MEMORANDUM TO: Eric Leeds, Chief
Special Projects Branch
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

Thru: Joseph G. Giitter, Chief
Enrichment Section
Special Projects Branch **/RA/**
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

FROM: David Brown, Health Physicist
Enrichment Section
Special Projects Branch
Division of Fuel Cycle Safety
and Safeguards
Office of Nuclear Material Safety
and Safeguards

SUBJECT: FEBRUARY 21-22, 2002 IN-OFFICE REVIEW SUMMARY: DUKE COGEMA STONE & WEBSTER CONSTRUCTION AUTHORIZATION REQUEST SUPPORTING DOCUMENTS FOR THE MIXED OXIDE FUEL FABRICATION FACILITY

On February 21-22, 2002, the U.S. Nuclear Regulatory Commission staff conducted an in-office review of supporting documents and information associated with the construction authorization request for the mixed oxide fuel fabrication facility submitted by Duke Cogema Stone & Webster on February 28, 2001. The attachment provides a summary of the meeting.

Docket: 70-3098

Attachment: Mixed Oxide Fuel Fabrication Facility
In-Office Review Summary

cc: P. Hastings, DCS
J. Johnson, DOE
H. Porter, SCDHEC
J. Conway, DNFSB
D. Moniak, BREDL
G. Carroll,GANE
R. Thomas, Environmentalists, Inc.

March 11, 2002

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DATE	3/ 06 /02		3/ 07 /02		3/ 11 /02			

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Mixed Oxide Fuel Fabrication Facility
In-Office Review Summary

Date: February 21-22, 2002

Place: Duke Cogema Stone & Webster (DCS) Offices; Charlotte, NC

Discussion:

The purpose of this in-office review meeting was for staff to review calculations that support DCS's responses to staff requests for additional information. The major purpose of the meeting was for the staff to review calculations that support DCS responses to Nos. 42, 44 and 59 of the staff's June 21, 2001 requests for additional information (RAI). In these RAIs, the staff directed DCS to correct errors in their consequence analysis methodology.

The staff also reviewed calculations in support of responses to: RAI 144, which requested justification for not enclosing the sintering furnaces in gloveboxes; In-Office Meeting Summary Issue 2 and 2E, in which staff asked to review calculations that demonstrate that three loss of confinement events are low consequence events; RAI 143, as modified by the second item 2 of the staff's December 18, 2001, In-Office Meeting Summary, in which the staff asked to review calculations that support DCS's assertion that events involving low-level liquid waste and spent solvent streams are low consequence events; a recent verbal clarification request from the staff, in which the staff noted that the effluent concentrations at the point of release from the ventilation discharge stack exceed the as low as is reasonably achievable (ALARA) design goal for effluent control stated in Section 10.1.1 of the Construction Authorization Request (CAR). The staff also reviewed several chemical accident consequence assessment calculations.

A. Environmental Consequence (EC) Calculations

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed the following documents:

1. DCS01-RRJ-DS-ANS-H-38332-A, "Environmental Consequences for Potential Radiological Releases for Hazard Events, QL1A (IROFS)," February 19, 2002.

The EC calculation addresses three issues identified by the NRC staff in RAIs 42, 44 and 59: (1) The original EC calculation results that were documented in the CAR demonstrated acceptable consequences beyond the controlled area boundary, whereas the regulation (10 CFR 70.61(c)(3)) clearly specifies that this requirement must be met outside the restricted area boundary; (2) The original EC calculation source term documented in the CAR includes a reduction factor on the postulated source term for the respirable fraction, which is not applicable for releases affecting the natural environment; and (3) a high efficiency particulate air (HEPA) filter system efficiency of no greater than 99 percent should be assumed for filters subjected to severe accident conditions.

The revised EC calculation report documents both the revised methodology and the new results. DCS has retained the use of the five factor formula for source term estimation described in NUREG/CR-6410, "Nuclear Fuel Cycle Facility Accident Analysis

Attachment

Handbook." However, the calculation report provides justification for changing the values of the five parameters and the atmospheric dispersion factor used in the calculations.

The five factors are (1) the material-at-risk (MAR), which is generally the amount of material involved in the event, (2) the damage ratio (DR), which is a fraction of the MAR actually impacted by the event, (3) the atmospheric release fraction or rate (ARF or ARR), which is the fraction of impacted MAR that can become airborne, (4) the respirable fraction (RF), the fraction of airborne material that can be inhaled into the human respiratory system, and (5) the leak path factor (LPF), which accounts for the fraction of material that breaches the containment barrier. These factors are multiplied together to derive an amount of material released that is a function of the amount of material present adjusted by four unitless reduction factors. The RF reduction factor is no longer used in the EC calculation. This correction adequately addresses the staff's comment in RAI 44.

Two new atmospheric dispersion factors are documented in the revised EC calculation. The first factor represents the value based on 5 percent meteorology and a distance from the plant stack to the restricted area boundary of 52 meters. The second factor represents the value based on 5 percent meteorology and a distance from the secured warehouse to the restricted area boundary of 28 meters. The second factor is only applied to hazard events SF-2 and SF-13 described in CAR Chapter 5. The derivation and use of these factors adequately addresses the staff's comment in RAI 42.

For those events in which the C3 or C4 confinement systems are credited with mitigating the event consequences to acceptable levels, DCS has retained the HEPA filter efficiency value of 99 percent per stage for each of two stages, which corresponds to a leak path factor of 10^{-4} for the system. The use of this value has not been justified and remains an open issue in the NRC staff's safety evaluation. However, the staff verified that if only 99 percent removal efficiency were allowed, there remains sufficient margin in the DCS EC calculation to ensure that the 10 CFR 70.61(c)(3) performance requirement is still met.

The major changes to the safety assessment described in the revised EC calculation involve "exceptions" to the use of values for the five factors originally documented in the CAR and RAI responses. For example, approximately 14 event consequences were recalculated using revised estimates of the material at risk. Seventeen event consequences changed as a result of using revised estimates of the ARF. The damage ratio was revised for four events. Another 24 events involve the use of a different leak path factor, which generally means that DCS has adopted a different safety strategy for these events (e.g., prevention, rather than mitigation). In total, considering that the consequence analysis for eight events included changes to more than one parameter (e.g., both the MAR and the ARF changed), consequences for a total of 52 events have been revised to meet the 10 CFR 70.61(c)(3) performance requirement. This is nearly 30 percent of the 184 hazard events described in Chapter 5 of the CAR.

The staff present at the meeting will discuss the DCS exceptions with other NRC technical reviewers to verify that the changes to values of the MAR, DR, ARF and LPF are acceptable to the staff.

One of the assumptions that staff questioned during the in-office review involved the reduction of the material at risk in the laboratory from 1.5 kg of plutonium compounds to 0.5 kg, including a reduction in the amount of material at risk directly involved in an explosion to 5 grams. The staff asked DCS to explain how the maximum quantity of plutonium compounds involved in an explosion is limited to 5 grams.

B. Low Consequence Events Involving Facility Workers

NRC staff reviewed the following documents:

1. DCS01-RRJ-DS-CAL-H-38334-A, "ISA MOX Accident Analysis, Facility Worker Dose, QL1," February 21, 2002.

This calculation demonstrates low mitigated dose consequences to the facility worker for three events for which the NRC staff requested additional information. These events are the postulated solid radioactive waste container drop, sintering furnace confinement breach, and the drop of a completed fuel assembly. DCS assumed that no more than one-half of the room volume is available for dispersion of airborne material following the release. The solid waste used in this calculation is of the type likely to contain the most amount of plutonium compound, which is the compacted plutonium dioxide convenience cans. The amount of airborne material in the sintering furnace is derived from operating experience with air filters downstream of the unit's ventilation system.

All of the calculations demonstrate that the consequences would be adequately mitigated by the worker's response, which is to evacuate the affected area. The DCS calculation demonstrates that the dose to the facility worker would be at least ten times lower than the 25 rem intermediate consequence threshold for facility workers. However, it is not clear how the facility worker becomes aware of the loss of confinement event involving the sintering furnace. As a result, the staff will request additional clarification on how an operator becomes aware of the sintering furnace loss of confinement event, which is event PT-6 in CAR Chapter 5.

C. Liquid Waste Stream Event Consequences

NRC staff reviewed the following documents:

1. DCS01-RRJ-DS-ANS-H-38310-A, "Dose Consequences for Potential Radioactive Releases from Hazard Events," QL1, February 28, 2001.

2. DCS01-RRJ-DS-ANS-H-38310-A, "Supplemental for the Analysis 'Dose Consequences for Potential Radioactive Releases from Hazard Events.'"

The staff reviewed the DCS calculations which demonstrated that unmitigated environmental and human health consequences are low following events involving low level liquid waste streams. The scope of the DCS calculation includes event consequences downwind from the postulated breach of containers or transfer lines involving liquid wastes. However, DCS failed to consider the concentration of radioactive material in the liquid waste and whether such concentrations directly exceed the intermediate consequence concentration threshold stated in 10 CFR 70.61(c)(3), which also applies to liquid releases.

For example, the staff have calculated using data provided by DCS that the concentration of plutonium in the solvent waste stream would exceed the 10 CFR 70.61(c)(3) concentration by 20 percent. Therefore, a spill of this waste of any magnitude outside the restricted area would be an intermediate consequence event, regardless of the downwind consequences derived from estimates of the material's evaporation and downwind dispersion. For this reason, the clarification provided in DCS's letter dated February 11, 2002 is inadequate, and this remains an open issue in the staff's review.

D. ALARA Design Goal for Effluent Control

NRC staff reviewed the following documents:

1. Presentation slides for a December 2001 meeting with the South Carolina Department of Health and Environmental Control regarding compliance with the Environmental Protection Agency's National Emission Standards for Hazardous Air Pollutants, 40 CFR Part 61, Subpart H.

2. DCS01-RRJ-DS-CAL-H-38333-B, "MOX Normal Operation Releases," QL2, December 19, 2001.

An ALARA goal for effluent control stated in Section 10.1.1 of the CAR is 20 percent of the concentrations provided in Table 2 of Appendix B to 10 CFR Part 20. It was not clear to NRC staff where the applicant intended to meet this goal. After reviewing estimates of the effluent concentrations in the above calculations, the staff requested additional clarification from the DCS staff on the physical location of the point of compliance. In their verbal response, DCS committed to meeting this goal at the boundary of the restricted area. This commitment is acceptable to the NRC staff because it is more conservative than the regulation requires in 10 CFR 20.1302(b)(2)(i), which describes the point of compliance as the boundary of the unrestricted area.

E. Chemical Consequence Assessment Methodology

NRC staff reviewed the following documents:

1. DCS01-RRJ-DS-CAL-H-35604-A, "Chemical Consequence for Potential Chemical Hazard Events," QL 1A, Items Relied on for Safety, September. 21, 2001.

2. DCS01-RRJ-DS-CAL-H-35602-A, "MFFF Chemicals: Unmitigated Public Consequence Evaluation," QL1, March 6, 2001.

3. DCS01-RRJ-DS-CAL-H-35601-A, “Maximum Threshold Quantity for MFFF Chemical Consequences,” QL1, November 17, 2000.

The staff reviewed the calculations listed above. The purpose of the review was to improve the NRC staff’s understanding of how DCS performed the calculations of chemical accident consequences. The staff did not identify any issues or questions during their review.