the Anode and the Titanium shell will be identified during the ISA process and will be capable of withstanding the environmental conditions associated with being submerged in the electrolyzer fluid. If appropriate, a maintenance/change out frequency will be established. | DCS-NRC-000165, dated 12 Mar 2004 |
| Electrolyzer structure<br>• Seismically designed<br>• Withstands turbulent flow and will not induce vibrations<br>• Maintains geometry (previously identified as geometrically safe for criticality purposes – a PSSC) | DCS-NRC-000162, dated 10 Oct 2003 |

In addition to the above list of PSSCs for the electrolyzer, DCS provided the following information in the letter from DCS to NRC dated 10 October 2003 (letter number DCS-NRC-000162) and restates it here for completeness.

"The electrolysis process takes place in the electrolyzer electrolysis pot. The configuration of the electrolysis pot is that of a vertical cylinder with a cathode compartment and an anode compartment. The cathode compartment is configured as a vertical cylinder at, and aligned with, the vertical axis of the electrolysis pot. The cathodic compartment is bounded by a sintered silicon nitride barrier which separates it from the anodic compartment. The anodic compartment surrounds the cathode compartment in an annular configuration.

The anode and anodic compartment circuit connects to the (+) positive terminal of the power rectifier. At the anode (a platinum electrode), the oxidation reaction oxidizes the silver ions in the anolyte solution. The cathode and cathodic compartment circuit connects to the (-) negative terminal of the power rectifier. At the cathode (a tantalum electrode), the reduction reaction reduces the $H^+$ and $NO_3^-$ ions to HNO2. The sintered silicon nitride barrier between the anode and cathode compartments is non-conductive, has a high dielectric strength, and minimal porosity. It prevents the passage of physical material between the compartments while facilitating ionic transfer. Accordingly, it is designated as a passive PSSC. In addition, the electrolyzer is geometrically safe and is seismically designed.

In addition to the PSSCs identified above, it should be noted that the electrolyzer is operated with nitric acid which provides a liquid heat sink for cooling during operations. Additional protection features also exist to limit operations, if there is current leakage to the titanium shell (anode +) during and after startup. The current leakage detection system is designed as a permissive signal and will stop the startup process (i.e., not allow the power to be turned on during startup) or cease operations (i.e., turn off power to the electrolyzer), if the normal operations set point of 10 mA is exceeded. Another protective feature during operations is the trip circuit of the rectifier. The rectifier (DC power source) supplies the electrolyzer a normal operating current density of 400 A at 30 V. The trip set point for the rectifier is 420 A, and, based on current design, the rectifier is physically incapable of providing more than 900 A. However, even if these two normal protective features fail, the passive PSSCs identified above prevent over current events hypothesized to cause titanium fires."