



DUKE COGEMA
STONE & WEBSTER

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U.S. Nuclear Regulatory Commission
Washington, DC 20555

14 May 2003
DCS-NRC-000134

Subject: Docket Number 070-03098
Duke Cogema Stone & Webster
Mixed Oxide (MOX) Fuel Fabrication Facility
Response to DSER Open Item FS-2

References: 1) R. C. Pierson (NRC), *Draft Safety Evaluation Report on Construction of Proposed Mixed Oxide Fuel Fabrication Facility, Revision 1*, Dated 30 April 2003

As part of the review of Duke Cogema Stone & Webster's (DCS') Mixed Oxide Fuel Fabrication Facility (MFFF) Construction Authorization Request (CAR) documented in the Draft Safety Evaluation Report (Reference 1), NRC Staff identified an open item related to fire safety. Enclosure 1 of this letter provides a response to close the fire safety open item FS-2.

If I can provide any additional information, please feel free to contact me at (704) 373-7820.

Sincerely,

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

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Document Control Desk
DCS-NRC-000134
14 May 2003
Page 2 of 2

Enclosure: 1) Response to DSER Open Item FS-02

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Open Item:

FS-2: The margin of safety of the fire barriers has not been adequately resolved.

Response:

As identified in Attachment Five (5) of NRC letter dated March 5, 2003 transmitting the February 6-7, 2003 DCS/NRC meeting minutes, DCS produced a fire modeling calculation to determine the peak fire temperatures in the 44 fire areas that were discussed in the meeting and previously evaluated for fire duration in the fire severity calculation. The peak fire temperature calculation utilized the assumptions and methodology in the fire severity calculation with the following exceptions:

- For each fire area, the lowest point where burning is expected and fire can freely entrain air is based on design documents in lieu of assuming the lowest point is at the floor level. This maximizes the peak fire temperature indicated by the fire model.
- A fast fire growth curve is assumed for each fire area simulation, unless the fire area contains combustible liquids, in which case an ultrafast fire growth curve is utilized. It was understood that this assumption will likely force the fire area simulation to reach temperatures faster than the ASTM E-119 curve.
- The fire simulations for each of the 44 fire areas were completed and the output from each of the fire simulations was reviewed to determine the acceptability of the peak temperature and time-temperature curve from each simulation with respect to the fire barriers of the corresponding fire area.

The determination of each fire simulation's peak temperature and time-temperature curve was a key output of this calculation. A fire simulation peak temperature and time-temperature curve was considered to be acceptable if it was bounded by the ASTM E-119 time-temperature curve; i.e., it did not exceed the ASTM E-119 curve at any point. In the event a fire simulation peak temperature or time-temperature curve did exceed the ASTM E-119 time-temperature curve, the acceptability of the simulation was contingent on an evaluation of the following curve output:

- The peak fire temperature,
- Whether or not flashover was indicated, and
- How long the ASTM E-119 curve was exceeded.

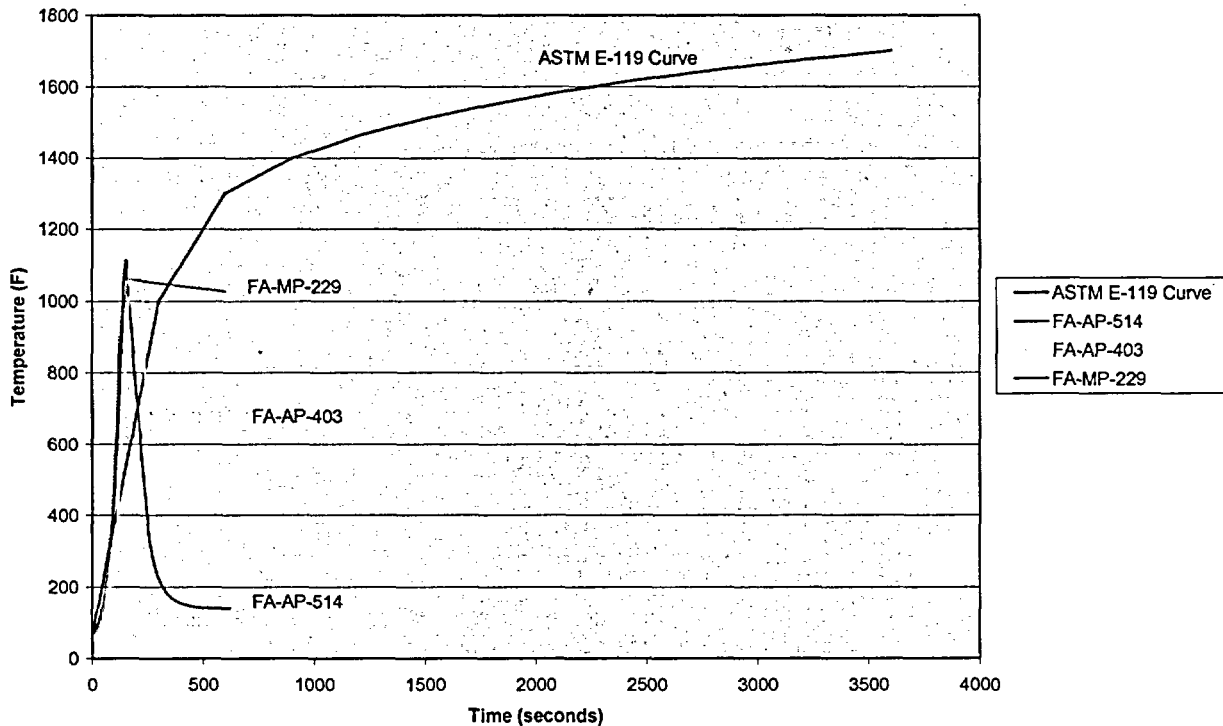
Based on the output of the fire simulations, the worst-case simulations for the flashover and non-flashover simulations where the ASTM E-119 curve was exceeded were analyzed as they bound the other fire simulations.

*Text removed under 10 CFR 2.390.

Enclosure 1 Response to DSER Open Item FS-02

maximum duration of 280 seconds, respectively. The worst-case simulation for a flashover condition involves FA-AP-514 where a maximum temperature of 1129°F was reached and the ASTM E-119 curve was exceeded for 130 seconds. Each of these worst-case simulations is shown below, with comparison to an abbreviated (1-hour) ASTM E-119 curve. Note that the fire barriers in the BMF are rated at a minimum of 2 hours.

Worst-Case Simulations - FA-MP-229, FA-AP-403, and FA-AP-514



As visually evident from the curves above, the worst-case (bounding) simulations are short-lived and have curves that achieve peak temperatures several minutes before the ASTM E-119 curve. It should be noted that the simulated bounding peak temperatures are hundreds of degrees below the ASTM E-119 curve peak temperature. In addition, the length of the excursions outside the ASTM E-119 curve is small. A fire following the ASTM E-119 curve for 2-hours, i.e., a fire loading equal to the rating of the fire-resistant barrier, would expose the fire-resistant barrier to temperatures in excess of 1600°F and heat fluxes in excess of the calculated bounding values (1088°F and 1129°F) for approximately 6810 seconds and 6770 seconds, respectively. Therefore, when the bounding analyses are compared to the standard curve's peak temperature and the total heat flux exposure of the fire barrier, the 280 seconds that the non-flashover fire exceeds the ASTM E-119 curve is approximately 4% of the total heat flux. Similarly, the 130 seconds that the flashover fire exceeds the ASTM E-119 curve is approximately 2% of the total heat flux.

Enclosure 1
Response to DSER Open Item FS-02

Therefore, given the conservatism that has been built into these simulations that maximize the peak temperature determination (as well as the fire severity calculation), such as 100% combustion efficiency (pre- and post-flashover), allowing the fire to burn (pre-flashover) down to a 6% oxygen level, and assuming all combustibles in a fire area are available to burn in a post-flashover environment, the quantity of time these bounding fire simulations exceed the ASTM E-119 curve are insignificant.

As demonstrated by the modeling of a statistically significant number of fire areas, the peak temperatures and the resultant heat fluxes in these rooms have an insignificant impact on the integrity of the fire barriers of the rooms. Since all of the remaining fire areas have a lower quantity of combustibles relative to their floor area and fire barrier ratings, the results of the peak fire temperature calculation can be extrapolated to conclude that the peak temperatures and heat fluxes in the remaining fire areas are bounded by this calculation and are therefore acceptable with respect to the rating of their fire barriers. In accordance with the DCS commitment in Attachment 5 of the NRC's March 5, 2003 letter, DCS has determined that no changes to fire barrier ratings are required. Therefore, no additional analyses are required and this open item can be closed.