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STONE & WEBSTER

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SUBJECT: Docket Number 070-03098
Duke Cogema Stone and Webster
Mixed Oxide Fuel Fabrication Facility
Update to Mixed Oxide Fuel Fabrication Facility
Environmental Report Revisions 1 & 2

Reference: Robert H. Ihde (DCS) letter to U.S. Nuclear Regulatory Commission Document Control Desk, *Mixed Oxide Fuel Fabrication Facility Environmental Report Revisions* 1 & 2, 11 July 2002

On 11 July 2002, Duke Cogema Stone and Webster (DCS) submitted the Mixed Oxide Fuel Fabrication Facility Environmental Report (ER) Revisions 1 & 2 to the U.S. Nuclear Regulatory Commission. Recent changes have resulted in a re-evaluation of the accident scenarios and consequences described in Section 5.5 and Appendix F of the ER. Attached are redlined pages from those sections of the ER indicating the changes resulting from the design modifications.

If you have any questions please contact me at 704-373-7820 or Mary Birch at 704-382-1401.

Sincerely,

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for
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Enclosures: Updated pages for ER Section 5.5 and Appendix F

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The loss-of-confinement event postulated to produce the largest radiological consequences (See Appendix F for a definition of bounding events) is an event caused by a load handling accident of the Jars Storage and Handling Unit. See Section 5.5.2.5 for a description of this event. The bounding radiological consequences associated with this event are provided in Table 5-13. Appendix F provides assumptions associated with this event. The frequency associated with this event is estimated to be unlikely or lower since multiple failures are required for this event to occur. R2 R2

The bounding low consequence event consequence is ~~a spill involving a silver recovery tank.~~ a drop of waste drums in the truck bay. Consequences are presented in Table 5-13b. The frequency of this event is estimated to be not unlikely or lower. R2

The MFFF utilizes many features to reduce the likelihood and consequences of these events as well as other loss-of-confinement events. Key features include reliable and redundant confinement systems; process temperature, pressure, and flow controls; radiation monitoring systems; redundant control systems; emergency procedures; and worker training.

As shown in Tables 5-13a and 5-13b, the radiological consequences at the SRS site boundary are low. Such impacts would not be sufficient to warrant evacuation of the public or interdiction or decontamination of land or food supplies. Tables 5-13a and 5-13b also show that the radiological consequences to the nearest site worker are low. Appendix F provides assumptions associated with this event. R2 R1

Given the low consequences and or low likelihood of this type of accident, the radiological risk from the loss-of-confinement events is low.

5.5.2.3 Internal Fire

A fire hazard arises from the simultaneous presence of combustible materials, an oxygen source, and a sufficient ignition source. A fire can spread from one point to another by conduction, convection, or radiation. The immediate consequence of a fire is the destruction, by combustion or by thermal damage, of elements in contact with the fire. A fire can lead to either the dispersion of radioactive materials and hazardous chemicals or a loss of subcritical conditions. Criticality events and the effects of hazardous chemicals are discussed in Sections 5.5.2.7 and 5.5.2.9, respectively.

Fires can be caused by human error, electrical equipment failures, equipment that operates at high temperatures, uncontrolled chemical reactions, or static electricity.

Fires are postulated to occur and are evaluated for each fire area within the MFFF without regard to the probability of the fire occurring. Fire areas and the associated fire boundary limit the size of the fire and contain the fire within the fire area. MFFF fire areas often correspond, but are not limited, to existing room boundaries. Thus, a facility-wide fire or a fire involving two or more fire areas simultaneously is a remote and speculative event. Postulated fires include the following: R2

5.5.2.9, respectively. Explosions may be caused by human error or equipment failure and include the following:

- Loss of instrument air or offgas exhaust flow in units where radiolysis is possible
- High flow of fluids into tanks or vessels
- Pressurizing chemical reactions in vessels or tanks
- Increase in temperature beyond the safety limit in tanks and vessels
- Incorrect chemical addition/reagent preparation
- Excessive introduction of hydrogen into furnace
- Hydrogen accumulation
- Oxygen leaks
- Organic liquid vapor/methane reactions.

Postulated explosions include explosions involving flammable gases, chemical interactions, and overpressurization events.

The MFFF processes are designed to preclude explosions through the use of reliable engineering features and administrative controls. Key features include scavenging air systems, hydrogen monitoring systems, temperature control systems, chemical addition and concentration control systems, sampling systems, process shutdown controls, operator training, and operations and maintenance procedures. Simultaneous failure of the design features and administrative controls resulting in an explosion and the subsequent release of radioactive materials is highly unlikely. Thus, explosions at the MFFF resulting in a radioactive material release are remote and speculative and need not be considered under NEPA.

Explosions are prevented by design features and administrative controls except in the laboratory. The radiological consequences of an explosion in the laboratory will not exceed regulatory limits., Although explosion events resulting in a radioactive material release at the MFFF are remote and speculative events, a hypothetical explosion event is evaluated. The evaluation conservatively assumes that an explosion occurs in an aqueous polishing process cell and involves the maximum material at risk in any process cell. The radiological consequences of this hypothetical event are presented in Table 5-13. As shown, the impacts to the public and the SRS workers are low. R2

Given the low consequences and/or low likelihood of this type of accident, the radiological risk from explosion events is low.

5.5.2.5 Load Handling

A load-handling hazard arises from the presence of lifting or hoisting equipment used during either normal operations or maintenance activities. A load-handling event occurs when either the lifted load is dropped or the lifted load or the lifting equipment impacts other nearby items. A load-handling event may result in either the dispersion of radioactive materials and hazardous chemicals or a loss of subcritical conditions. Criticality events and the effects of hazardous chemicals are discussed in Sections 5.5.2.7 and 5.5.2.9, respectively.

Load-handling events can be caused by equipment failure or human error.

Load-handling events are postulated to occur and are evaluated for all primary confinements throughout the MFFF without regard to the probability of the initiating event. Postulated load-handling events include the following:

- Drops impacting a glovebox containing powders, pellets, solutions or fuel rods
- Drops impacting aqueous polishing process equipment containing plutonium and/or americium in solution form R2
- Drops involving plutonium in canisters, fuel rods, fuel assemblies, HEPA filters, or waste drums
- Drops involving plutonium in transportation packages or uranium in drums.

The bounding load-handling event is a drop event involving the glovebox in the Jar Storage and Handling Unit. This glovebox contains jars of plutonium powder. The glovebox is postulated to be impacted during maintenance operations by either a lifting device or a lifted load outside of the glovebox, damaging a portion of the glovebox causing some of its contents to drop to the floor, resulting in a release of radioactive material. The bounding radiological consequences associated with this event are provided in Table 5-13a. The frequency associated with this event is estimated to be unlikely or lower since multiple failures are required for this event to occur. R2

The bounding low consequence load handing event ~~is associated with the spill of a silver recovery tank postulated to occur during maintenance operations in the process cell~~ involves waste drums located in the truck bay. The frequency of this event is estimated to be not unlikely or lower as a ~~tank spill~~ waste drum drop could occur due to human error or equipment failure ~~during maintenance activities~~. Consequences are provided in Table 5-13b. R2

The MFFF utilizes many features to reduce the likelihood and consequences of this event as well as other load-handling events. Key features include loadpath restrictions, crane-operating procedures, maintenance procedures, operator training, qualified canisters, reliable load-handling equipment, and ventilation systems with HEPA filters.

As shown in Tables 5-13a and 5-13b, the radiological consequences at the SRS site boundary are low. Such impacts would not be sufficient to warrant evacuation of the public or interdiction or decontamination of land or food supplies. Tables 5-13a and 5-13b also show that the radiological consequences to the nearest site worker are low. Appendix F provides assumptions associated with this event. R2

R2

Table 5-13a. Summary of Bounding Mitigated MFFF Events/Consequences

Bounding Accident[a]	Meteorology[b]	Maximum Impact to Site Worker (mrem)	Maximum Impact to Site Worker (probability of cancer deaths)	Maximum Impact to Public at SRS Boundary (mrem)	Maximum Impact at SRS Boundary (probability of cancer deaths)	Impact on Population within 80 km (person-rem)	Impact on Population within 80 km (LCFs)
Internal Fire	bounding – 95% percentile	<100	~~<4E-5~~ <2E-5	<0.5	~~<3E-7~~ <1E-7	~~<3E-2~~ <6E-7	~~<2E-5~~ <4E-10
Load Handling	bounding – 95% percentile	<150	<6E-5	<1.0	<5E-7	~~<3E-2~~ <3E-6	~~<2E-5~~ <2E-9
Hypothetical Explosion Event	bounding – 95% percentile	~~<500~~ <750	<3E-4	~~<3.0~~ <5.0	~~<2E-6~~ <4E-6	~~<9E-2~~ <2E-5	~~<5E-5~~ <7E-9
Hypothetical Criticality Event	bounding – 95% percentile	<2200	<9E-4	<12	<6E-6	<6	<3E-3

[a] The bounding loss of confinement event is bounded by the load-handling event.

[b] Values calculated for 50th percentile indicate that median meteorology is at least three times lower than the bounding values.

Table 5-13b. Summary of Bounding Low Consequence Events

Bounding Accident	Meteorology[a]	Maximum Impact to Site Worker (mrem)	Maximum Impact to Site Worker (probability of cancer deaths)	Maximum Impact to Person at Site Boundary (mrem)	Maximum Impact at Site Boundary (probability of cancer deaths)	Impact on Population within 80 km (person-rem)	Impact on Population within 80 km (LCFs)
Loss of Confinement	bounding – 95% percentile	~~<2~~ <500	~~<4E-7~~ <3E-4	~~<1E-2~~ <4	~~<5E-9~~ <2E-6	~~<8E-4~~ <1E-5	~~<4E-7~~ <5E-9
Internal Fire	bounding – 95% percentile	<500	~~<2E-4~~ <3E-4	~~<4~~ <4	~~<2E-6~~ <2E-6	~~<5E-3~~ <1E-5	~~<3E-6~~ <5E-9
Load Handling	bounding – 95% percentile	~~<2~~ <500	~~<4E-7~~ <3E-4	~~<1E-2~~ <4	~~<5E-9~~ <2E-6	~~<8E-4~~ <1E-5	~~<4E-7~~ <5E-9
Hypothetical Explosion Event	bounding – 95% percentile	N/A	N/A	N/A	N/A	N/A	N/A
Hypothetical Criticality Event	bounding – 95% percentile	N/A	N/A	N/A	N/A	N/A	N/A

[a] Values calculated for 50th percentile indicate that median meteorology is at least three times lower than the bounding values

filters is the product of the individual leak path factors for successive filter stages. Thus, a leak path factor of 1E-04 was applied for the HEPA system. The combination of efficiencies is more conservative than the value of 2E-06 presented in NRC 1998d (Section F.2.1.3) for filters protected by pre-filters, sprinklers and demisters. R1

The estimation of event frequency is especially subject to considerable uncertainty. The uncertainty in estimates of the frequency of Highly Unlikely events can be several orders of magnitude. For this reason, event frequency is reported qualitatively, in terms of broad frequency bins, as opposed to numerically.

The analysis uses an extremely conservative approach with respect to frequency. All natural phenomena hazards and external man-made hazards are considered unless their probability of impacting the MFFF is extremely low, and all internal hazards generated by the MFFF design and operations are considered. For these hazards, unmitigated events are evaluated without regard to the frequency of the initiating event. In most cases, the failure of many features is required for the bounding event to occur.

F.6 ADDITIONAL INTERNAL EVENT DESCRIPTIONS

This section provides supporting details for the bounding events described in Section 5.5. Two types of events are presented; bounding events and bounding low consequence events. Bounding events are defined as events that have a frequency greater than or equal to unlikely and that have the potential to produce the largest unmitigated consequences. Bounding low consequence events are defined as events that have the potential to produce the largest ~~unmitigated~~ consequences that are below the intermediate consequence criteria of 10CFR70.61 for the public, the site worker, and the environment.. These events do not require mitigation or prevention, however mitigation may be available from features required for other events. All events identified in the PHA (Preliminary Hazards Analysis) are evaluated to determine the bounding and bounding low consequence events.

F.6.1 Loss of Confinement

R1

The bounding loss of confinement event is an event caused by a load handling accident of the Jar Storage and Handling Unit. (See Section F.6.3 for a description of this event.) The bounding radiological consequences associated with this event are provided in Table 5-13a. The frequency associated with this event is estimated to be unlikely or lower since multiple failures are required for this event to occur.

The bounding low consequence event is a ~~spill of the silver recovery tank.~~ drop of waste drums located in the truck bay. (See Section F.6.3 for a description) ~~This unit contains americium and other metals that have been removed during the plutonium purification process. The evaluation conservatively assumes the tank is full to its service capacity resulting in a total MAR for this event of 2.2 lb (1.0 kg) of americium in solution. The ARF is 2E-5, the RF is 1.0, and the DR is conservatively assumed to be 1.0.~~ Consequences are presented in Table 5-13b. ~~Although not required in order to satisfy the requirements of 10CFR70.61, an LPF of 1E-4 is applied to this event because the event takes place in a process cell and the release of the radiological material would pass though multiple banks of credited HEPA filters.~~ R1

The MFFF utilizes many features to reduce the likelihood and consequences of these events as well as other loss-of-confinement events. Key features include reliable and redundant confinement systems; process temperature, pressure, and flow controls; radiation monitoring systems; redundant control systems; emergency procedures; and worker training.

F.6.2 Internal Fire

The bounding internal fire event is a fire in the fire area containing the Final Dosing Unit. This unit contains polished plutonium powder for the purpose of down blending the mixed oxide powder to the desired blend for fuel rod fabrication. This fire area is postulated to contain the largest source term for this event, thus producing the largest consequences. Fire areas with a larger material at risk have a lower damage ratio for this event resulting in a lower overall source term. R2

The evaluation conservatively assumes that a fire occurs in this fire area and impacts the powder stored in this area, resulting in a release of radioactive material. The maximum amount of plutonium in this fire area does not exceed ~~90~~ 136 lb (~~41~~ 64 kg) of polished powder. Due to the low combustible loading in this fire area, just a small fraction of this material would be expected to be involved in the fire. However, the evaluation conservatively uses the entire fire area inventory in the consequence analysis. The damage ratio is assumed to be 1.0, the bounding respirable release fraction is 6E-04, and the bounding leak path factor is 1E-04. The bounding radiological consequences associated with this event are provided in Table 5-13a. R2

R2

The MFFF utilizes many features to reduce the likelihood and consequences of this event as well as other fire-related events. Key features include fire barriers, minimization of combustibles and ignition sources, ventilation systems with fire dampers and HEPA filters, qualified canisters and containers, fire suppression and detection systems, emergency procedures, worker training, and local fire brigades.

The frequency associated with this event is estimated to be Unlikely or lower because multiple failures are required for this event to occur.

The bounding low consequence fire event is due to a fire in a waste drum located in the truck bay. Although most waste drums contain only small amounts of plutonium, the evaluation conservatively assumes that ~~50~~ 80 grams of unpolished plutonium is involved in the fire. The ARF is ~~6E-3~~ 5E-4, the RF is ~~0.1~~ 1.0, the LPF is 1.0, and the DR is 1.0. The results are presented in Table 5-13b. R1

F.6.3 Load Handling

The bounding load-handling event is a drop event involving the glovebox in the Jar Storage and Handling Unit. This glovebox contains jars of plutonium powder. This glovebox is postulated to contain the largest source term for this event, thus producing the largest consequences. Gloveboxes that contain a larger material at risk have a lower damage ratio for this event resulting in a lower overall source term. R1

The glovebox is postulated to be impacted during maintenance operations by either a lifting device or a lifted load outside of the glovebox, damaging a portion of the glovebox causing some of its contents to drop to the floor, resulting in a release of radioactive material. The maximum amount of plutonium in this glovebox is approximately ~~743~~ lb (~~337~~ kg) of polished powder. Due to the large glovebox size, it is expected that just a small fraction of this amount would be involved in the event. However, the evaluation conservatively uses the entire glovebox inventory in the consequence calculations. The damage ratio is assumed to be one, the bounding respirable release fraction is 6E-04, and the bounding leak path factor is 1E-04. The bounding radiological consequences associated with this event are provided in Table 5-13a. R2

The MFFF utilizes many features to reduce the likelihood and consequences of this event as well as other load-handling events. Key features include loadpath restrictions, crane-operating procedures, maintenance procedures, operator training, qualified canisters, reliable load-handling equipment, and ventilation systems with multiple banks of HEPA filters. R1

The frequency associated with this event is estimated to be Unlikely or lower because multiple failures are required for this event to occur.

The bounding low consequence load handling event ~~is a spill of the silver recovery tank. This event differs from the previous loss of confinement bounding low consequence event in the respect that this event is postulated to occur during maintenance operations in the process cell. During maintenance operations, the tank contains a minimal amount of MAR to minimize the potential exposure to operators. However, for conservative evaluation of the event, the tank is assumed to be full resulting in a total MAR of 2.2 lb (1.0 kg) of americium in solution form.~~ The ARF is ~~2E-5,~~ the RF is ~~1.0~~, and the DR ~~is~~ conservatively assumed to be 1.0. ~~Although not required in order to satisfy the requirements of 10CFR70.61, an LPF 1E-4 is applied to this event because the event takes place in a process cell and the release of the radiological material would pass though multiple banks of credited HEPA filters.~~ Consequences are presented in Table 5-13b. R1

F.6.4 Hypothetical Criticality Event

The MFFF processes are designed to preclude a criticality event through the use of reliable engineered features and administrative controls. Adherence to the double contingency principle, as specified in ANSI/ANS-8.1 (ANSI/ANS 1983b), is employed. Simultaneous failure of the criticality controls is Highly Unlikely.

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...involves waste drums located in the truck bay. Waste drums are stored inside the MFFF, then moved to the truck bay and placed on a truck for transport off the MFFF site. Waste drums contain small amounts of radioactive material, and only a small number of waste drums are transported at one time, thus the maximum MAR estimated to be involved in the load handling event is 80 grams of unpolished plutonium powder.

Although criticality events at the MFFF are prevented, a generic hypothetical criticality event is evaluated. A bounding source term of 10^{19} fissions in solution is evaluated consistent with guidance provided in Regulatory Guide 3.71 (NRC 1998c). Airborne releases and direct radiation result from the criticality. The direct radiation contribution is negligible due to the shielding provided by the building and the distance to the site worker and the offsite public. Airborne releases are calculated consistent with the guidance of Regulatory Guide 3.35 (NRC 1979). The leak path factor for gases and particulates is 1.0 and 1E-04, respectively. The evaluation is based on 88 lb (40 kg) of unpolished plutonium, the maximum tank inventory of plutonium in solution. The radiological consequences associated with this event are shown in Table 5-13a. R2

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F.6.5 Hypothetical Explosion Event

The MFFF processes are designed to preclude explosions through the use of reliable engineered features and administrative controls, the simultaneous failure of which is Highly Unlikely.

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Although explosion events at the MFFF are Highly Unlikely, a generic hypothetical explosion event is evaluated. The evaluation conservatively assumes that an explosion occurs and involves the entire material at risk within a process cell. The maximum amount of plutonium in any process cell is approximately 132 lb (60 kg) of unpolished plutonium. Because the material at risk is in three separate tanks within this cell, only a fraction of this amount would be involved in the event. However, the evaluation conservatively uses the entire process cell inventory in the consequence calculation. The damage ratio is assumed to be one, the bounding respirable release fraction is 0.01, and the bounding leak path factor is 1E-04. The radiological consequences of this hypothetical event are presented in Table 5-13a. R1

and airborne release fraction are

F.6.6 Chemical Releases

Consequences of chemical releases were determined for a potential release of each chemical. For evaporative releases, the chemical consequence analysis modeling for public consequences used the ALOHA code (EPA 1999), the ARCON96 code (NRC 1997), and the MACCS2 code (NRC 1998a) to calculate the maximum airborne chemical concentration at the SRS boundary (5.0 miles from the MFFF). R1

An evaporation model extracted from the ALOHA code was used to calculate a release from a spilled or leaked chemical, which is assumed to form a puddle one-centimeter deep. A spill or leak from the largest tank or container holding the chemical was modeled. Consideration for spill size, location, container integrity, and chemical concentration was included in the evaluation. R2

Calculated concentrations were compared to Emergency Response Planning Guidelines (ERPGs) or to Temporary Emergency Exposure Limits (TEELs). TEELs describe temporary or equivalent exposure limits for chemicals for which official Emergency Response Planning Guidelines have not yet been developed. This method was adopted by DOE's Subcommittee on Consequence Assessment and Protective Action (SCAPA). The SCAPA-approved methodology published in