DUKE COGEMA
STONE & WEBSTER

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DCS-NRC-000081

Subject: Docket Number 070-03098
Duke Cogema Stone & Webster
Mixed Oxide Fuel Fabrication Facility
Construction Authorization Request
Clarification of Responses to NRC Request for Additional Information

As part of the review of Duke Cogema Stone & Webster's (DCS') Mixed Oxide Fuel Fabrication Facility (MFFF) Construction Authorization Request (CAR), NRC Staff requested clarifications of DCS' responses to NRC's Request for Additional Information (RAI). These clarifications were discussed during a series of teleconferences and meetings between NRC Staff and DCS. The majority of the clarifications are noted in the NRC meeting summaries from A. Persinko to E. Leeds dated 03 November 2001, 06 November 2001, and 18 December 2001. DCS provided part of the requested information by letter DCS-NRC-000074 dated 05 December 2001.

Enclosure A to this letter provides additional responses to NRC clarification requests. The responses address clarifications regarding material handling, nuclear criticality safety, safety assessment of design bases, instrumentation and control, human factors, electrical, and fire protection. Additionally, DCS determined that a portion of the text was inadvertently missing from the clarified response to RAI 162 provided in the 05 December 2001 letter. This was discussed with Fred Burrows of the NRC Staff, and the response has been corrected in Enclosure A.

As noted in the previous letter, DCS anticipates additional letters addressing the remaining clarification requests by NRC Staff. A summary of the remaining action items is provided in Enclosure B. Providing these clarifications remains among DCS' highest priorities. If you have any questions, please contact me at (704) 373-7820.

Sincerely,

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Enclosures: Responses to NRC Clarification Requests
Summary of Remaining Action Items

xc (with enclosures):

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Enclosure A
Responses to NRC Clarification Requests

HEAVY LOADS/MATERIAL HANDLING

Clarification Requested:

RAI 183, 185, 186: DCS committed to provide clarifications related to material transport systems on the principal structures, systems and components (SSCs) for material handling equipment (i.e., provide examples) {06 Nov 2001 item 1E}

RAI 186: DCS committed to provide clarifications related to material transport systems on the term "engineered equipment" {03 Nov 2001 item 2C and 06 Nov 2001 item 1D}.

Response:

Certain design features associated with material handling equipment may be relied upon for safety as discussed in CAR Chapter 5, which describes PSSCs at the system or functional level. The term "engineered equipment" is intended to distinguish between engineered controls and administrative controls. Responses to RAI questions 183, 185, and 186 deal with engineered controls and not administrative controls.

When the CAR refers to "material handling equipment," it is referring to engineered features. "Material handling controls" refers in general to administrative controls; as the design and ISA evolve, certain material handling (*i.e.*, administrative) controls may involve the use of engineered controls (*e.g.*, controls of a crane's lift height, where not limited by the design itself, could result in hard stops or limit switches, etc.) Specific controls will be identified as part of the ISA.

Material handling equipment used at the MFFF includes the items identified in the previous response to RAI 183, and additionally, turntables outside of gloveboxes. Examples of specific features of this equipment that may be designated as IROFS are provided in the previous response to RAI 185. These specific features are examples of the "engineered equipment" in CAR 5.5.2.3. Additional features that may be designated at IROFS include indexers, speed limiters, and bumpers. The specific IROFS will be identified during the ISA associated with the detailed design.

Not all material handling equipment will be designated as IROFS, but rather only the specific subcomponent design feature relied on for safety. As part of detailed design, it will be demonstrated that a load drop inside a glovebox does not lead to a confinement breach as discussed in the previous response to RAI 186. The safety strategy is as follows:

- Process equipment that forms a portion of the confinement boundary must maintain structural integrity under loading from all normal operating, credible accident, and design basis natural phenomena conditions in such a way as to not compromise performance of the confinement function (exceed requirements of 10CFR70.61).

- Process equipment inside or outside of a glovebox enclosure must not interact with confinement boundary elements during normal operation, credible accident, and design basis natural phenomena condition in such a way as to compromise performance of the confinement function (exceed requirements of 10CFR70.61).

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- Process equipment inside or outside of a glovebox that supports process containers or other loads capable of breaching the confinement boundary must retain its loads during normal operation, credible accident, and design basis natural phenomena conditions, or the confinement barrier must be protected in such a way as to not compromise performance of the confinement function (exceed requirements of 10CFR70.61).

To the extent an SSC is relied upon for complying with the above functions – and therefore for compliance with performance requirements – it will be designated as an IROFS in the ISA.

Additional discussion of administrative controls applicable to control of material handling may be found in a subsequent clarification (*i.e.*, clarification to RAI 186 from 06 Nov 2001 item 2A, found in the *Safety Assessment of Design Bases* section below).

Table 1 below clarifies the entries in various tables from CAR Chapter 5 with respect to material handling controls and equipment.

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Table 1 Comparison of Material Handling Engineered and Administrative Controls[1]

CAR Table	Event Group	Principal SSC	Safety Function	Clarification
Table 5.5-10	Rod handling operations	Material Handling Controls	Ensure proper handling of primary confinement types outside of gloveboxes	Administrative: refers to proper handling of assemblies
		Material Handling Equipment	Limit damage to fuel rods/assemblies during handling operations	Engineered: refers to engineered features associated with elevator, gantries, stacker retriever, and trolleys used to handle either single rods or rod trays (see responses to RAIs 183 and 185)
	Breaches in containers outside gloveboxes due to handling operations	Material Handling Controls	Ensure proper handling of primary confinement types outside of gloveboxes	Administrative: refers to ensuring design accommodates criteria associated with 3013 canister and transfer canister (*e.g.*, design precludes exceeding lift heights)
Table 5.5-11	Breaches in containers outside gloveboxes due to handling operations in C2 and C3 areas	Material Handling Controls	Ensure proper handling of primary confinement types outside of gloveboxes	Administrative: refers to ensuring design accommodates criteria associated with 3013 canister and transfer canister (*e.g.*, design precludes exceeding lift heights)

[1] As the design and ISA evolve, certain material handling (*i.e.*, administrative) controls may involve the use of engineered controls (*e.g.*, controls of a crane's lift height, where not limited by the design itself, could result in hard stops or limit switches, etc.). Specific controls will be identified as part of the ISA.

HEAVY LOADS/MATERIAL HANDLING

Table 1 Comparison of Material Handling Engineered and Administrative Controls[1]

Table 5.5-16	AP/MP C3 Glovebox Areas	Material Handling Controls	Prevent impacts to the glovebox during normal operations from loads outside or inside the glovebox that could exceed the glovebox design basis	Administrative: refers to ensuring design criteria such as separation of process equipment from contact with glovebox windows are satisfied
		Material Handling Equipment	Prevent impacts to the glovebox through the use of engineered equipment	Engineered: includes engineered features such as hard stops, interlocks, etc.
	C2 – 3013 Canister	Material Handling Controls	Ensure that the design basis lift height of the 3013 canisters is not exceeded	Adminstrative: refers to ensuring design accommodates design basis of 3013 canister
	C2 – 3013 Transport Cask	Material Handling Controls	Ensure that the design basis lift height of the 3013 canisters is not exceeded	Administrative: refers to ensuring design accommodates design basis of 3013 transport cask
	C2 – MOX Fuel Transport Cask	Material Handling Controls	Ensure that the design basis lift height of the MOX fule transport cask is not exceeded	Administrative: refers to ensuring design accommodates design basis of transport cask
	C2 – Transfer Container	Material Handling Controls	Ensure that the design basis lift height of the transfer container is not exceeded	Administrative: refers to ensuring design accommodates design basis of transfer container
	C2 – Final C4 HEPA Filter	Material Handling Controls	Prevent load handling activities that could potentially lead to a breach in the final C4 HEPA filters	Administrative: refers to ensuring design provides for limiting such activities where an impact could occur.
	Facilitywide	Material Handling Controls	Prevent load handling events that could breach primary confinements	Administrative: refers to ensuring design provides for limiting such activities where an impact could occur.

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Table 1 Comparison of Material Handling Engineered and Administrative Controls[1]

Table 5.5-17	C2 – 3013 Canister	Material Handling Controls	Ensure that the design basis lift height of the 3013 canisters is not exceeded	Adminstrative: refers to ensuring design accommodates design basis of 3013 canister
	C2 – 3013 Transport Cask	Material Handling Controls	Ensure the design basis lift height of the 3013 transport cask is not exceeded	Administrative: refers to ensuring design accommodates design basis of 3013 transport cask
	C2 – Transfer Container	Material Handling Controls	Ensure that the design basis lift height of the transfer container is not exceeded	Administrative: refers to ensuring design accommodates design basis of transfer container
	C2 – Final C4 HEPA Filter	Material Handling Controls	Prevent load handling activities that could potentially lead to a breach in the final C4 HEPA filters	Administrative: refers to ensuring design provides for limiting such activities where an impact could occur.
	Facilitywide	Material Handling Controls	Prevent load handling events that could breach primary confinements	Administrative: refers to ensuring design provides for limiting such activities where an impact could occur.
Table 5.6-1	N/A	Material Handling Controls	Ensure proper handling of primary confinement types outside of gloveboxes	Administrative: discussed above
			Ensure that the design basis lift heights of primary confinement types (3013 canister, 3013 transport cask, MOX fuel transport cask, and transfer containers) are not exceeded	
			Prevent load handling activities that could potentially lead to a breach in the final C4 HEPA filters	
			Prevent impacts to the glovebox during normal operations from loads outside or inside the glovebox that could exceed the glovebox design basis	
			Prevent load handling events that could breach primary confinements	

HEAVY LOADS/MATERIAL HANDLING

Table 1 Comparison of Material Handling Engineered and Administrative Controls[1]

Table 5.6-1	N/A	Material Handling Equipment	Limit fuel damage to fuel rods/assemblies during handling operations	Engineered: discussed above
			Prevent impacts to the glovebox through the use of engineered equipment	

NUCLEAR CRITICALITY SAFETY

Clarification Requested:

RAI 83: DCS agreed to provide additional justification for parameters in Tables 6-1 and 6-2 (containing dominant controlled parameters by process step), which are assumed to be less than optimal values {03 Nov 2001 item 3B}

Response:

Based on DCS' notes during the associated discussion with the Staff, this question originated as a request for clarification of criticality control units shown in Tables 6-1 and -2 with *no* highlighted criticality control mode (*i.e.*, solvent recovery mixer settlers, acid recovery, and silver recovery in Table 6-1; there are no examples in Table 6-2). As discussed with the Staff and indicated in the notes associated with Table 6-1, concentration for each of these examples is controlled in upstream units.

With regard to entries in the tables that contain less than optimal values (*e.g.*, density and isotopics for several control units), Note 1 of each table addresses the fact that these parameters are not directly controlled by the process. Rather they represent bounding conservative values based on the defined limits of the process or material itself (*e.g.*, Pu-240 content is controlled by constraints on material introduced into the process). Therefore, values that may appear sub-optimal are nonetheless bounding because they represent the maximum credible conditions.

All criticality control modes, including the values for controlling parameters, will be fully justified in nuclear criticality safety evaluations in support of the ISA.

SAFETY ASSESSMENT OF DESIGN BASES

Clarification Requested:

RAI 64: Clarify "Training and Procedures" and show that training and procedures are management measures, not principal SSCs; that the principal SSCs are the worker actions; and add information to radiological protection section regarding respirator procedures and codes {06 Nov 2001 item 2F and 03 Nov 2001 item 5}.

With respect to worker safety, staff sought further clarification on the rationale being used for fire and other slow-acting events. More information on use of masks will be provided {06 Nov 2001 item 2}.

Response:

The following information is added to the previous response to RAI 64 for principal SSCs that may involve the use of administrative controls:

Training and Procedures:

Where events obvious to a facility worker and the worker has time to respond by taking self-protecting action, that action is credited in mitigating consequences to the worker. The CAR identifies several events that may require facility workers in the room where an event occurs to evacuate the room and/or don their masks. The principal SSCs identified to represent this safety function is "Training and Procedures." DCS concurs with the NRC Staff's observation that training and procedures are management measures, and their execution (*i.e.*, worker actions) are the "items" relied on for safety (and, hence, "PSSCs"). For clarification, the name of this principal SSC will be changed to "Facility Worker Action."

Execution of training/qualification programs and the use of procedures are part of the qualitative demonstration of likelihood with respect to a facility worker's actions to protect himself (*e.g.*, by evacuation and/or donning respiratory equipment) under certain scenarios. As described in the CAR, this principal SSC is credited in events such as: assembly or rod handling events, waste drum handling events, glovebox events, and a leak from the sintering furnace. In all cases, the facility worker will be aware of the event, and take appropriate action to minimize dose. A discussion of each is provided below.

A fuel assembly drop event is postulated to occur during transfer. The transfer systems and the training for operators responsible for transfers will assure that this event is unlikely, but it is conservatively assumed to occur over the lifetime of the facility. Because the event occurs during a procedurally-controlled assembly transfer using trained operators who are aware of the assembly position at all times, the event would be readily identified and operators would immediately evacuate the assembly area and/or take personnel protective actions (e.g., don masks). The assembly is structurally robust but the drop is conservatively assumed to result in a release via cracking of the rod

cladding. Some contamination may be released and small amounts of the contamination would become airborne and would be controlled within the ventilation system. The rod drop or damage events are similar to and bounded by the assembly events.

A waste drum drop is postulated to occur during waste drum handling. Waste is packaged inside plastic (*e.g.*, polyethylene) bags, then in drums that are sealed prior to transfer for material accounting, storage, and ultimate shipment. Waste drums are designed to maintain their integrity from a one-meter drop height. Drums are transferred within the facility below the one-meter height. Although drums are stacked for storage above one meter, the storage room is normally unoccupied while drum storage operations are taking place. If a drop were to occur with personnel in the storage room, it would be readily recognized and immediate operator self-protective action would be taken. The consequences of the drop would be limited to a small release of contamination and the contamination would be limited to a small area. Any airborne contaimination would be controlled within the ventilation system.

Loss of confinement events involving a glovebox are evaluated based on MELOX operating experience. See chapter 9 section 1 for a description of the events and their consequences. These events are categorized as a release of glovebox contamination due to glove failures. The consequences of an event that results in no significant pressure change are limited to a small area of glove contamination. Dose consequences do not approach the 10 CFR §70.61 performance criteria because of operator self-protective actions. Events that produce a pressure change will be detected by pressure alarms and would cause immediate operator self-protective action. Large gloveboxes failures are prevented by the design.

The sintering furnace is designed to be operated at a slight overpressure, and is essentially leaktight. Seals failures are not expected to occur. However, a local seal defect is conservatively postulated to occur, resulting in the release of some portion of the furnace atmosphere to the furnace process area. The consequences of this event are low for the following reasons: (1) the furnace atmosphere is continually changed, thus it contains low amounts of airborne radioactive material; (2) the internal furnace pressure is low, thus there is very low energy available to make internal surface contamination airborne and respirable; and (3) various local monitors and alarms (e.g., hydrogen, airborne radiation) would identify the event and cause immediate operator self-protective action.

Worker actions to take self-protection measures are credited in certain scenarios, as discussed above. Much of the training and procedures that constitute management measures in support of these worker actions are provided under the radiation protection program. The radiation protection program is established as good management practice for a facility such as this, and pursuant to 10 CFR 20; it also provides for maintaining exposures ALARA, and provides additional protection features in support of worker safety. Continuous air radiation monitors are positioned close to work locations and

within the ventilation air flow from potential release points. This feature provides additional assurance of an immediate response to a glove failure. Other fixed air monitors are positioned within the process room for general surveillance. Monitors are designed for extremely high plutonium alpha radiation sensitivity – activity as low as 4 DAC-hours is detected (equivalent to doses in the range of a few millirem). Gloves are routinely surveyed for contamination. Gloves are also replaced frequently to prevent loss of confinement due to glove degradation. All workers are provided with respirators that are designed to filter plutonium particulate. Respirators are qualified to ANSI-Z88.2-1992, *Practices for Respiratory Protection*, ANSI-Z88.6-1984, *Physical Qualifications for Respirator Use*, and NUREG-0041, *Manual of Respiratory Protection Against Airborne Radioactive Materials*. The radiation protection program, including appropriate training with respect to worker evacuation, the use of respirators, etc., is a management measure that supports the IROFS of worker actions for self-protection. The basic elements of the program are summarized in section 9.2 of the CAR.

Clarification Requested:

Additional information on the protection of the facility worker for the load handling event involving the final C4 filter within the C2 area. This will likely involve a revision to the response to Request for Information (RAI) 186 {06 Nov 2001 item 2A}.

Response:

The principal SSC, Material Handling Controls, includes the potential controls on material handling equipment as described in additional response to RAI 183, 185, and 186 in this letter, and potential administrative controls.

"Material Handling Controls" is specified as the principal SSC for potential load handling events involving the C4 final HEPA filters (CAR Tables 5.5-16 and -17). Even though these HEPA filters are expected to contain very little material, principal SSCs are conservatively specified. The material handling controls referred to in these tables consists primarily to the administrative control of ensuring the design provides for limiting load-handling activities where an impact to the C4 final HEPA filters could occur. In the current design and operations, there are no cranes or other equipment in the vicinity of the final HEPA filters that could cause a load handling event. Thus there are no credible load handling events during normal operations.

During maintenance operations, maintenance will be performed on the out-of-service train and will be performed in accordance with maintenance procedures. As necessary, precautions will be taken to ensure that no release of material occurs during maintenance operations.

Specific material handling controls will be identified in the ISA.

SAFETY ASSESSMENT OF DESIGN BASES

Clarification Requested:

RAI 135: DCS will provide additional information to the response to RAI 135 to show that the waste transfer line is buried and therefore unlikely to be damaged by normal load handling activities {06 Nov 2001 item 2B}.

Response:

The waste transfer line is a double-walled stainless steel pipe with leak detection and is buried underground and unlikely to be impacted by load handling activities. The waste transfer line will not be routed through yard storage areas where load handling activities are likely to occur. Load handling activities are not expected to occur outside of designated storage areas. The waste transfer line will be designed to accommodate external loads including dead loads (soil pressure) and live loads (wheel loads).

Clarification Requested:

RAIs 135 and 140: Written comparison/analysis demonstrating the proposed MFFF facility's waste streams will meet SRS/DOE WACs, and assurance (at the functional level) from DCS, SRS, and DOE that the site can accept them in the expected quantities generated by MFFF operations {18 Dec 2001 item C3 and CC1*}.

Response:

DCS' contract with DOE states that DOE will provide various host site services including "[t]ransportation and disposal of low level, hazardous, non-hazardous, mixed and TRU waste" [Table H.6, *List of DOE Host Site Services*, Contract No. DE-AC02-99CH10888, p. H-15]. To implement the interface/integration requirements of these services, an agreement has been established between DCS and Savannah River (*i.e.,* DOE-SR and Westinghouse Savannah River Company [WSRC]). It ensures appropriate DOE/DCS/WSRC reviews and approvals and is negotiated between DCS and WSRC, including collaboration on defining the wastes that would be generated at MFFF and handled through the SRS waste management system. Although DOE is committed to accepting the waste generated by DCS as a contractual matter, this agreement provides the means to develop the details of the interface between MFFF and WSRC.

This agreement assessed the acceptability of high-alpha waste at the WSRC facility, defined WSRC high-alpha waste pre-treatment and acceptance requirements, and assessed the means of transfer of high-alpha waste from MFFF to the SRS waste facility.

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* Note on usage: Section C of the 18 Dec 2001 letter contains two action item lists, both beginning with "item 1"; the first list is herein designated beginning with "C1" and the second beginning with "CC1" for clarity.

SAFETY ASSESSMENT OF DESIGN BASES

The baseline reflects this agreement, that is, piping the high-alpha waste to the F-Area Outside Facility (F/OF) for pH adjustment prior to transfer to the high level waste tank farm. A study determined that the annual quantity of silver discharged with the waste would be acceptable under the WAC for the high-level waste tank farm. The highly enriched uranium stream (HEU) is isotopically diluted, in process, from over 90% U-235 to 30% U-235. Before sent to waste management with the high-alpha waste stream, it undergoes further dilution to 1% U-235 to meet the WAC for the high-level waste tank farm.

This agreement also developed the MFFF Waste Management Program to support operations and WSRC acceptance of 100% of MFFF Wastes; defined WSRC waste acceptance requirements and WSRC disposition for MFFF wastes ; and identified MFFF waste processing system requirements or permits.

MFFF waste stream characteristics are summarized in Table 2. The Westinghouse Savannah River Company (WSRC) waste acceptance criteria (WAC) for the various MFFF streams and the associated compliance with the WAC is shown in Table 3.

SAFETY ASSESSMENT OF DESIGN BASES

Table 2 Summary of MFFF Waste Streams

WASTE STREAM	WASTE TYPE	ANNUAL VOLUME (m3) Expected/Max	ANNUAL WEIGHT (t) Expected/Max	CONTAMINATION (mg Pu/kg) Expected/Max	MAIN CHARACTERISTICS Expected/Max
TRU Waste					
(Solid)	Low Contaminated (organics)	42 / 51	5.5 / 6.6	~5	Paper, plastics
	Low Contaminated (miscellaneous)	16 / 19	3.8 / 4.6	~5	Metals
	Low Contaminated	9 / 11	3.6 / 4.4	~10	Zirconium clads, molybdenum boats, Lab wastes
	Highly Contaminated (organics)	37 / 45	5.7 / 6.9	~250	
	Highly Contaminated (miscellaneous)	13 / 16	3.7 / 4.5	~250	
	PuO2 convenience cans (not compacted)	~5 / 5	0.9 / 0.9	~200	
	Dust Catchers 1st barrier filters	~2 / 2.4	~0.1 / 0.1	~1000	Preliminary estimate
	Other active filters	~7 / 8.4	~0.7 / 0.9	Up to 100	Rough Values
	Other TRU Waste	~1/ 1.2	0.4 / 0.5	~200	Grinding wheels, U balls, Lab wastes. Non compactible
	Total Operating TRU waste	132 / 158	24 / 29.4		
High Alpha Activity Liquid Waste					
(Liquid)	Raffinate stream from AP	31.6 / 37.9			24.5 kg Am-241, 84,000 Ci,, Pu<152 g,[H+]=3N, Ga=42 kg, Ag=4 kg, NO3=250 kg / Ag = 5 kg max
	Stripped Uranium Stream	134 / 161			U=16 g/L, Pu <0.1mg/l, [H+]=0.108N, 2,150 kg U/yr / U = 13.4 g/l max.
	Alkaline wash stream	9.4 / 11.28			Pu<13g/yr; U<13g/yr, Na = 96 kg / 116 kg max
	Excess Acid	5			[H+]=13.6N, Am-241< 48 mCi/yr.
	Total High Alpha waste	180 / 215.18			
Operating LLW					
(Solid)	UO2 area wastes (organic)	7 / 14	0.8 / 1.6		U contam, mostly incinerable
	Cladding area waste (organics)	8 / 16	0.9 / 1.8	<1	Mostly incinerable
	Swarf and samples (Zirconium)	1 / 2	~0.2 / 0.4	<0.2	Possible zirconium hazards
	Inner cans (stainless steel)	Up to 7	1.8	<0.2	Bulk volume
	Building ventilation and U area filters	Up to 20 / 40	2.8 / 5.6	<0.3	Bulk volume
	Miscellaneous LLW-non-compactible	0.5 / 1	~0.1 / 0.2	<0.2	Assumed non compactible
	Total Operating LLW waste	43.5 / 80	6.6 / 11.4		
Potentially Contaminated Waste					
(Solid)	Incinerable (organics)	204 / 408	32 / 64	<0.3	Contamination levels are expected to be below the lower limit of detection
	Non Incinerable (miscellaneous)	27 / 54	7 / 14	<0.3	Contamination levels are expected to be below the lower limit of detection
	Total Potentially contaminated Waste	231 / 462	39 / 78		

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Table 2 Summary of MFFF Waste Streams (continued)

WASTE STREAM	WASTE TYPE	ANNUAL VOLUME (m3) Expected/Max	ANNUAL WEIGHT (t) Expected/Max	CONTAMINATION (mg Pu/kg) Expected/Max	MAIN CHARACTERISTICS Expected/Max
LLW					
(Liquid)	Distillate	320 / 384			Am-241<2.9 mCi/yr; [H]=0.02N
(Liquid)	Laboratory rinsing	100			
	Sanitary washing	350			
	Room HVAC condensate	50			
	Total Rinsing Water	500 / 600			<4 Bq alpha/L [<0.14 pCi/ml]
Mixed LLW					
(Liquid)	Excess solvent (TBP & dodecane)	8.8 / 10.56			Pu<17.2mg/yr; [H]=0.007N; α = 1.4 mCi/yr; β = 1.8 mCi/yr.
Non-Hazardous					
(Solid)	Non-Hazardous solid waste	<440 / <880			MOX Process Design Criteria
(Liquid)	Non-Hazardous liquid waste	6500 / 7800			MOX Process Design Criteria
Hazardous					
(Solid)	O&M	0.1			MOX Process Design Criteria
(Liquid)	O&M	1			MOX Process Design Criteria

SAFETY ASSESSMENT OF DESIGN BASES

Table 3 Summary of MFFF Waste Streams and WSRC WAC Requirements

WASTE STREAM	WASTE TYPE	SRS DESTINATION	WAC SECTION / REQUIREMENT	MOX WASTE COMPLIANCE W/ WAC
TRU Waste				
(Solid)	Low Contaminated (organics)	E-Area TRU Pads	WAC section 3.06-E-Area, TRU Pads. Must meet WIPP WAC.	Waste Characteristics: solids >100 nCi/g. No free liquids. Contact Handled TRU, dose rate at contact <200 mrem/hr. Packaging in accordance with WIPP (55-gallon drum, WIPP SWB). Data Package, acceptable knowledge. Only toxicity characteristic inorganic RCRA constituents.
	Low Contaminated (miscellaneous)			
	Low Contaminated			
	Highly Contaminated (organics)			
	Highly Contaminated (miscellaneous)			
	PuO2 convenience cans (Not compacted)			
	Dust Catchers 1st barrier filters			
	Other active filters			
	Other TRU Waste			
High Alpha Activity Liquid Waste				
(Liquid)	Raffinate stream from AP	HLW Tank Farm	WAC section X-SD-G-00001. No waste containing silver, unless quantity is determined by WSRC to be acceptable.	Level of silver in waste stream was evaluated by WSRC to have no impact
	Stripped Uranium Stream	HLW Tank Farm	WAC section X-SD-G-00001. Waste inherently safe.	Weight ratio of U-238/U-235 of 103.
	Alkaline wash stream	HLW Tank Farm	WAC section X-SD-G-00001. No specific provisions.	Meets WAC
	Excess Acid	HLW Tank Farm	WAC section X-SD-G-00001. No specific provisions.	Meets WAC
Operating LLW				
(Solid)	UO2 area wastes (organic)	Compaction/Direct disposal	WAC section 3.17, Low Level radioactive waste. No explosives, gaseous waste, pyrophoric, shock sensitive, and propellant waste. No PCBs, pathogens, hazardous wastes, pressurized containers, incompatible wastes, asbestos, animal carcasses, freon or petroleum contaminated soil.	Waste Characteristics: solids <100 nCi/g. No free liquids. Packaging in 55-gallon drums, which can be emptied, compacted and placed into B-25 boxes.
	Cladding area waste (organics)	Compaction/Direct disposal		
	Swarf and samples (Zirconium)	Compaction/Direct disposal		
	Inner cans (stainless steel)	Compaction/Direct disposal		
	Building ventilation and U area filters	Compaction/Direct disposal		
	Miscellaneous LLW-non-compactible	Compaction/Direct disposal		

SAFETY ASSESSMENT OF DESIGN BASES

Table 3 Summary of MFFF Waste Streams and WSRC WAC Requirements (continued)

WASTE STREAM	WASTE TYPE	SRS DESTINATION	WAC REQUIREMENTS	MOX WASTE COMPLIANCE
Potentially Contaminated Waste				
(Solid)	Incinerable (organics)	Compaction/Direct disposal	WAC section 3.17, Low Level radioactive waste. No explosives, gaseous waste, pyrophoric, shock sensitive, and propellant waste. No PCBs, pathogens, hazardous wastes, pressurized containers, incompatible wastes, asbestos, animal carcasses, freon or petroleum contaminated soil.	Waste Characteristics: solids <100 nCi/g. No free liquids. Packaging in 55-gallon drums, which can be emptied, compacted and placed into B-25 boxes.
	Non Incinerable (miscellaneous)	Compaction/Direct disposal		
LLW				
(Liquid)	Distillate	ETF	WAC section 4.02, F/H ETF, VOC. Toxic gases vapors and fumes, listed wastes prohibited. Radionuclide content <100 dpm/ml alpha to the waste water collection tanks.	No VOC, toxic gases vapors and fumes, or listed wastes. Alpha < 0.24 dpm/ml.
(Liquid)	Laboratory rinsing	ETF		
	Sanitary washing	ETF		
	Room HVAC condensate	ETF		
Mixed LLW				
(Liquid)	Excess solvent (TBP & dodecane)	CIF Solvent Storage Tanks/Commercial	WAC section 3.16, Solvent Storage Tank. Nuclear safety criteria <23 g/1000 gal Fissile Gram Equivalents U-235.	FGE=0.007
Non-Hazardous				
(Solid)	Non-Hazardous solid waste	Three Rivers Landfill	WAC section 3.14, Sanitary WAC. 3Q-ECM 6.2 (Environmental Compliance Manual). Green is Clean and clean associated waste.	No radioactive contamination present.
(Liquid)	Non-Hazardous liquid waste	Sanitary Sewer	NA	NA
Hazardous				
(Solid)	O&M	Haz.Waste Storage Facility	WAC section 3.18, Hazardous, Mixed and PCB WAC. No TRU waste and No Greater than Class C waste sent to HWSF/MWSF. No added radioactivity allowed at HWSF. Physical/chemical forms compatible. Only specified hazardous waste codes will be transferred.	Hazardous and mixed waste storage facilities hold waste for shipment to TSD facility. No TRU waste sent to HWSF/MWSF. Physical/chemical forms compatible. Packaging, labeling and documentation complete per WAC.
(Liquid)	O&M			

INSTRUMENTATION AND CONTROL

Clarification Requested:

RAI 164: DCS stated that smoke is not a design basis condition for the facility electronics systems. DCS response covered fire prevention, movement of smoke, dispersal of electronics, and housing of electronics in cabinets and panels as sufficient to minimize exposure to fire and smoke. Redundant digital control equipment will be located in separate fire areas. DCS stated that if such equipment becomes subjected to smoke, it will be renovated as necessary and tested before being placed back into service. DCS will confirm the above in a letter {03 Nov 2001 item 9, 4th paragraph}.

Response:

Smoke is not a design basis for I&C systems. Where required to meet 10 CFR §70.61 performance requirements, MFFF redundant digital equipment will be located in separate fire areas. Digital control systems and components that have been exposed to a smoke event will be evaluated for repair or replacement following the event. The functionality of the digital control systems will be verified by testing in accordance with the test requirements established by the plant maintenance program for replacement or repair of a digital control component.

Clarification Requested:

RAI 169: Information is requested on what the MPQAP says about software control, i.e., is procured software treated differently from developed software. DCS agreed to clarify that all software is subjected to life-cycle controls as if it were developed software {verbal information request}.

Response:

As a supplement to the response to RAI 169, the MPQAP discusses software control in section 3.2.7. As stated in that response, in particular, the MPQAP invokes ASME NQA-1a (1995) Subpart 2.7 requirements for computer software whether it is purchased, modified existing software, or newly developed software.

Clarification Requested:

RAI 173: Discuss need to qualify IROFS under electromagnetic spectra (including networks). Discuss how EMI was addressed and applicability of RG-1.180 {verbal information request}.

Response:

Electronic control systems are designed to reduce electromagnetic and radio frequency interference by using the methods and practices identified in IEEE 518-1982, IEEE Guide for the Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources, and IEEE 1050-1996, Guide for Instrumentation and Control Equipment

INSTRUMENTATION AND CONTROL

Grounding in Generating Stations. The design will follow the requirements of Regulatory Guide 1.180 regarding EMI required testing and acceptance criteria for IROFS control systems.

Clarification Requested:

RAI 180: DCS response indicates that they will follow the guidance in ISA-S67.04. DCS will clarify its commitment to the guidance in Regulatory Guide 1.105 {03 Nov 2001 item 8E}.

Response:

DSC has committed to using ANSI/ISA S67.04. DCS will apply the 95/95 criteria identified in section C.1 of Regulatory Guide 1.105 and in accordance with Section 4 of ANSI/ISA S67.04 to setpoints credited in the safety analysis as IROFS.

Clarification Requested:

RAI 182: Provide revision level of EPRI TR-106439 used in the response {verbal information request}.

Response:

EPRI report TR-106439, Guideline on Evaluation and Acceptance of Commercial Grade Digital Equipment for Nuclear Safety Applications, does not carry a revision status or level. The "Final Report" for EPRI TR-106439 is dated October, 1996.

Clarification Requested:

RAI 66: Clarify language in the response that "software...will not be the single element of a protection scheme" did not imply that such software is not IROFS {verbal information request}.

Response:

Any software programmable electronic device that is performing a safety function will be designated as IROFS. The software for that safety function will also be designated as IROFS. Any protective functions that are classified as IROFS assigned to software programmable electronic systems will be designed to satisfy the safety system criteria of IEEE 603 and IEEE 7-4.3.2.

Clarification Requested:

Subsequent to the visit to the DCS office, NRC staff also questioned the design basis for the seismic monitoring system. DCS agreed to review this matter and ensure that the design basis for the seismic monitoring system is addressed {06 Nov 2001 item 4, last paragraph and 18 Dec 2001 item B5}.

INSTRUMENTATION AND CONTROL

Response:

The seismic monitoring system is designed to satisfy the criteria provided in Regulatory Guide 3.17-1974, Earthquake Instrumentation for Fuel Reprocessing Plants. The design basis of the seismic monitoring system is that it provides data sufficient to evaluate the response of the confinement structure to the seismic event, provide data to enable an evaluation of other principal SSCs and to initiate a shutdown of process AP and MP systems in the event of a high seismic event. The seismic trip system will satisfy the requirements of IEEE 603.

Clarification Requested:

The staff surveyed some preliminary functional specifications and an architectural diagram of the control systems. DCS stated that the drawings were proprietary. The staff requested that the drawings be submitted for additional design basis understanding; DCS said they would determine if this is feasible {03 Nov2001 item 9, 2nd paragraph and 06 Nov 2001 item 4}.

Response:

The documents reviewed by the Staff represent a level of detail that is greater than that submitted with the License Application (LA) or Integrated Safety Analysis (ISA) Summary. Rather, this level of detail is normally maintained by the licensee and available for NRC review onsite. As these documents evolve with the development of detailed design, the maintaining the Staff on controlled distribution for this level of detail would represent an undue burden. If the documents are not controlled, over time they would become inconsistent with formal, controlled submittals (*e.g.*, the CAR, LA, and ISA Summary). Therefore, DCS believes it would not be appropriate to submit these detailed design documents. However, as indicated previously, NRC Staff may review these (and any other) design documents onsite at any time. Should specific information needs be identified that cannot be resolved by an onsite visit, then DCS would work with NRC staff to address those specific information needs.

Clarification Requested:

The referenced drawings in Table 1 [of the 18 Dec 2001 NRC letter] will be designated quality level QL1, not QL3 as presently shown; software controlled devices will be QL1b {18 Dec 2001 item B1}

Response:

DCS will review the associated drawings and correct any misidentified QL designations. Software-controlled devices that are relied on for safety will be controlled as QL-1 (typically QL-1b, although it is possible some will be QL-1a).

HUMAN FACTORS

Clarification Requested:

RAI 228: DCS agreed to reconsider its rationale for not using NUREG-0711 as guidance in their design review process. With respect to the status of the revision to IEEE Standard 1023, NRC stated that due to issues arising from the last balloting of the IEEE Standard 1023 revision, NRC would provide DCS a draft in approximately a month, and the revision is scheduled to be issued some time in CY 2002 {03 Nov 2001 item 7D}.

Response:

The Human Factor Engineering (HFE) review program described in NUREG-0711 describes a structured, top-down review of the design and engineering process for the development of Human System Interface (HSI) designs for standard-design-certification nuclear power plants. Some information from reactor-based guidance might be useful for design of the MFFF, but most elements of the MFFF design that relate to HSI are based largely on facilities that already exist, and the design process for which is mature.

The HFE process for the HSI of the principal SSCs of the MFFF will consist of a careful review of these existing HSI designs. This review will verify that the designs accord with the guidelines provided in IEEE-1023. The review will use the criteria provided in NUREG-0700, Rev. 1.

DCS has used NUREG-0711 to develop an understanding of the HFE review process. DCS has reviewed, and will continue to review, NUREG-0711 for HFE criteria that may be applicable to the design of the HSI for the control systems of principal SSCs in the MFFF. Additionally, DCS will review the latest issue of IEEE-1023 for applicability once it has been published.

Clarification Requested:

RAI 224: Clarify response that NUREG 0700 and all of the NUREG/CR references in Chapter 12 of the standard review plan as guidance documents would be used as appropriate during the detailed design process for human performance activities associated with maintenance of MOXFFF automated systems {03 Nov 2001 item 7A}.

Response:

Of the many research and advisory reports that have been written, Chapter 12, Human Factors Engineering, of the Standard Review Plan, NUREG-1718, identifies five particular references that were commissioned to develop an understanding of the HFE peculiarities of advanced digital control systems. These studies were performed in an effort to develop the technical basis of HSI guidelines as well as particular guidelines used in future revisions of NUREG 0700. It is appropriate that DCS evaluate the reports to understand the review criteria that could be applied to a review of the design of the HSI of the principal SSCs of the MFFF and to develop an understanding of the technical basis of the guidelines. As noted below, however, some of these reports have little applicability to the MFFF.

HUMAN FACTORS

NUREG/CR-6633, Advanced Information System Design: Technical Baseline and Human Factors Review Guideline, provided a technical basis for the development of guidelines for reviewing the design process applied to developing systems and methods for processing and displaying information to plant operators. Section 9 of this report provides guidelines for reviewing the design processes. Because the MFFF is predicated on existing facilities, the design process for the information processing and display systems has largely been completed and there is limited applicability to the MFFF.

NUREG/CR-6634, Computer-Based Procedure Systems: Technical Basis and Human Factors Review Guidelines, was written to generate a technical basis for developing guidelines for reviewing the efficacy of computerized operations and maintenance procedures. The applicability of this NUREG will be evaluated as part of detailed design.

NUREG/CR-6635, Soft Controls: Technical Basis and Human Factors Review Guidelines, was written to generate a technical basis for developing review guidelines of soft control systems and identify areas where guidelines can not be provided because development of a technical basis requires further research. Section 9 of this report provides guidelines for reviewing soft control systems. DCS will review these guidelines for applicability to the digital controls of the principal SSCs of the MFFF during the HFE verification process.

NUREG/CR-6636, Maintainability of Digital Systems: Technical Basis and Human Factors Review Guidelines, was developed to address maintenance requirements and protocols exercised on digital control systems, which are somewhat different from the maintenance requirements and protocols applied to traditional analog control systems. Section 9 of this report supplies criteria for design practices that contribute to effective maintenance of a digital control system. DCS will review these criteria for applicability to the digital controls of the principal SSCs of the MFFF during the HFE verification process.

NUREG/CR-6637, Human System Interface and Plant Modernization Process: Technical Basis and Human Factors Review Guidance, is oriented to the design process of upgrading the HSI or plant equipment rather than toward the design details of any one specific technology. As such it is not directly applicable to the MFFF which has an existing HSI design that is generally not going to be modified unless specific weaknesses are identified in the review and verification process.

As discussed in the clarification response to RAI 228 above, IEEE 1023 will be used for guidance during the final design of the HSI for the principal SSC control systems. The design of the HSI for the principal SSC control systems will be reviewed using the criteria of NUREG 0700.

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Clarification Requested:

RAI 159: Regulatory Guide 1.100 addresses seismic qualification of electric and mechanical equipment. DCS has committed to IEEE Standard 344-1987 for seismic qualification of electrical equipment. DCS will clarify its commitment to Regulatory Guide 1.100, including providing design basis information with respect to seismic qualification of mechanical equipment {03 Nov 2001 letter, item 8D}.

Response:

The MFFF design criteria for seismic systems and components invokes IEEE 344-1987 and addresses the additional criteria Regulatory Guide 1.100.

Clarification Requested:

RAI 162: DCS has committed to follow the guidance of IEEE Standard 484. DCS will clarify its commitment to the guidance contained in Regulatory Guide 1.128 {03 Nov 2001 item 8F}.

Response:

By letter dated 05 December 2001, DCS provided a response to this request. After subsequent review, DCS determined that a portion of the text was missing from the response and the response addressed the incorrect revision of the regulatory guide. The response to CAR RAI question 162 is amended as noted below to include the following additional information addressing RG 1.128 (note that the applicability of specific requirements indicated below may be impacted by the ISAs determination of the extent of equipment designated as IROFS). Changes from the previous clarification response are denoted by underlines and revision bars:

Regulatory Guide 1.128 <u>Revision 1, October 1978</u> endorses the requirements of IEEE Std 484-1975 as an adequate basis for complying with the design, fabrication, erection, and testing requirements of Criteria 1 and 17 of Appendix A and Criterion III of Appendix B to 10 CFR Part 50 with respect to quality standards applied to installation design and installation of large lead storage batteries, subject to the following:

1. *In subsection 4.1.4 , "Ventilation," instead of the second sentence, the following should be used:*

   "The ventilation system shall limit hydrogen concentration to less than two percent by volume at <u>any location within the battery area.</u>"

The 1996 revision of the standard has the following wording in section 5.4, Ventilation : "The ventilation system shall limit hydrogen accumulation to less than 2% of the total volume of the battery area."

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2. *In subsection 4.2.1, "Location," item 1- The general requirement that the battery be protected against fire should be supplemented with the applicable recommendations in Regulatory Guide 1.120, "Fire Protection Guidelines for Nuclear Power Plants."*

The overall fire protection program at MFFF is in accordance with NFPA 801. In addition, battery rooms shall meet the requirements identified in NFPA 110.

3. *Items 1 through 5 of subsection 4.2.2, "Mounting," should be supplemented with the following:*

   "6. Restraining channel beams and tie rods shall be electrically insulated from the cell case and shall also be in conformance with item 2 above regarding moisture and acid resistance."

In addition, the general requirement in item 5 to use IEEE Standard 344-1975 should be supplemented by Regulatory Guide 1.100, "Seismic Qualification of Electric Equipment for Nuclear Power Plants."

The 1996 revision in section 5.2 states that the most common practice is to mount cells on a steel rack with acid resistant insulation between the cells and the steel of the rack. See RAI 159 for the DCS position on RG 1.100.

4. *In subsection 5.3.2, "Acceptance Test," instead of IEEE Std 450-1972, IEEE Std 450-1975 should be followed.*

   The 1996 revision of the standard requires that an acceptance test be conducted in accordance with IEEE Std 450-1995.

5. *Section 7, "References," of IEEE Std 450-1975, lists reference documents. The specific applicability or acceptability of these referenced documents has been or will be covered separately in other regulatory guides where appropriate.*

The 1996 revision of the standard references only three other standards, all of which are cited in one or more sections. The standards referenced are: IEEE Std 100-1992, The New IEEE Standard Dictionary of Electrical and Electronic Terms; IEEE Std 450-1995, IEEE Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications; and IEEE Std 485-1983, IEEE Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations.

6. *In addition to the requirements of the standard, recommendations (indicated by the verb "should") contained in the sections of IEEE Std 484-1975 noted below (including supplementary material) have sufficient safety importance to be treated the same as the safety requirements of the standard.*

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a. *Subsection 4.1.1, "Location," item 2—The recommendations that address the need for a well-ventilated location with adequate aisle space and space above cells.*

Item 5.1 c) of the 1996 standard contains the same requirements for space around and above the battery.

b. *Subsection 4.1.1, "Location," item 4 –The recommendations that address temperature differential between cells at a given time and the avoidance of localized heat sources.*

Item 5.1 f) of the 1996 standard contains the same requirements regarding avoiding conditions that could cause spot heating or cooling.

c. *Subsection 4.1.1, "Location," item 5 –The recommendations set forth in item 5 that addresses the provisions for containing or safely dispersing spillage from water facilities, supplemented with the following:*

"Where stationary water facilities are provided within the battery room, their design should be such as to preclude any inadvertent spilling of water from these facilities on the battery installation itself."

Item 5.1 d) of the 1996 standard addresses the intent of this concern with the following, "The battery should be protected against natural phenomena such as earthquakes, winds, and flooding, as well as induced phenomena such as fire, explosion, missiles, pipe whips, discharging fluids, and CO_2 discharge."

d. *Subsection 4.1.2, "Mounting," item 2—The recommendation that addresses the number of tiers or steps for mounting batteries.*

Item 5.2 b) of the 1996 standard contains the same wording in part and adds the following, "A three-tier rack is acceptable provided the requirements of 5.1 item f) are met (see above), and maintenance is not adversely affected."

e. *Subsection 4.1.5, "Instrumentation and Alarms" –The three items listed. Instead of the "NOTE" following the last paragraph of Subsection 4.1.5, the following should be used:*

"NOTE: The preceding recommendations for instrumentation and alarms could be satisfied by equipment in the d.c. system, with the exception of items 4 and 5."

In addition, the three listed item should be supplemented with the following items:

"4. Ventilation air flow sensor(s) and alarm(s) in the control room."
"5. Fire detection sensor(s), instrumentation, and alarm(s)."

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Section 5.5 of the 1996 standard contains the same wording of the note above in the body of the section text. The previous three items remain in the section and a fourth item has been added, "Instrumentation to measure current through the battery (refer to 4.5 of IEEE Std. 450-1995)."

The 1996 revision of the standard does not address fire detection or air flow sensors for the battery rooms. DCS will provide a fire detection system for the MOX facility that will include monitoring of all areas and rooms containing electrical equipment, including the battery rooms. DCS will also provide the battery rooms with air flow sensor(s) to alarm a low flow condition and start a backup fan.

f. *Subsection 5.1.2, "Unpacking," item 3—The recommendation that any cell that exhibits an electrolyte level ½ inch or more below the top of the plates be replaced.*

Section 6.1.2 c) of the 1996 standard contains the recommendation listed above and adds, "If the level is less than approximately 13mm (0.5 in.) below the top of the plates, add electrolyte of approximate strength, or water, and fill to cover the plates.

g. *Subsection 5.1.3, "Storage," item 1 – The recommendation that cells not be exposed to extremely low ambient temperatures or localized sources of heat during storage.*

Section 6.1.3 a) of the 1996 standard contains the recommendation listed above.

h. *Subsection 5.2.3, "Preoperational Care," with "IEEE Std. 450-1975" used in lieu of IEEE Std. 450-1972."*

IEEE Std. 450-1995 is referred to in the 1996 version of the standard.

i. *The eight items listed in Subsection 5.3.1, "Freshening Charge, " supplemented with the following item:*

"9. At the completion of Item 7 above, hydrogen survey should be performed to verify that the design criteria required by Position 1 are met (see Section 6, "Records")."

The 1996 version of the standard does not address performing a hydrogen survey of the battery rooms after a freshening charge. DCS intends to install a hydrogen detection system in each battery room to alarm should the room hydrogen concentration approach the 2% concentration level.

j. *The five items listed in Section 6, "Records," supplemented with the following item:*

"6. Initial hydrogen survey data for future reference."

Hydrogen Survey data is not addressed in the records section of the 1996 version of the standard. As stated earlier DCS intends to install hydrogen monitors in each battery room. With

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continuous monitoring of the battery rooms, increases in the hydrogen concentration would be identified so that corrective action could be taken.

Enclosure A
Responses to NRC Clarification Requests

FIRE PROTECTION

Clarification Requested:

Discuss how fires are prevented from propagating between fire areas through the pneumatic tubes, sampling systems, and other interconnected systems {verbal information request}.

Response:

A preliminary assessment of this type of fire was conducted as part of the Preliminary Hazard Analysis (PHA) performed in support of the CAR. Certain design information is helpful to clarify the limited potential for propagation through interconnected systems. The systems of interest to this clarification are the Laboratory Sample Pneumatic Transfer Unit (LLP), the Sample Pneumatic Transfer Unit (LTP), and the PuO_2 Cans Pneumatic Transfer Unit (NTP).

These interconnected systems are from glovebox to glovebox, (*i.e.*, where the starting or destination gloveboxes may be in different fire areas).

The pneumatic transfer tubes are noncombustible, thus a fire starting in the starting or destination gloveboxes cannot propagate to the other glovebox though the transfer system due to a lack of continuity of combustibles.

If a fire were to occur after the transfer evolution completes when one of the slide valves is open, the fire could potentially spread into the transfer tube. But, since the pneumatic transfer tubes are noncombustible, the fire cannot propagate through the transfer system due to a lack of continuity of combustibles.

The propagation of hot gases through a pneumatic transfer tube is being evaluated. If this hazard poses a fire risk in the downstream fire area, then IROFS (such as the sliding valves) will be identified to isolate the pneumatic tube.

In conclusion, the design features inherent to the LLP, LTP, and NTP systems prevent fires from propagating between fire areas through these systems.

Clarification Requested:

Discuss assumptions regarding typical transient combustibles, transient loads in fire modeling, and assumptions regarding transient loading assumed for a possible fire on the MFFF loading dock {06 Nov 2001 item 3F and verbal information request}.

Response:

Note that this request was partially addressed in DCS' 05 December 2001 letter.

The combustible loading calculation for the MFFF will assume transient combustible for each fire area where transient combustibles are feasible. For example, the process rooms will assume transient combustibles while HVAC plenums will not.

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Operating experience (*i.e.*, based on discussions with operations staff) regarding typical and maximum transient combustible loadings at MELOX were used to determine the typical and maximum transient combustibles that should be considered in the MOX Fuel Fabrication Building (BMF). Based on this experience, typical transient combustibles include a one-liter bottle of lube oil and ten paper towel sheets, while the maximum transient combustibles consist of one sheet of Kyowaglass (1.5 m by 1.0 m by 46 mm).

Transient combustibles will be included in fire modeling where appropriate (as per discussion above). For example, when modeling the impact of a fire in the Receiving Truck Bay, the fire modeling calculation will assume transient combustibles in the truck bay – including vehicle fuel – based on the evolution of receipt and processing of a 3013 transport cask. The nature of the transient combustibles, as well as their quantity and location, will be determined as part of the fire modeling. (It should be noted that, although it is not expected to be credited in the fire modeling of the Receiving Truck Bay, the truck bays have automatic sprinkler systems; further, the MFFF has its own fire brigade, and the SRS fire department can provide fire fighting assistance as necessary.)

Clarification Requested:

Related to the review of fire protection documents such as the Fire Hazards Analysis (FHA), NRC questioned the adequacy of combustible loading controls alone to protect various forms of plutonium that are not in fire-qualified containers. This included surveillance to augment the controls, fire modeling to demonstrate margin between available fuel loads and critical fuel loads, and the role of fire detection features not being credited. Further clarification on this issue will be provided by DCS {06 Nov 2001 item 2}.

Additional information regarding combustible loading controls and other fire prevention or mitigation features for areas containing 3013 canisters, fuel rods, and the final C4 high efficiency particulate air filter {06 Nov 2001 item 2C}.

Response:

During the NRC onsite review the week of 16 Oct 2001, the NRC Staff inferred that combustible loading controls constituted the "sole IROFS" for certain scenarios. As discussed during the onsite review, the principal SSC combustible loading controls represent many IROFS, are based on defense-in-depth principles, and provide multiple layers of protection. The inference that combustible loading controls is the sole IROFS does not reflect the full suite of fire protection controls.

Combustible loading controls are identified as the principal SSCs for potential fire events involving handling or storage of plutonium in C2 areas of the MFFF facility. Section 5.5.2.2.6.3 of the CAR identifies these events as potential fires that could involve the following confinement barriers: the 3013 canisters, the 3013 transport casks, the fuel rods, the MOX fuel transport casks, transfer containers, and the final C4 HEPA filters.

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The principal SSC, combustible loading controls, is used to describe control of the combustible loading by design, and control of transient combustibles by design and during operations. These items are further discussed below.

Initially, the combustible load in fire areas containing the 3013 canisters, fuel rods, transfer containers, and final C4 HEPA filters, is designed to be low. Analysis to support the ISA will demonstrate that credible fires will not significantly impact the above confinement barriers. In this case, "significantly" is defined to mean that the consequences of any potential release associated with these events will not exceed the requirements of 10CFR70.61. Transient loads will be considered in the analysis.

The combustible load in the fire areas containing the 3013 transport casks and the MOX fuel transport casks is relatively low, but does include the fuel associated with the shipping vehicles. As above, analysis to support the ISA will demonstrate that credible fires will not significantly impact the above confinement barriers, and "significantly" means that the consequences of any potential release associated with these events will not exceed the requirements of 10CFR70.61. Transient loads will be considered in the analysis; if necessary, controls will be placed on the amount of fuel allowed for the shipping vehicles.

Next, the transient combustibles in fire areas containing the above confinement barriers is low by design. This occurs because normal operations in these fire areas do not require the use of significant transient combustibles, where significant is defined in the same manner as above. In addition, many of the operations involving these confinement barriers do not require operators to be in the vicinity, and some of the areas containing these confinement barriers restrict or limit facility worker entry during normal operations.

Finally, the transient combustibles in fire areas containing the above confinement barriers is controlled during operations, and this control is itself provided by multiple layers. First, facility workers are trained on the importance of controlling transient combustibles. Second, facility workers conduct regular surveillance for the presence of transient loads (regular surveillance intervals will be determined at a later date). Additionally, postings related to transient combustibles, such as "no combustible storage" zones, will be made within the MFFF facility as deemed necessary by fire protection and/or safety personnel. During maintenance activities, special precautions will be taken to minimize fire risks.

In addition to combustible loading controls, the MFFF employs a multi-level approach with regards to fire safety and these potential fire events. First, the fire protection program is designed to prevent fires through the control (by design and operation) of ignition sources and combustibles. Second, if a fire were to occur, it is detected quickly and facility workers are trained to fight small fires and to evacuate the area if conditions warrant it. Third, all of the fire areas containing the above confinement barriers have automatic fire detection, and as required, some areas are equipped with automatic fire suppression systems. Finally, the medium depression exhaust system (C2 confinement system) provides forced ventilation of these areas

through multiple stages of HEPA filters as long as normal or standby power is available, and provides a static barrier if these power systems are not available.
In summary: the design limits combustible loading and ignition sources such that for the design itself high-consequence fires are highly unlikely; transient loads are conservatively assumed in fire hazards analyses; controls are developed and applied on transient combustible loading; training and posting provides additional control over combustible loading; and surveillance is conducted periodically to verify conditions are within assumed limits. This combination of items ensures that it is highly unlikely that potential fire events involving these confinement barriers will result in consequences that exceed the requirements of 10CFR70.61.

Clarification Requested:

Given that the use of fire severity analysis is controversial in that it may not be representative of an actual fire duration, other methods should be used to demonstrate that flashover is not reached, especially where severity times are close to the barrier rating. In other words, the analysis should demonstrate a larger factor of safety. As a result, DCS will consider performing additional fire analysis of bounding fires {06 Nov 2001 letter, item 3}.

Response:

The fire severity analysis referred to in this request is by its nature not sophisticated; it is, however, significantly conservative. For example, the severity analysis assumes distribution of combustible material throughout the fire area (*i.e.*, average combustible loading). In addition, the simplified analysis assumes 100% fire efficiency.

Further, the simplified, conservative severity analysis is not used to model fire barrier performance for all fire areas, but rather as a screening analysis to identify those areas that do require more detailed modeling. For those fire areas whose conservatively estimated severity is within 15-20% of the rating of the associated fire barriers, more detailed fire modeling will be used to further evaluate the fire severity. It is expected that, as a result of the gross conservatisms in the simplified model, detailed fire modeling (where applied) will result in a lower (and more accurate) fire severity.

Enclosure B
Summary of Remaining Open Items

DCS has compiled the various requests for clarification from the 03 and 06 November 2001 NRC letters into a total of approximately 62 clarification requests[2]. Of these, 24 clarifications were provided in DCS' 05 December 2001 letter, and another 22 are provided in this letter. (These statistics do not include the various verbal requests for which clarifications have been provided in both DCS responses.) The recently received 18 December 2001 NRC letter results in another approximately 19 clarification requests, four of which are included in the clarifications provided in this letter. The following table summarizes the 31 remaining open clarification requests.

Subject Area/Action Item	Source
Heavy Loads/Material Handling	
RAI 221: Clarify the editions of the Codes and Standards that will be used to design heavy lift cranes.	03 Nov 2001 item 2E
DCS committed to provide clarification related to material transport systems on the release fraction for respirable plutonium *Note*: This comment appears to be a duplicate of 03 Nov 2001 item 2D, although DCS did not identify it as such in the response provided in 05 Dec 2001 DCS letter; DCS requests NRC clarification on whether additional information is required.	06 Nov 2001 item 1C
Nuclear Criticality Safety	
RAI 80/81: DCS stated that its response relating to the use of either reliance on geometry control or dual parameter control would be clarified. In the case where geometry is the sole controlled parameter, DCS will still meet double contingency by ensuring that no single credible change in process conditions can produce a criticality. DCS further asserted that if there is no credible means for geometry to change, there is no need for further controls. NRC agreed that this meets the wording and intent of the DCP.	03 Nov 2001 item 3G
Confinement and Ventilation	
NRC recommends the use of a 99 percent removal efficiency in both fuel cycle facility and reactor applications. NRC staff explained that there have been fires at plutonium facilities that have resulted in failures of banks of HEPA filters and that the recommended removal efficiency of 99 percent reflected such experience. DCS proposed to consider another calculation that would better define the accident conditions affecting the HEPA filters.	03 Nov 2001 item 4
RAI 144 requested justification for not enclosing the furnaces in gloveboxes. The response provided by DCS was proprietary and not included in the redacted version of the DCS response to the RAI. During the meeting, DCS stated that the glovebox is not used because of maintenance reasons and because the environment in the glovebox does not make enclosing the furnace necessary. DCS agreed to evaluate this issue further and to provide justification in a letter to NRC.	03 Nov 2001 item 6

[2] There is some minor overlap between discussions in the NRC letters such that an exact count is subject to some interpretation. DCS' compiled list numbers 62 clarification requests.

Enclosure B
Summary of Remaining Open Items

Subject Area/Action Item	Source
Human Factors	
RAI 225: (1) Clarify its response by more explicitly defining what is meant by "significant human-system interface" for the protective control system. (2) DCS agreed to consider and evaluate the potential for personnel errors of commission that might result in overriding or defeating safety systems. (3) DCS also agreed to provide a cross-reference(s) to appropriate parts of Chapter 11 of the CAR.	03 Nov 2001 item 7B
RAI 227: Clarify its response by more explicitly defining what is meant by "other deterministic design basis accident assumptions and scenarios," and also to consider and evaluate the potential for personnel errors of commission that might result in overriding or defeating safety systems.	03 Nov 2001 item 7C
RAI 230: Clarify its response by including both human errors of omission and commission in their evaluation of the probability of human error.	03 Nov 2001 item 7E
RAI 231, 233: Summarize significant events involving human performance as part of the review of operating experience at the MELOX and LaHague that were discussed at the meeting.	03 Nov 2001 item 7F
Instrumentation and Controls	
RAI 66: DCS will provide clarification that criticality prevention related to material inventory control is the only safety function that has been allocated to software. A list will be provided if there is more than one safety function allocated to software	03 Nov 2001 item 9, 3rd paragraph
The staff pointed out that IEEE 603-1998 conformance may be difficult for the following reasons: A. The MMIS computer system and the data communications network would have to meet IEEE 603-1998 criteria; and B. The subset of the MMIS software that would be used for IEEE 603 credit would have to be qualified. After discussion of the dimensions of the difficulties, DCS stated that it would take the observations under advisement and inform the staff whether it intends to revise its design basis for the MMIS system.	06 Nov 2001 item 4
A list of functional units showing non-PSSCs and PSSCs will be submitted	18 Dec 2001 item B2
Identify the requirements for the fire detection system interface with the PSSC safety controller VDT	18 Dec 2001 item B6
DCS staff will further describe the basis for not classifying the communications system as an IROFS	18 Dec 2001 item B7

Enclosure B
Summary of Remaining Open Items

Subject Area/Action Item	Source
Safety Analysis and Chemical Safety	
Calculations for three load drop type events were requested by NRC because it was not clear that the development of the accident left sufficient time for worker protective action. Calculations for facility worker dose from the fuel rod/fuel bundle drop event, the waste container drop event, and breach of container outside gloveboxes (confinement event). Alternatives to calculations may be proposed by DCS.	06 Nov 2001 item 2 and 2E
As a result of the review of safety analysis documents, NRC staff questioned the terminology "Process Safety I&C Systems" to determine the actual systems were being listed as SSCs. DCS will provide the information. For each listing of "Process Safety I&C systems" in the Principal SSC summary tables of Section 5.5 of the CAR, DCS will replace with "Process Safety Control Subsystem" or "Emergency Control System." DCS staff will clarify Section 11.6.2.1 (last paragraph) of the application to describe those cases where a safety control subsystem is used as a PSSC (the case which invokes IEEE Std 603-1998) DSC staff will review other sections in the application, such as Section 11.6.7, Table 5.6-1, and Section 5.5.5.2, to ensure the correct design basis information is included for safety control subsystems	06 Nov 2001 item 2, 5th paragraph, and 2D 18 Dec 2001 item B3 and B4
Review of the pyrophoric nature of plutonium and uranium oxides; clarification or justification of adequate control of potential hazards from UO_2 and PuO_2	18 Dec 2001 item A1
Basis (*i.e.*, correspondence from DOE) for explosion potential in F area	18 Dec 2001 item A2
An analysis of the potential for steam explosion in the MFFF	18 Dec 2001 item A3
Clarification/explanation of sintering furnace sensors, controls, and PSSCs related to hydrogen explosions. Verify that pressure sensors will detect a hydrogen leak in the sintering furnace and will terminate hydrogen flow.	18 Dec 2001 item C1* 18 Dec 2001 item CC5*
Explanation of the applicant's interpretation of the red oil phenomena and justification for a temperature design basis of 135 C (RAI 123). RAI 123: Provide information to support and justify the 135 C limit as the only design basis for the evaporators.	18 Dec 2001 item C2* and CC3*
RAI 143: Update the response to the RAI to include analytical results showing low consequences from low-level radioactive waste and spent solvent streams, and identification of upstream PSSCs.	18 Dec 2001 item CC2*

* Note on usage: Section C of the 18 Dec 2001 letter contains two action item lists, both beginning with "item 1"; the first list is herein designated beginning with "C1" and the second beginning with "CC1" for clarity. Also, certain items in the second list are repeated; the redundant actions (CC6-8) are excluded in this listing.

Enclosure B
Summary of Remaining Open Items

Subject Area/Action Item	Source
RAI 122: Respond to NRC concerns about the approach for inerting hydrazine and solvent.	18 Dec 2001 item CC4*
RAI 204: Estimate the number of high pressure cylinders in the facility and the annual usage.	18 Dec 2001 item CC9*
Fire Protection	
NRC staff requested that DCS provide a summary table/spreadsheet from the FHA; DCS will consider providing this table/spreadsheet with fire area information such as principal SSCs/IROFS, additional protective features, and fire barrier rating.	06 Nov 2001 item 3