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AIRBORNE EXPRESS

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November 7, 2003

Director
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555

References:
1) Docket No. 70-143; SNM License 124
2) Letter from B.M. Moore to NRC, License Amendment Request for BLEU Preparation Facility, dated October 11, 2002 (21G-02-0310)
3) Letter from NRC to B.M. Moore, Nuclear Fuel Services, Inc., Blended Low-Enriched Uranium Preparation Facility Remaining Questions (TAC NO. L31693), dated October 17, 2003
4) Letter from B.M. Moore to NRC, Responses to Remaining Questions Regarding License Amendment Request for BLEU Preparation Facility, dated October 31, 2003 (21G-03-0284)

Subject: Non-Proprietary Responses to Remaining Questions Regarding License Amendment Request for BLEU Preparation Facility

Dear Sir:

Nuclear Fuel Services, Inc. (NFS) hereby submits non-proprietary responses to the subject NRC questions regarding the licensing action pertaining to the BLEU Preparation Facility (BPF) to fulfill the commitment made in Reference 4. These responses contain non-proprietary information are are suitable for public disclosure.

NMSS01

If you or your staff have any questions, require additional information, or wish to discuss this, please contact me, or Mr. Rik Droke, Licensing and Compliance Director at (423) 743-1741. Please reference our unique document identification number (21G-03-0298) in any correspondence concerning this letter.

Sincerely,

NUCLEAR FUEL SERVICES, INC.

B. Marie Moore
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JSK/lsn

Attachment

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ATTACHMENT

(Non-Proprietary Information)

"Responses to Remaining Questions Regarding License Amendment Request for BLEU Preparation Facility"

RESPONSES TO REMAINING QUESTIONS REGARDING LICENSE AMENDMENT REQUEST FOR BLEU PREPARATION FACILITY

RAI Question 3:

Describe how the design and the management measures for passive engineered controls relied on for criticality safety ensure that all of these controls are "exceptionally robust." Also describe how NFS ensures that the appropriate management measures are applied to these passive engineered controls rather than applying the management measures used for non-criticality safety passive engineered controls.

NFS' response number 3, dated September 3, 2003, does not justify why all of the criticality safety passive engineered controls should be considered "exceptionally robust." These criticality safety passive engineered controls that NFS consider as "exceptionally robust" include not only overflow drains, as indicated in NFS' response number 12, but other items such as piping, etc. 10 CFR 70.62(c)(vi) requires that the Integrated Safety Analysis (ISA) Summary identify the characteristics of preventive, mitigative, or other safety function of each Item Relied on for Safety (IROFS), and the assumptions and conditions under which the IROFS support compliance with the performance requirements of 10 CFR 70.61.

NFS Response:

Management measures are applied to all passive engineered controls in the same manner, whether for criticality safety or any other safety discipline, as prescribed in NFS procedure NFS-GH-56, *Management Measures Identification and Implementation for IROFS.* Passive engineered controls (PECs) are neither segregated based on safety discipline, nor are they implemented any differently. They are, however, usually provided with more justification when used as a Nuclear Criticality Safety (NCS) control through the Nuclear Criticality Safety Evaluation (NCSE). The NCSE provides more written documentation than other safety discipline's evaluations which supports assigning lower risk indices for criticality safety IROFS versus non-criticality safety IROFS. Further, not all passive engineered controls relied on for nuclear criticality safety are designated "exceptionally robust" and given a risk index of –4. The ISA summary submittal contains many NCS PECs whose indexes are –2 or –3. As examples, the engineered spacing barrier (ENCLOS-3E03) in the U Metal Sampling area is designated a –3 and the condensers in the U-Al dissolution, Solvent Extraction, and U Metal Dissolution areas are designated –2.The indexes are based upon the analysis of the controls' capability, availability and reliability, which is demonstrated in the area NCSE.

The PECs that were assigned indexes of –4 in the ISA Summary are of exemplary design and construction and have extremely remote failure modes. The original response to **Question 12** gave five distinct and robust design features of the overflow drains as an example of this exemplary design and construction. The other PECs that were designated –4 were 1) the storage racks for U Metal; 2) a pipe sleeve; 3) the U Metal dissolver column wall; 4) the storage racks and carts for U-Al; 5) a spacing barrier in the U-Al dissolution enclosures; and 6) the geometry of a filter. All six of these controls are physical controls that are constructed of rugged, heavy gauge materials to suit their operating conditions (carbon steel for the racks, stainless steel for the pipe sleeve, dissolver, spacing barrier and filter and aluminum for the carts). These physical passive engineered controls are designed and constructed in an exceptionally robust manner and therefore are essentially never expected to fail.

Example of "exceptionally robust" justification:

The design of the storage racks (for U-Al cans) is considered exceptionally robust (for preventing the spacing violation) because they are constructed of pipe mounted vertically from the floor, with the fixed horizontal spacing guaranteed by the placement of each rack when it is bolted to the floor. Since each is a single pipe, there are no shelves or other locations between each rack that can support a can being placed between. Also, the vertical spacing is guaranteed by the placement of the shelves within the pipe vertically and that only one can will fit on each. Since this design meets the criteria of exceptionally robust, the effectiveness of protection for this IROFS in this sequence is –4.

RAI Question 4:

Provide the routine operating limits for the nuclear criticality safety controlled parameters. Alternatively, describe the process by which routine operating limits are determined.

NFS' response number 4, dated September 3, 2003, did not provide the routine operating limits as requested. These are required to understand the margin of safety for these operations and to ensure that the performance requirements of 10 CFR 70.61 are met.

NFS Response:

Routine Operating Limits (ROLs) are set **conservatively** to the Limiting Conditions of Operation (LCOs) based on probable failures, operational uncertainty, engineering judgement, and operational flexibility. Essentially, an ROL is determined by examining where operations management wants to operate, and determining the margin between that and the LCO. The ROL is then chosen between to allow both operational flexibility and margin to the LCO. ROLS will be available for the Operational Readiness Review.

RAI Question 5:

For the accident scenario described in Section 4.1.1.1 of the BLEU Preparation Facility (BPF) downblending Nuclear Criticality Safety Evaluation (NCSE), include as IROFS for this sequence the blend tank controls that ensure the minimum volume of LEU is in the tank. All IROFS relied upon for an accident sequence must be included for that sequence.

NFS' response number 5, dated September 3, 2003, states that the blend tank volume is a controlled parameter, yet this specific accident sequence does not include the IROFS necessary to control the blend tank volume. Because the scenario depends upon having the minimum volume present (e.g., the in-line monitor response time is based on having the minimum volume), these IROFS must be included in this sequence to render the sequence highly unlikely. This information is required to determine if this scenario is highly unlikely as required by 10 CFR 70.61.

<u>NFS Response:</u>

IROFS LS-4CO1A and LS-4CO1B, the level switch interlocks that close the HEU feed valves upon low blendstock volume in the blend tank will be included in accident scenario 4.1.1.1 of the BLEU Preparation Facility (BPF) Downblending Nuclear Criticality Safety Evaluation (NCSE).

<u>RAI Question 11:</u>

Provide justification for the duration failure used in scenarios 4.1.1.7 and 4.1.4.2 described in the BPF downblending NCSE.

NFS' response number 11, dated September 3, 2003, did not provide any justification for the duration failure as requested. This is required to ensure that this limits provide an adequate margin of subcriticality and meet the performance requirements of 10 CFR 70.61.

<u>NFS Response:</u>

Because these controls have no formal monitoring (such as a required surveillance of the area specifically looking for an improper container), these durations were inadvertently indexed at –3 and -2. According to the NFS ISA Risk Assessment procedure NFS-HS-A-68, a duration index less than –1 requires said formal monitoring. These four duration indices have been changed from either –3 or -2 to –1 to be in accordance. An index of –1 is felt justified, as it is described to be an average failure duration of 1 month. The LEU area will be operated on a three-shift daily basis, with trained operators routinely cleaning the area and sampling the tanks. With this level of activity, it is justified that a prohibited container or sample will be identified and corrected within one month.

<u>New criticality RAI Question:</u>

Provide further details as to why a spring closed isolation valve is considered a passive engineered control as stated in scenario Backflow-3.

Typically, any device that uses moving parts is considered an active engineered control rather than a passive engineered control. This information is required to determine if this scenario is highly unlikely as required by 10 CFR 70.61.

NFS Response:

NFS classified these spring-closed isolation valves as passive engineered controls (even though they contain moving parts) because they require no external source of energy to perform the safety function. The energy required to close the valve is imparted on the spring when the valve is opened by the operator. Availability of this energy to close the valve is guaranteed by Hooke's Law.

However, NFS will classify these spring-closed isolation valves as Active Engineered Controls, and will apply the appropriate index category and Management Measures.

RAI Question 15:

Provide further details to justify the discrepancy between the freezing temperatures of the uranyl nitrate (UN) solution in the BPF and the UN solution in the Uranyl Nitrate Building.

NFS' response number 15, dated September 3, 2003, did not provide enough information to demonstrate that the UN does not freeze at 32 degrees F. The response provided a report without providing enough information to use this chart for the material at NFS (the uranium and nitric acid concentration ranges are needed). This information is required to determine if this scenario is highly unlikely and meets the performance requirements of 10 CFR 70.61.

NFS Response:

The uranium concentration of the UN solution delivered from the Savannah River Plant to the Uranyl Nitrate Building is approximately , which yields a freezing temperature of 32 degrees F. The nitric acid and uranium concentrations for the NFS blending and hold tanks will be between and approximately , respectively. Using the chart previously provided, the freezing temperature of the NFS UN solution is approximately

RAI Question 22:

Provide further justification that the accident sequences for the uranium metal dissolution process using administrative controls meets the double contingency principle. To support this, provide a description of the process by which NFS evaluates the independence of administrative controls. Because the preference is for engineered controls over administrative controls, describe if it is possible to place containers together in the rack and if so, why an engineered control is not used.

Also, revise the description of BPF-5 in the ISA Summary to reflect that the actual IROFS includes the requirement that only one container may be placed on a rack at a time, as stated in the response.

NFS' response number 22, dated September 3, 2003, did not provide enough information to determine that these scenarios meet the double contingency principle and the performance requirements of 10 CFR 70.61. The actions involved rely on administrative controls that have a single failure point. A large safety margin or other defense in depth may render this accident sequence highly unlikely.

<u>**NFS Response:**</u>

Each rack position does rely on an engineered control through its design to only accommodate The rack spacing is approximately and the cans are . Therefore, it is not credible to improperly store the containers vertically on the racks. The structural framework for the racks is also designed to ensure that there are no convenient locations in which containers could be stored on the framework between containers. Therefore, hand carry of containers is the only way to have containers too close together.

IROFS BPF-4 limits the hand carry of containers to a maximum of one (1) container per person and BPF-5 requires 12-inch spacing between hand carried containers. Even if both of these limits are violated, the calculations in Section 4.2.2.10 demonstrate that two containers held next to a container already in a rack position will remain subcritical. Therefore, IROFS BPF-7 for verifying the container mass on the shipping papers and IROFS BPF-8 of weighing the container would have to fail concurrently before a criticality could be possible. IROFS BPF-4 or BPF-5 and BPF-7/BPF-8 are independent, because they involve different actions at different times with sufficient margin specified and lack of common mode failure (e.g., failing to verify the container mass on the shipping papers does not lead to improper spacing of containers or failing to weigh a container).

Therefore, this sequence relies on IROFS BPF-4 *or* BPF-5 *and* both BPF-7 and BPF-8. No other instances of this error were found in the Criticality Safety Risk Index Table, and therefore it has been updated to reflect this change and now reads as follows:

Accident Sequence	Initiating Events/ Enabling Events	IROFS Failure	Likelihood Index T Uncontrolled/ Controlled	Likelihood Category	Conseq. Category	Risk Index
U-METAL DISSOLUTION						
4.1.5.4.1 Too much moderator is present in containers on a rack and spacing upset 4.1.1	See IROFS	BPF-5 Frq_2 = -2 OR BPF-4 Frq_2 = -2 AND BPF-7 Frq2 = -2 AND BPF-8 Frq2 = -2	Unc T = -2 Con T = -6	Unc = 3 Con = 1	3 3	9 3

NFS evaluates the independence of administrative controls based on any one of the following numbered criteria. These criteria are located in NFS procedure NFS-HS-A-68, *ISA Risk Assessment Procedure.*

1. Administrative controls may be considered independent if the performance is conducted by at least two qualified individuals and,

    a. if similar or like controls are used, each qualified individual control performance is conducted within a separate defined time constraint or,

    b. if separate or unlike controls are used, each qualified individual control performance is conducted without a separate defined time constraint.

2. Administrative controls with sufficient safety margin, such that multiple failures of each independent control (3 or more times) would not result in a high consequence, may be considered independent.

3. Administrative controls may be considered independent if a means to detect the control failure is provided, such that the likelihood of both controls being in a failed state at the same time is significantly reduced, the time period is sufficiently short compared to the expected time between control failures, and the period is specified and justified in an NCSE.

4. Administrative controls may be considered independent when performed by the same person provided the controls require two different actions at different times with sufficient margin specified and lack of common mode failure justified in the NCSE.

The ISA Summary will be revised to state that IROFS BPF-5 only allows one container to be placed on a rack at a time.

RAI Question 26:

For the Process Exhaust Ventilation accident sequence 4.1.4, describe how the administrative IROFS BPV-5 and BPV-6 requiring a non-destructive assay (NDA) scan is independent from the second administrative IROFS requiring cleanout of the ventilation system when the NDA scan exceeds the mass limit.

NFS' response number 26, dated September 3, 2003, did not describe how the IROFS for this accident sequence are independent. This information is required to determine if this scenario is highly unlikely and meets the performance requirements of 10 CFR 70.61. This is also required to determine if this scenario meets the double contingency principle of 10 CFR 70.64.

NFS Response:

A transposition error was made from the NCSE to the ISA Summary for this sequence. Controls for NDA scanning and cleanout are actually combined into one IROFS: BPV-5. IROFS BPV-6 was eliminated prior to the Summary submittal. For the sequence of accumulation in the ductwork, IROFS BPV-1 and BPV-5 are relied upon. BPV-1 requires monitoring of the HEPA filters' pressure differential indicators (this alerts the operator to a problem with the HEPA filter). BPV-5 requires **BOTH** periodic NDA scanning and cleanout (if necessary) of the ductwork. These are independent because they are performed by different operators at different times under different procedures.

RAI Question 28:

The portion of the request that was not fulfilled was for cross-reference of tag numbers identified for IROFS, the specific process step, the chemical reaction occurring (or specific chemicals present in the case of no reaction), the temperature and pressure. Most of this information can be obtained by reviewing the P&IDs with the exception of the temperatures and pressures. Provide temperatures and pressures for each specific process step. We will contact you with regard to the logistics of reviewing the P&IDs.

10 CFR 70.65(b)(3) requires that the ISA Summary include a "description of each process...in sufficient detail to understand the theory of operation..."

NFS Response

The BPF is comprised of 5 systems:

- Down Blending
- Uranium Metal Dissolution
- Uranium/Aluminum Dissolution
- Solvent Extraction
- Liquid Waste Processing

A summary of operating temperature and pressures follows. It is noted that temperatures are typically variable operating parameters. Temperatures given are typical operating ranges. Actual temperatures will be adjusted as needed to optimize the processes. The upper bound for temperatures are the boiling points for the various solutions and mixtures. In the event that operating temperature control is defined as an item relied on for safety, that temperature will be maintained within prescribed ranges.

<u>RAI Question 29 (bold type) and NFS Response (standard type):</u>

The mass balances were provided in response to RAI question 29. However, the following questions regarding this information is needed:

- **A mass and molarity is given but no volume. Provide information on the physical state of this material and the volume of .**

  Barium nitrate is added to the process as a solid. It would be added to the sodium hydroxide stream or the sodium nitrate stream prior to the stream entering the dissolver. The molarity value provided in the table represents the concentration of barium nitrate in the combined sodium hydroxide and sodium nitrate streams as they enter the dissolver.

- **Provide information on whether the mass of aluminum given includes the mass of the uranium.**

  The ingots are a mixture of uranium and aluminum rather than a compound, so, the masses of aluminum and uranium that make up the ingots are stated in the table separately, 3.7 kg and , respectively.

- **The caustic waste stream appears to include the entire NaOH and NaNO3 stream, though the table indicates it to all be NaOH but mass would have been created to get this quantity. Since some of the sodium is consumed to produce the sodium diuranate this is not possible. Provide clarification regarding these effluent streams.**

  The mass table information was compiled to provide volume information needed to size pumps, piping and vessels (tanks, dissolvers, etc.). The information of interest for Stream #7 (solution exiting the centrifuge) is the total volume of the stream, for the batch rather than the volume attributable to each component of this stream. The stream is made up of residual sodium hydroxide, residual sodium nitrate, sodium nitrite, barium carbonate, and sodium aluminate. Stating sodium hydroxide as the only component in this stream was an error.

- **and aluminum are identified feeds in the U/Al dissolution process but no effluent is identified. Provide information on these effluents.**

  The effluent stream is Stream #7 as the stream leaving the centrifuge is collected, sampled, analyzed and then released to NFS' Waste Water Treatment Facility for treatment. The stream will be made up of residual sodium hydroxide, residual sodium nitrate, sodium nitrite, barium carbonate, and sodium aluminate.

- **In determining the maximum hydrogen generation it is identified that each ingot of U/Al has a mass of 5 kg, there are dissolvers and ingots are placed in each dissolver. Based on the math this would be 5 kg/ingot * However, the mass balance sheet uses a mass of . Provide an explanation of this difference. Also provide units for the density of hydrogen and verify the calculation of the volume of hydrogen in liters.**

  The average mass of an U/Al ingot is 5 kg and the make up of an ingot is typically 81.45% aluminum and 18.55% uranium. A maximum charge for the

  The unit of measure for the hydrogen density value is grams/liter.

  The maximum hydrogen generation calculation provided with the mass balance information is based on processing . So the total amount of hydrogen generated while dissolving the ingots was calculated and then an average generation rate over the hours determined. Using the average aluminum content for the U/Al ingots there are

- **For the mass balance on the feed columns and first pass extraction column provide information on the difference in the starting mass of uranium and that resulting from the mass balance for uranium dissolution.**

  The BPF U-Aluminum Mass Balance represents the balance around a typical ingot batch.

  The mass balance for the feed columns and first pass extraction represents the balance around a batch of feed solution that would be processed in the solvent extraction system during a typical week. That amount of solution is .

10 CFR 70.65(b)(3) requires that the ISA Summary include a "description of each process...in sufficient detail to understand the theory of operation..."

RAI Question 30:

Provide the criteria used to determine independence of administrative IROFS. Specifically provide information on how much time constitutes independence, what is "margin" and what is the amount of margin that would constitute independence, how much conservatism, as defined by NFS, is necessary to be independent and how are "administrative actions required" considered independent. Provide examples of the independence of "administrative actions required."

The written response provided identifies elements of the determination of independence but does not identify thresholds considered for these elements that would make them independent. This information is required to determine if the performance requirements of 10 CFR 70.61 will be met.

NFS Response:

NFS has developed independence criteria based on significant past experience with protection of dynamic operational plant processes using administrative controls. Guidance is not provided for independence criteria in NRC's Standard Review Plan, NUREG 1520, March 2002 or 10 CFR 70 Subpart H. Therefore the criteria is subject to licensee interpretation.

NFS has reviewed all non-criticality high consequence accident sequences that rely on two administrative controls to be performed by the same operator. These accident scenarios fall into three categories: nitric acid line breach outside Building 333 due to maintenance (human error), nitric acid line breach inside Building 333 due to maintenance (human error), and nitric acid line breach outside Building 333 due to an impact accident from a motorized vehicle.

To provide additional margin to the independence of these IROFS, NFS will generate a maintenance safety procedure for working on nitric acid lines requiring independent verification of maintenance isolation and system drainage, and also to verify that the maintenance is performed correctly upon completion. To provide an additional margin of safety for the impact accident due to vehicular traffic, NFS will provide a passive barrier around the outside nitric acid lines that can be accessed by traffic. If vehicular access is needed within the passive barrier, NFS will require an independent spotter be assigned to direct the vehicle and act as an independent notification mechanism for mitigative emergency response and spill cleanup should a line be breached. NFS believes that these actions will effectively remove the question of independence associated with these accident scenarios.

The following are the criteria that NFS uses to establish independence for administrative controls. These criteria are located in NFS procedure NFS-HS-A-68, *ISA Risk Assessment Procedure*.

1. Administrative controls may be considered independent if the performance is conducted by at least two qualified individuals and,

    a. if similar or like controls are used, each qualified individual control performance is conducted within a separate defined time constraint or,

    b. if separate or unlike controls are used, each qualified individual control performance is conducted without a separate applied time constraint.

2. Administrative controls with an assigned safety margin, such that multiple failures of each independent control (3 or more times) would not result in a high consequence, may be considered independent.

3. Administrative controls may be considered independent if a means to detect the control failure is provided, such that the likelihood of both controls being in a failed state at the same time is significantly reduced, the time period is sufficiently short compared to the expected time between control failures, and the period is specified and justified.

4. Administrative controls may be considered independent when performed by the same person provided the controls require two different actions at different times

    1. if the controls mitigate or prevent a non-criticality safety high consequence accident sequence,

        a. sufficient conservatism is incorporated in a consequence assessment, or,

        b. sufficient margin to a high consequence exists such that failure would not immediately result in a high consequence event, it is readily apparent that the accident has occurred and it is unlikely that the individual or individuals will remain in an exposed situation due to human senses not associated with the exposure pathway.

NFS provided in the response to **RAI Question 30** dated September 3, 2003, how NFS applied this criteria to a specific accident scenario protected by two administrative controls performed by the same operator. In the example, the time between actions, margin and the amount of conservatism were identified and discussed. NFS drafted the criteria for individual application to each accident sequence requiring two administrative controls. Each accident sequence is different and requires a different argument to justify independence. It is not possible to generate one definition or threshold for time between actions, "margin" or "sufficient conservatism" to cover all accident scenarios that require two administrative controls performed by one operator to meet the performance criteria.

NFS believes that the September 3 response illustrates how the criteria are to be applied to other accident sequences requiring two administrative controls performed by the same operator. Similar arguments will be generated for each chemical accident scenario that is mitigated or prevented by two administrative controls performed by one operator. NFS would expect that the NRC would review these accident sequences individually on site during inspections to determine if adequate time between actions, margin, and sufficient conservatism justify the chosen administrative IROFS independence.

RAI Question 31:

Define in terms of frequency (e.g. times per year, times per week) routine, fairly routine, and non-routine operations for IROFS. This information is needed to determine if a failure frequency index of –2 is justified for an operation that has been identified as fairly routine.

10 CFR 70.62(c)(vi) requires that the integrated safety analysis identify the characteristics of preventive, mitigative or other safety functions of IROFS, and the assumptions and conditions under which the IROFS support compliance with the performance requirements of 10 CFR 70.61.

NFS Response:

1. There are only two terms to define: routine and non-routine with respect to IROFS functions. The term fairly routine in the September 3, 2003 response to **RAI Question 31** was not used in the IROFS context but was provided to qualitatively illustrate to the NRC that maintenance on nitric acid lines is a routine occurrence (approximately twenty-five times per year).

2. In the context of non-criticality IROFS function, the following discusses routine and non-routine operations.

   NFS used the same risk indexing method approved for the UNB ISA Summary through NRC's issuance of the NFS, Inc., UNB Amendment Safety Evaluation Report (SER) dated, July 7, 2003.

   The risk indexing method is a qualitative method. Justification for the qualitative –2 IROFS Effectiveness of Protection Index was provided to the NRC in Attachment III to NFS' RAI response submittal, dated March 7, 2003.

Qualitative definitions of routine and non-routine IROFS actions are as follows:

- Routine operation – Those operations that consist of normal trained operator actions that prevent accident scenarios from occurring such as shutting a valve due to an alarm. (Assigned an Effectiveness of Protection Index of –2)

- Non-routine operation – Those operations that a trained operator may not perform during process operation but are performed as mitigative actions to reduce the consequence of an accident, such as spill cleanup. (Assigned an Effectiveness of Protection Index of –1)

<u>RAI Question 32 (bold type) and NFS Response (standard type):</u>

Provide supporting documentation for using a TEEL-3 value. Some of the chemicals with TEELs identified have established IDLHs that would be more protective than the TEEL-3.

The Standard Review Plan (SRP), NUREG-1520, identifies acceptable exposure standards that include, but are not limited to, the Emergency Response Planning Guidelines (ERPGs) established by the American Industrial Hygiene Association, the Acute Exposure Guideline Levels (AEGLs) established by the National Advisory Committee for Acute Guideline Levels for Hazardous Substances, the exposure limits established by OSHA, and the exposure limits contained in International Organization of Standardization (ISO) standards. 10 CFR 70.61 requires the applicant propose appropriate quantitative standards for the health effects identified for the performance requirements.

When reviewing the BPF chemicals, it was noted that 3 chemicals had IDLHs lower than their TEEL-3 level of concern and 4 had IDLHs lower than their ERPG-3 level. Of the 3 chemicals that had IDLHs lower than their TEEL-3 level, the IDLH was listed as   , while the TEEL was specific for the chemical compound. Additionally, in checking 60 chemicals with established ERPG-3 levels, approximately 28 had ERPG-3 levels higher than their established IDLH levels.

In an article by John Nordin, Ph.D. titled *What Chemical Concentration Is Safe?*, he displays a table called "Example Toxic Inhalation Concentration Limits" where several of the ERPG-3 limits are higher than the IDLH limits. He also references the *2000 Emergency Response Guidebook* whose level of concern is based on ERPG limits. The Guidebook uses the ERPG-3 for the Initial Isolation Zone and the ERPG-2 for the Protective Action Distance. For many chemicals, the Guidebook used a fraction of the LC50 for the ERPG limits. Dr. Nordin also references TEELs, many of which are included in the Palmtop Emergency Action for Chemicals Unit.

OSHA defines IDLH concentration for hazardous waste operations and emergency response as "an atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere." IDLH limits were developed and are used as part of the respirator selection process. The purpose for establishing IDLH levels was to determine a concentration from which a worker could escape without injury or without irreversible health effects in the event of respiratory protection equipment failure and to determine a concentration above which only highly reliable respirators would be required. IDLH levels were intended as guidance for healthy workers and would establish a level for upgraded respiratory protection requirements that could be routinely used. IDLH levels are not listed in 29CFR Subpart Z as promulgated regulatory limits.

ERPG and TEEL levels are intended for emergency planning and response. ERPG-3 is defined as the maximum concentration in air below which it is believed nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects while TEEL-3 is defined as the maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing or developing life-threatening health effects. TEELs levels are recommended to be used with 15-minute exposure times. The ERPG-2 definition is the maximum concentration in air below which it is believed nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

In addition to an immediate threat to life, the OSHA IDLH definition also includes reference to irreversible or delayed adverse health effects or would interfere with an individual's ability to self rescue, which seems to be more consistent with an ERPG-2 level. This makes it difficult to identify the IDLH wholly with an ERPG-3 or ERPG-2, especially for some chemicals whose irritant properties may be taken into account.

While TEELs may change more frequently than IDLHs or ERPGs, this allows them to incorporate new studies into the TEEL estimate sooner than other agencies could. With an annual review, significant changes to TEEL limits could be incorporated into the annual summary document.

As stated in the previous response, NFS will review the limits used in the ISA against the *ERPGs and TEELs for Chemicals of Concern* as published by the US Department of Energy's Subcommittee on Consequence Assessment and Protective Actions (SCAPA) on the SCAPA website prior to initiating the annual ISA Summary update. TEELs are developed where no ERPG value has been established. SCAPA recognizes the preferability of peer-reviewed ERPG values, and TEELs are only identified by SCAPA when ERPGs do not exist. As ERPG values are adopted and published (annually), the SCAPA website is revised to reflect the ERPG value on the TEEL list.

NFS uses the ERPG as the preferred value. Where no ERPG value has been established, the TEEL value will be used as an equivalent ERPG limit until it is replaced with an ERPG value.

In the absence of an established ERPG, SCAPA has developed and implemented methodology to define a TEEL value. According to the SCAPA methodology, TEELs are developed using a hierarchy of established limits, including concentration limits such as the EEGL, IDLH, PEL, STEL, TLV, REL, WEEL, and other concentration-based limits. Toxicity-based limits may also be considered in the SCAPA methodology, including LD_{50}, LD_{LO}, TD_{LO}, LC $_{50}$, and TC_{LO}. It should be noted, however, that the SCAPA-defined TEELs may be based on a number of different limits and are not necessary directly related to a single value. Therefore, it is not possible to develop a TEEL value by applying this methodology without having all the relevant limits.

Explain and justify the criteria and the methodology used for choosing LD_{50}, an exposure that causes death of 50% of the population tested, to evaluate high consequence events related to chemical safety which is defined as an acute chemical exposure that could endanger the life of a worker.

LD_{50} values were only used for establishing exposure limits for soluble uranium. This issue is addressed in the response to **RAI Question 33** below.

Provide clarification regarding the applicability and relationship of the air permit to the exposure limits associated with the release of nitrogen oxide as a result of an accident. There are lower exposure limits for other NO_x compounds that may be the hazard posed to the worker.

The air permit form requested nitrogen oxides and did not specify type. In going back to the original calculations of NO_x off-gas emissions for dilute Nitric Acid Dissolution for the design basis, calculations include NO_2 and NO reported as NO_2. Consequence evaluations will reflect the higher MW and different physical properties, as well as the lower TEEL levels. Bounding scenarios performed by environmental safety indicate that the amount of NO_x released for an intermediate consequence to the public would not exceed the maximum average amount of NO_x produced in Building 333 as evaluated for the design basis and for the air permit.

The changes to the worker consequences resulting from NO_x rather than NO_2 are still being evaluated. The remainder of the response to **RAI Question 32** will be included in a subsequent submittal to allow for completion of the response.

<u>RAI Question 33:</u>

Provide justification for using the DOE 50% lethality for soluble uranium versus calculating a value from the TEEL-3 value for soluble uranium. 50% lethality means half the population exposed will die without medical treatment while a TEEL-3 is the maximum airborne concentration below which nearly all individuals could be exposed without experiencing or developing life-threatening health effects. Provide the bases for the assumption that the operator will be able to perform its function(s) if the exposure limit for a high consequence is 50% lethality for soluble uranium.

Note: Any additional information provided regarding a calculated value from the TEEL-3 should include breathing rate assumptions, exposure time considered for the assessment, and the concentration corresponding to the quantity of uranium proposed as TEEL-1, TEEL-2, and TEEL-3.

This information is needed to determine whether the performance requirements identified in 10 CFR 70.61 can be met in the event of a high consequence incident.

NFS Response:

Uranium particles that are soluble in lung fluid are chemically dissolved, and the ions are transported into the bloodstream where they are further distributed. Uranium particles remaining in the lung constitute a potential radiological hazard. Particles removed from the lung to the bloodstream primarily represent a potential chemical hazard. Uranium is chemically toxic to the kidneys and exposure to soluble (transportable) compounds can result in renal injury.

10 CFR 20 classifies all materials into three inhalation classes according to its rate of clearance from the pulmonary region of the lung; Class D (i.e. uranyl nitrate solution) is most transportable (pulmonary removal half-time of days), Class W (i.e. UO_3 powder) is only moderately transportable (lung retention time in weeks) and Class Y (i.e. U_3O_8 powder) is the least transportable (removal half-time of years). Considerations of the chemical toxicity (for Class D and W compounds) require that operations be designed to maintain exposures below levels that will cause kidney damage due to the toxicity of soluble (transportable) uranium. TEEL values are based on chemical solubility, while health effects from acute intake of soluble (transportable) uranium are defined in NRC regulation and guidance documents.

The 50% lethality value was originally chosen due to the limited availability of technically supported threshold values that appeared applicable to the health effect standard "could endanger the life of a worker." Upon further review and discussion, NFS is no longer supporting use of the 50% lethality value to meet this standard. 10 CFR 70.61 requires the applicant to develop appropriate quantitative standards for chemical exposure. NUREG-1520, *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility* (page 3-16), requires calculation methods that are consistent with NUREG-6410, *Nuclear Fuel Cycle Facility Accident Analysis Handbook.* In the case of chemical exposure to soluble uranium, the quantitative standards that have been proposed are based on the methodology provided in NUREG-6410.

A high consequence event by 10 CFR 70.61 definition is an event that results in an acute chemical exposure to an individual from licensed material or hazardous chemicals produced from licensed material that "could endanger the life of a worker". NUREG/CR-6410 section 5.8.3.1 (Exposure to Soluble Uranium) specifies that the threshold level, as referenced in NUREG-1391 (McGuire 1991), to cause permanent renal damage to a 70-kg (154-lb) individual by inhalation is 40 mg soluble uranium, due to chemical damage. While this intake level is arguably most applicable to the standard for intermediate consequences, "irreversible, or serious long-lasting health effect," it is clearly protective to use it for high consequences, at least until a more appropriate, technically supported, alternative value is available. To convert from airborne concentrations to inhaled mass, the breathing rate of the exposed individual may be assumed to be 2.6E-4 m3/s (33 ft3/hr), consistent with people in an active state (USNRC 1988). The intake level necessary to cause permanent renal damage is independent of exposure duration. Therefore, an intake (versus concentration) standard of 40 mg soluble (transportable) uranium will be used as the high consequence performance criteria.

An intermediate consequence event by 10 CFR 70.61 definition is an acute chemical exposure to an individual from licensed material or hazardous chemicals produced from licensed material that could lead to "irreversible or other serious long-lasting health effects to a worker". A 30 mg intake is specified in 10 CFR 70.61 as a high consequence for soluble uranium intake to an individual located outside the controlled area based on the individual developing irreversible or other serious long-lasting health effects. Operational guidelines (i.e. *DOE STD 1136 2000, Guide of Good Practices for Occupational Radiological Protection in Uranium Facilities, Tables 5-13 and ANSI/HPS N13.22-1995 Bioassay Programs for Uranium: An American National Standard*) are based on the same guidance (NUREG 1321) for health effects from acute intakes of soluble uranium. Per these guidance documents, an acute intake of ≥ 30 mg soluble uranium could result in renal damage, which, is an irreversible, or serious long-lasting health effect. While not identical to the threshold for similar effects given in NUREG/CR-6410 (40 mg), it is consistent, and protectively lower. Therefore, an intake (versus concentration) standard of 30 mg soluble (transportable) uranium will be used as the intermediate consequence performance criteria.

RAI Question 34:

NFS' response identified "impaired coordination" at 15 – 19% oxygen level. Based on the calculations provided it appears an oxygen level in this range could occur in Scenario A. Justify how this atmosphere would not hinder the operator's ability to perform functions associated with IROFS. 10 CFR 70.22(a)(7) requires a description of the equipment and facilities to protect health and minimize danger to life or property.

NFS Response:

The original scenario specific verbage contained information on release rates and air changes. The scenario specific information for U Metal stated that "Although nitrogen is not a chemical hazard in itself, it does displace oxygen and can result in an oxygen deficient atmosphere. The room area is approximately . (Later information used as the room volume.) With an estimated release rate of 409 cubic feet per minute for an open end break on the 1 inch supply line, an estimated release rate of 35 cubic feet per minute from the 3/8 inch tubing before the regulator, an estimated release rate of 14 cubic feet per minute for a break after the regulator, an estimated 31.2 recirculation air changes per hour, and an estimated 4.0 fresh air changes per hour, no exposure above the TEEL-1 is expected."

The following bounding scenarios were reviewed and calculated for a 5 minute exposure consistent with other chemical calculations. Exposure limits were as follows: TEEL-2 = 350,000 ppm (intermediate consequence) and TEEL-3 = 500,000 (high consequence).

Scenario A: Assume Nitrogen line break or leak inside building. Assume open end break on the 1-inch schedule 40 pipe supplying the building. Per engineering information, the release rate would be 408.6 cfm, assuming nitrogen tank pressure is 75 psig.

Estimate Spill Duration

Multiply release rate in cfm x 5 min to estimate vaporization generation for a 5 minute exposure.

Calculations:

408.6 cfm x 5 min = 2043 cubic feet

Estimate Exposure in ppm

Parameters:

$$\frac{\text{Cubic feet of chemical}}{\text{Cubic feet of air}} \times 10^6 = \text{concentration in ppm}$$

Calculations:

$\underline{2043} \times 10^6 =$ HEU

(10,000 parts per million equals 1% by volume).

10,000 = change in air. Air has approximately 21% Oxygen by volume. (change in total air volume) x .21 (percentage of Oxygen in Air) = change in oxygen from release of Nitrogen. 21% (original Oxygen Level) – (change in Oxygen Level from Nitrogen Release) = level in air.

$\underline{2043} \times 10^6 =$ SX

(10,000 parts per million equals 1% by volume).

/10,000 = change in air. Air has approximately 21% Oxygen by volume. (change in total air volume) x .21 (percentage of Oxygen in Air) = change in oxygen from release of Nitrogen. 21% (original Oxygen Level) – (change in Oxygen Level from Nitrogen Release) = Oxygen level in air.

2043 x 10^6 = Outside

(10,000 parts per million equals 1% by volume).

/10,000 = change in air. Air has approximately 21% Oxygen by volume. (change in total air volume) x .21 (percentage of Oxygen in Air) = change in oxygen from release of Nitrogen. 21% (original Oxygen Level) – (change in Oxygen Level from Nitrogen Release) = Oxygen level in air.

TEEL Limits

TEEL-1 = 210,000ppm

210,000 ppm (10,000 parts per million equals 1% by volume). 210,000/10,000 = 21% change in air. Air has approximately 21% Oxygen by volume. 21 (change in total air volume) x .21 (percentage of Oxygen in Air) = 4.41% change in air from release of 210,000 ppm Nitrogen. 21% (original Oxygen Level) – 4.41% (change in Oxygen Level from 210,000 ppm Nitrogen Release) = 16.59% Oxygen level in air.

TEEL-2 = 350,000 ppm

350,000 ppm (10,000 parts per million equals 1% by volume). 350,000/10,000 = 35% change in air. Air has approximately 21% Oxygen by volume. 35 (change in total air volume) x .21 (percentage of Oxygen in Air) = 7.35% change in air from release of 350,000 ppm Nitrogen. 21% (original Oxygen Level) – 7.35% (change in Oxygen Level from 350,000 ppm Nitrogen Release) = 13.65% Oxygen level in air.

TEEL-3 = 500,000 ppm

500,000 ppm (10,000 parts per million equals 1% by volume). 5000,000/10,000 = 50% change in air. Air has approximately 21% Oxygen by volume. 50 (change in total air volume) x .21 (percentage of Oxygen in Air) = 10.5% change in air from release of 500,000 ppm Nitrogen. 21% (original Oxygen Level) – 10.51% (change in Oxygen Level from 500,000 ppm Nitrogen Release) = 10.5% Oxygen level in air.

Scenario B: Assume Nitrogen line break or leak inside building. Assume break/leak on the ¼-inch stainless steel tubing. Per engineering information, the release rate would be 13.98 cfm, assuming nitrogen tank pressure is 20 psig.

Estimate Spill Duration

Multiply release rate in cfm x 5 min to estimate vaporization generation for a 5 minute exposure.

Calculations:

13.98 cfm x 5 min = 69.9 cubic feet

Estimate Exposure in ppm

Parameters:

$\frac{\text{Cubic feet of chemical}}{\text{Cubic feet of air}} \times 10^6$ = concentration in ppm

Calculations:

69.9 x 10^6 = HEU

(10,000 parts per million equals 1% by volume).

/10,000 = change in air. Air has approximately 21% Oxygen by volume. (change in total air volume) x .21 (percentage of Oxygen in Air) = change in oxygen from release of Nitrogen. 21% (original Oxygen Level) – (change in Oxygen Level from Nitrogen Release) = Oxygen level in air.

69.9 x 10^6 = SX

(10,000 parts per million equals 1% by volume).

/10,000 = change in air. Air has approximately 21% Oxygen by volume. (change in total air volume) x .21 (percentage of Oxygen in Air) = change in oxygen from release of Nitrogen. 21% (original Oxygen Level) – (change in Oxygen Level from Nitrogen Release) = Oxygen level in air.

69.9 x 10^6 = Outside

(10,000 parts per million equals 1% by volume).

/10,000 = change in air. Air has approximately 21% Oxygen by volume. (change in total air volume) x .21 (percentage of Oxygen in Air) = change in oxygen from release of Nitrogen. 21% (original Oxygen Level) – (change in Oxygen Level from Nitrogen Release) = Oxygen level in air.

TEEL-1 = 210,000 ppm
TEEL-2 = 350,000 ppm
TEEL-3 = 500,000 ppm

Scenario C: Assume Nitrogen line break or leak inside building. Assume break/leak on the 3/8-inch stainless steel tubing. Per engineering information, the release rate would be 34.55 cfm, assuming nitrogen tank pressure is 75 psig.

Estimate Spill Duration

Multiply release rate in cfm x 5 min to estimate vaporization generation for a 5 minute exposure.

Calculations:

34.55 cfm x 5 min = 172.75 cubic feet

Estimate Exposure in ppm

Parameters:

$\frac{\text{Cubic feet of chemical}}{\text{Cubic feet of air}} \times 10^6$ = concentration in ppm

Calculations:

$\frac{172.75}{\quad} \times 10^6$ = HEU

(10,000 parts per million equals 1% by volume).

/10,000 = change in air. Air has approximately 21% Oxygen by volume. (change in total air volume) x .21 (percentage of Oxygen in Air) = change in oxygen from release of Nitrogen. 21% (original Oxygen Level) – (change in Oxygen Level from Nitrogen Release) = Oxygen level in air.

$\frac{172.75}{\quad} \times 10^6$ = SX

(10,000 parts per million equals 1% by volume).

/10,000 = change in air. Air has approximately 21% Oxygen by volume. (change in total air volume) x .21 (percentage of Oxygen in Air) = change in oxygen from release of Nitrogen. 21% (original Oxygen Level) – (change in Oxygen Level from Nitrogen Release) = Oxygen level in air.

172.75 x 10^6 = Outside

(10,000 parts per million equals 1% by volume).

/10,000 = change in air. Air has approximately 21% Oxygen by volume. (change in total air volume) x .21 (percentage of Oxygen in Air) = change in oxygen from release of Nitrogen. 21% (original Oxygen Level) – (change in Oxygen Level from Nitrogen Release) = Oxygen level in air.

TEEL-1 = 210,000 ppm
TEEL-2 = 350,000 ppm
TEEL-3 = 500,000 ppm

These bounding calculations were performed without taking area ventilation into account and using TEELs for consequence levels. None of the referenced scenarios exceed TEEL limits resulting in an intermediate or high consequence. None of the referenced scenarios result in an oxygen deficient atmosphere.

Integrated Safety Analysis Consequence Evaluations are performed to identify scenarios that would result in high or intermediate levels as defined by Part 70 and to institute IROFS to prevent their occurrence. Other exposure limits provided by OSHA or other appropriate regulatory agencies are available to provide guidance for day to day operations.

NFS-GH-07, *Respiratory Protection*, Section 4.1.6, states that work shall not be performed in known IDLH or oxygen deficient atmospheres without the approval of the Industrial Safety Department and defines the required respiratory protection for known IDLH or oxygen deficient atmospheres. This section references 20 CFR 1910.134, which defines an oxygen deficient atmosphere as an atmosphere with an oxygen content below 19.5% by volume. 20 CFR 1910.134 also provides a table with approved oxygen levels corrected for altitude. These regulatory requirements will be consulted for routine operations.

<u>RAI Question 39 (bold type) and NFS Response (standard type):</u>

Provide quantitative and qualitative assumptions considered in the red oil scenario such as:

- **Whether the system was analyzed as an open or a closed system and include the definition of closed and open systems for this facility and for this specific process.**
- **Provide supporting information regarding the statement that the red oil phenomena will occur at higher temperatures in than in kerosene.**

- **Parameters (e.g., temperature, pressure), values, and conditions to evaluate the red oil scenario.**

- **Quantity of solvent assumed to enter to the system as part of the analysis of the red oil scenario including the reaction time for the operator to stop the flow of solvent.**

This information is required to determine compliance with 70.65(b)(3) which states that the application should contain a description of each process analyzed in sufficient detail to understand the theory of operations and its hazards.

Provide and justify the safety strategies (e.g., appropriate ventilation, prevent local high temperatures) to be used to prevent a runaway reaction in the system with Tributyl Phosphate (TBP), , and nitric acid. Response to RAI question 39 mentions several quotations from literature depicting safety strategies for a runaway reaction but it is not clear if NFS will implement these strategies. Also, provide any references associated with this assessment (e.g., Wilbourn and others, temperature, temperature range, different quotations). These are statements taken from literature but the source is not clearly provided.

This information is required to determine compliance with 70.65(b)(3) which states that the application should contain a description of each process analyzed in sufficient detail to understand the theory of operation and its hazards.

Provide and explain in detail the controls, other than steam temperature, that will be used to ensure that the solution temperature will not exceed 121° C as suggested in response to RAI question 49. Monitoring the temperature of the solution is not mentioned as a control. In a runaway reaction, most of the heat comes from the exothermic reaction taking place in the solution.

This information is required to determine compliance with 70.65(b)(3) which states that the application should contain a description of each process analyzed in sufficient detail to understand the theory of operation and its hazards.

The following description of chemical reactions is described in response to RAI question 39:

a. **Hydrolysis of TBP in contact with nitric acid to produce butanol and dibutyl phosphate.**
b. **Reaction of butanol with nitric acid to produce butyl nitrate**
c. **Partial oxidation reaction of butanol**
d. **Exothermic reactions producing gases such as CO, CO_2, steam, nitrogen, and nitrogen oxides that "can proceed with explosive violence.**

Provide the chemical reactions described above and the controls used to avoid the formation and accumulation of the potential products and by-products of the runaway reaction (e.g., butene). Include information on the controls used to avoid overpressurization of the system if gases from the exothermic reaction build up in the evaporator (e.g., credit for the ventilation systems).

This information is required to determine compliance with 70.65(b)(3) which states that the application should contain a description of each process analyzed in sufficient detail to understand the theory of operation and its hazards.

Provide information on whether an analysis was performed of a scenario for a heat of reaction, during a red oil runaway reaction that is greater than the heat provided by the steam. This may generate gases and undesired by-products, even though the steam is shut off. Provide the details of the assessment and criteria considered to analyze or not analyze this situation.

This information is required to determine compliance with 70.65(b)(3) which states that the application should contain a description of each process analyzed in sufficient detail to understand the theory of operation and its hazards.

The response to **RAI Question 39** will be included in a subsequent submittal to allow for completion of the response.

RAI Question 49 (bold) and NFS Response (standard type):

S Interlock # 1 and S Interlock # 2 are active engineered controls with failure frequency indices of –2. The ISA Summary indicates that an IROFS failure frequency is defined as the probability that the identified control will prevent or mitigate the accidental consequence given the initiating event (or set of occurrences) occurs. Also NFS stated that the index is assigned to each IROFS based on industry accepted values, past experience, engineering judgment, analytical data, and/or any other applicable information. Does the failure frequency truly represent the probability of the IROFS being successful or should it in terms of the IROFS failing? Justify the assignment of the failure frequency indices of –2 for these IROFS. This justification should identify the specific basis (i.e., industry accepted values, past experience, etc.) for assigning of the indices with enough supporting detail to permit independent evaluation of the adequacy of the assignment.

In the September 3, 2003, response, NFS stated that component testing frequency is established based on the most conservative of: duration of failure index required to meet the 10 CFR 70.61 criteria, applicable standards, codes or manufacturers' specifications. For these interlocks identify which was the most conservative basis for their testing frequency with enough supporting detail to permit independent evaluation of the adequacy of the testing frequency.

This information is required to determine if these IROFS are sufficiently reliable to meet the performance requirements of 10 CFR 70.61.

The response to **RAI Question 49** will be included in a subsequent submittal to allow for completion of the response.

RAI Question 49:

The NFS September 3, 2003 response to Question 49 did not describe the methodology used to establish the setpoints for Interlocks # 1 and # 2. For these interlocks and all other IROFS containing setpoints, discuss the generic method used to account for the instrumentation errors (setpoint methodology) and ensure that the associated safety limits are not exceeded.

This information is required to determine if IROFS are sufficiently reliable to meet the performance requirements of 10 CFR 70.61 and the requirements of 10 CFR 70.64(a)(4).

NFS Response:

The response to **RAI Question 49** will be included in a subsequent submittal to allow for completion of the response.

RAI Question 50:

The section on Environmental and Dynamic Effects contains the words "appropriate consideration." The NFS September 3, 2003, response to Question 50 stated that IROFS will be qualified to demonstrate that they can perform their safety functions under environmental and dynamic service conditions in which they will be required to function and for the length of time their function is required. Discuss if non-IROFS will be able to withstand environmental stresses caused by environmental and dynamic service conditions under which their failure could prevent satisfactory accomplishment of safety functions by IROFS.

This information is required to determine if IROFS are sufficiently reliable to meet the performance requirements of 10 CFR 70.61 and the requirements of 10 CFR 70.64(a)(4).

NFS Response:

Non-IROFS will be able to withstand environmental stresses caused by environmental and dynamic service conditions under which their failure could prevent satisfactory accomplishment of safety functions by IROFS.

For the purposes of this response, NFS assumes that the NRC term "non-IROFS" means essential utilities. **Question 52,** in NFS' September 3, 2003 response specifies that the only BPF facility essential utility is electric power to NFS' criticality detection system and that the criticality alarms and detectors are supplied emergency power by means of the existing plant emergency power system. NFS has designed the system IROFS to fail in a safe configuration. Fail-safe is a term applied to a process or component for which removal of a utility results in the process or component failing in a safe configuration.

If however, a utility were required to ensure the safety function of the IROFS, this utility would fall within the IROFS boundary for functional testing and application of management measures. In addition, the essential utility will be designed to withstand environmental stresses caused by environmental and dynamic service conditions under which its failure could prevent satisfactory accomplishment of IROFS safety function.

"Appropriate consideration," can best be defined through the following example.

An IROFS will not be designed to withstand dynamic effects associated with vibration if it is not subject to a vibration hazard. Appropriate consideration is given to the dynamic conditions to which the IROFS is expected to function and the design is adjusted as appropriate.

RAI Question 51:

The NRC staff requested that NFS describe how the behavior of IROFS is monitored. The NFS September 3, 2003, response to Question 51 stated that the behavior of IROFS is maintained through periodic functional testing of key components. Describe the instrumentation and control system provided to monitor and control the behavior of IROFS. Otherwise reference an appropriate section of the analysis performed pursuant to 10 CFR 70.62(c) which demonstrates that an instrumentation and control system to control the behavior of IROFS is not relied on for safety or that adherence to 10 CFR 70.64(a)(10) is not required.

This information is required to determine if the licensee is meeting the requirements of 10 CFR 70.64(a)(10) or adherence is not required.

NFS Response:

The response to **RAI Question 51** will be included in a subsequent submittal to allow for completion of the response.

RAI Question 53:

The NRC staff requested that Table 4-14 be revised to include appropriate management measures for enhanced administrative controls. The NFS September 3, 2003, response to Question 53 provided the requested revision but did not include "calibration" for enhanced administrative controls. Revise Table 4-14 to include "calibration" for the instrumentation included in the enhanced administrative controls.

This information is required to ensure that these IROFS are sufficiently reliable to meet the performance requirements of 10 CFR 70.61.

NFS Response:

NFS supplied the same management measures table approved for the UNB ISA Summary through NRC's issuance of the NFS, Inc., *UNB Amendment Safety Evaluation Report (SER)* dated July 7, 2003.

NFS will update the table in the UNB and BPF ISA Summaries to include the calibration requirement. This, however, is a new requirement specified by the NRC. NFS did not exclude this from Table 4-14. This was never a requirement identified by the NRC until the issuance of this revised RAI question.

New RAI Question:

On Page 4-121 of the ISA Summary under accident sequence 4.1.1.1, HV-4B10A and HV-4B10B are valves controlled by FT-4B09 as the first IROFS credited. Valves HV-4B10A and HV-4B10B are controlled by RE-4B11 as the second IROFS credited. Discuss the independence of these two IROFS which share these two valves.

This information is required to determine if these IROFS are sufficiently reliable to meet the performance requirements of 10 CFR 70.61.

NFS Response:

Valves HV-4B10A and HV-4B10B are indeed part of both IROFS, as they are the valves that close to stop HEU flow to the eductor. Independence between the two IROFS is guaranteed because only one of the valves is needed for each of the two IROFS. The monitors are designed to close both valves only for redundancy, which strengthens the safety basis. The risk index (-2 in this case) is sufficiently demonstrated by having each monitor only close one valve each.

The system is designed such that both valves are spring closed. Energy to open either is provided by a motor operator in the case of HV-4B10A and by an air operator in the case of HV-4B10B. These operators are provided electrical energy (when the valves are allowed to be opened) through relays. The flow totalizer (FT-4B09) and the inline monitor (RE-4B11) both send signals independently that close these relays that **allow** valves HV-4B10A&B to **open**. To illustrate, in order to open valve HV-4B10A, flow totalizer FT-4B09 must send a signal to the relay on the power lead to the motor operator of HV-4B10A **AND** the inline monitor, RE-4B11, must also send a signal to a different relay on the power lead to the motor operator of HV-4B10A. In order to blend, both monitors must send signals to the separate relays to open both valves.

RAI Question 59:

Revise Section 2.12 of the license application to clarify the application of management measures to existing processes for which ISA Summaries have been approved. This can be accomplished by revising the second sentence to read, "Additionally, the requirements described in Section 2.12 shall apply to IROFS upon approval of an ISA Summary submitted to fulfill the requirements of 10 CFR 70.62(c)(3)."

This information is necessary to assure that management measures will be applied to IROFS for all existing processes for which NRC has approved ISA Summaries.

Revise Table 2.2 in Section 2.12 of the license application to include Maintenance as a management measure for active engineered, passive engineered, and enhanced administrative controls.

This information is necessary to assure that active engineered, passive engineered, and the engineered components of enhanced administrative controls will be maintained as required by 10 CFR 70.62(d).

NFS Response:

NFS will not defer implementation of management measures described in Section 2.12 of SNM-124 for the existing processes located in the BPF until October 18, 2004. NFS will implement each management measure described in Section 2.12 of SNM-124 for both new and existing processes in the BPF upon approval of the associated ISA Summary (i.e., approval of the ISA Summary submitted with the license amendment on October 11, 2002 and approval of the ISA Summary for the existing processes submitted on October 14, 2002).

To ensure that this concept is clearly articulated in Section 2.12 of SNM-124, changes to the second sentence in paragraph one of Section 2.12 of the referenced license are as follows:

> *Additionally, the requirements described in Section 2.12 shall apply to IROFS upon approval of an ISA Summary submitted to fulfill the requirements of 10 CFR 70.62(c)(3)..."*

NFS has also revised Table 2.2 in Section 2.12 of SNM-124 to include "maintenance" as a management measure for active engineered, passive engineered, and enhanced administrative controls. Please note that this commitment currently exists in Section 2.12.2 *Maintenance of IROFS* and Section 2.12.2.2 *Maintenance of Administrative Controls* of SNM-124.

While not requested by NRC staff with respect to **Question 59**, NFS has also added "calibration" under the category for enhanced administrative controls listed in Table 2.2 of SNM-124. Inclusion of this commitment is intended to provide consistency with a similar request by NRC staff regarding **Question 53**.