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AIRBORNE EXPRESS

21G-03-0065
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ACF-03-0087

March 6, 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 to Support the Uranyl Nitrate Building at the BLEU Complex, dated February 28, 2002 (21G-02-0051)
3) Letter from B.M. Moore to NRC, Reply to Request for Additional Information Concerning Integrated Safety Analysis Summary for the Uranyl Nitrate Building, dated December 23, 2002 (21G-02-0409)

Subject: Additional Information to Support NRC Review of the ISA Summary for the Uranyl Nitrate Building

Dear Sir:

Nuclear Fuel Services, Inc. (NFS) is hereby providing, for docketing purposes, information to support the subject licensing action for the BLEU Project Uranyl Nitrate Building.

Attachment I contains proprietary information that should be withheld from public disclosure in accordance with Title 10, Code of Federal Regulations, Part 2.790. Attachments II and III do not contain proprietary information and may be disclosed to the public.

N1155O1

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-03-0065) in any correspondence concerning this letter.

Sincerely,

NUCLEAR FUEL SERVICES, INC.

B. Marie Moore

B. Marie Moore
Vice President
Safety and Regulatory

Attachments

JSK/lsn

cc:
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ENCLOSURE

AFFIDAVIT

I, B. Marie Moore, Vice President of Safety and Regulatory at Nuclear Fuel Services, Inc. (NFS), make the following representations that to the best of my knowledge and beliefs:

1. The following document which Nuclear Fuel Services, Inc. (NFS) wishes to have withheld from public disclosure, is:

   Attachment I to NFS letter B. M. Moore to Director, NMSS, dated March 6, 2003 (21G-03-0065), in its entirety.

2. The information contained in the document cited in 1 above has been held in confidence by Nuclear Fuel Services, Inc. (NFS) in that it is of a privileged and confidential commercial nature.

3. The information contained in the document cited in 1 above is the intellectual property of Nuclear Fuel Services, Inc. (NFS) and as such is customarily held in confidence by Nuclear Fuel Services, Inc. (NFS). Nuclear Fuel Services, Inc. (NFS) has customarily submitted privileged and confidential information of this type to the Nuclear Regulatory Commission (NRC) and to its predecessor, the Atomic Energy Commission (AEC), in confidence.

4 The information contained in the document cited in 1 above has not been made available to public sources by Nuclear Fuel Services, Inc. (NFS), nor has Nuclear Fuel Services, Inc. (NFS) authorized that it be made available.

5. The public disclosure of the information contained in the document cited in 1 above is likely to cause substantial economic harm to Nuclear Fuel Services, Inc. (NFS).

B Marie Moore 3/6/03

B. Marie Moore Date
Vice President
Safety and Regulatory

I certify the above named person appeared before me and executed this document on this the 6th day of March, 2003.

Notary Public

My commission expires: 02/04/07

ATTACHMENT II

Draft Talking Points for NFS/NRC Meeting on December 18-19, 2002
Regarding NRC's Request for Additional Information

(13 pages to follow)

Draft Talking Points for NFS/NRC Meeting on December 18-19, 2002
Regarding NRC's Request for Additional Information

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10 CFR 70.64(a) Baseline Design Criteria

Nuclear Fuel Services, Inc. (NFS) discussed measures needed to implement 10 CFR 70.64 *Baseline Design Criteria* with NRC during two "On-site Reviews" that were conducted on June 11-13, 2002 and October 22-23, 2002. To NFS' understanding, responses provided by NFS during these On-site Reviews were acceptable (except for accidents involving external Bulk Chemical Storage) to demonstrate compliance with the Baseline Design Criteria.

NFS' measures that demonstrate compliance with the Baseline Design Criteria (10 CFR 70.64), included in the revised Integrated Safety Analysis (ISA) Summary[1], are summarized below. These measures reflect the commitments discussed during the referenced On-site Reviews that were understood by NFS to be acceptable to the Nuclear Regulatory Commission (NRC), with respect to compliance with these regulatory requirements. For clarification, NFS has prepared more detailed assessments of accident scenarios involving Bulk Chemical Storage.

<u>Quality Standards and Records:</u> 10 CFR 70.64(a)(1) requires the use of appropriate management measures to assure the availability and reliability of items relied on for safety. The management measures listed in Section 4.8 of the ISA Summary have been programmatically used by NFS since 1996 to successfully maintain items relied on for safety (IROFS). The successful implementation of this management measure program is verified by NFS through regularly scheduled Quality Assurance audits and has been rigorously scrutinized by the NRC since its inception. As required by the latter part of 70.64(a)(1), appropriate program records have been and will continue to be maintained by NFS. Concerning materials and equipment specifications, NFS defines and confirms upon procurement the applicable design specifications prior to materials and equipment use. When standard off-the-shelf components are identified as items relied on for safety, the appropriate management measures (e.g. functional testing, inspections, calibration) are implemented to assure their availability and reliability.

<u>Natural Phenomena Hazards:</u> NFS committed to construct the Uranyl Nitrate Building to meet seismic criteria specified in the 1997 Standard Building Code (SBC) during the NRC's On-site Review in June 2002. NFS stated that the baseline design criteria required to address natural phenomena do not dictate that IROFS are protected from natural phenomena hazards, but that the facility is designed to prevent unsafe conditions arising from natural phenomena. NFS' position is that an IROFS would have to be designed to withstand specific natural phenomena (earthquake, etc.) only if that IROFS is designed to prevent or mitigate an accident scenario that results from such an event.

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[1] Letter from B.M. Moore to NRC, Revised Integrated Safety Analysis Summary for Uranyl Nitrate Building, dated August 23, 2002 (21G-02-0268).

NFS committed to perform an engineering evaluation to demonstrate that seismic events predicted for the site would not breach the storage tanks located at the UNB by common mode failures. During NRC's June On-Site Review, NFS committed to perform necessary evaluations and revise the ISA Summary[2] to reflect use of the SBC to prevent or mitigate natural phenomena hazards. As discussed with NRC staff, the proposed approach was fully consistent with precedence established by other fuel cycle facilities during similar licensing actions needed to implement 10 CFR 70, Subpart H requirements. Based on these discussions, the manner in which NFS intended to implement the Baseline Design Criteria (10 CFR 70.64) was sufficient to fulfill this regulatory requirement.

The following information provides additional details regarding compliance with specific codes that will be used to construct the UNB to natural phenomena hazards and relevant issues associated with the NRC's Request for Additional Information(RAI)[3].

<u>UNB Code Compliance:</u> The UNB and related systems are being designed and built per various building and fire codes. The following steps will be taken to ensure that the commitments made in the ISA Summary to meet these codes are met:

- Design drawings and specifications call out applicable code requirements.
- Suppliers and vendors will certify that supplied equipment and systems comply with the drawings and specifications, and other relevant codes. For instance, the building supplier provides certification that the building structure was designed to the pertinent Standard Building Code.
- Construction/installation will be per the design documentation by qualified contractors. For example, the building is being constructed by trained construction personnel; the construction contractor has many years of experience with industrial and commercial construction projects; and the contractor will provide certification that the building was constructed per the design.
- Construction progress is reviewed daily by qualified Framatome ANP engineering personnel.
- Multiple inspections are performed by the City of Erwin inspectors as part of the Building Permit process (plumbing, electrical, building, etc.). A Certificate of Occupancy will be issued only when the last inspection has been completed satisfactorily.
- The internal Acceptance Test Procedures will have signoff/checklists that document the as-built verifications that the various installations meet code requirements, where applicable.

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[2] See Item No. 10 contained in the attachment to *Letter from NRC to B.M. Moore, Nuclear Fuel Services, Inc., (TAC NO. L31599) Uranyl Nitrate Building License Amendment Application and Integrated Safety Assessment On-Site Review, June 11-13, 2002*, dated July 11, 2002.

[3] Letter from NRC to B.M. Moore, Nuclear Fuel Services, Inc., Request for Additional Information (TAC NO. L31688) Blended Low-Enriched Uranium Project Uranyl Nitrate Building Revised ISA Summary, dated November 29, 2002.

- Walkdowns of the facility will be conducted as part of the internal Operational Readiness Review process to ensure the building construction and equipment installation was completed properly.

- Protection of IROFS from natural phenomena: There are no IROFS in the UNB that are applied to protect against hazards associated with natural phenomena. IROFS are designed and maintained per the management measures listed in the ISA Summary and engineering and operations experience. Therefore, no credible natural phenomena scenarios have been identified that would compromise the safety of the UNB operation by causing any of the IROFS to fail (as defined in Table 9 of the ISA Summary).

- Seismic protection of electrical components: The electrical supply systems are not IROFS, nor are they necessary to prevent failure of any IROFS because of the failsafe design implemented throughout the facility (see exception below). They are however necessary for proper and efficient operation of the facility. For these reasons, appropriate seismic design criteria will be applied in the specification and installation of this equipment to ensure that these controls are available and reliable.

- General seismic issues: The building and tank restraint system are designed to meet the seismic requirements of SBC Zone 2A, as stated in the ISA Summary. Based on the discussions with the NRC at the June On-site Review in Erwin, NFS believes that this is adequate protection against seismic events.

- High winds: As stated in Section 1.4 of the ISA Summary, the building is designed per building code requirements with a design wind load of 80 mph.

- Tornado: The only tornado reported in Unicoi County in the last 50 years occurred July 10, 1980. According to NOAA event data, no deaths occurred and only 12 injuries were reported. According to the *Johnson City Press*, high winds caused damage in the north side of Erwin, and in the Limestone Cove area northwest of Unicoi. These areas are more open than the NFS Site, which is in a fairly narrow valley. The adjacent Tennessee counties of Washington and Carter reported two tornadoes each in the last 50 years, which is also very infrequent.

  The annual average number of tornadoes per 10,000 square miles for the State of Tennessee from 1950 – 1995 as reported by NOAA is 2.9. This equates to an average probability of 6.4 E-6 per square mile per year. Since the NFS Controlled Area is 0.047 square miles, the average probability is 3.0 E-7 per year for a direct hit at the NFS Controlled Area. This probability is considered conservative since the NFS Controlled Area (0.047 sq. miles) is not an open area, but bounded by mountain ranges that run in a southwest to northeast direction indicative of the northeast Tennessee topography. The NOAA statistics bound the entire state of Tennessee, of which a majority of the area is more open topography than northeast Tennessee. Therefore, the probability of a tornado occurring is even less at the NFS Controlled Area site.

Considering the low probability of a tornado striking the NFS Site, of tornadoes developing in the Unicoi County area, and even lower probability of a tornado developing at the NFS Site, a damaging tornado is not considered a significant concern for site operations. In the event that a tornado did occur on site, protective actions would be implemented in accordance with the NFS Emergency Plan.

- Hurricane: The Process Hazards Analysis determined that damage from a hurricane was not credible, based on historic data for the Erwin, TN area. Heavy rain damage to the building is bounded by snow loading, against which the building is designed per building code requirements.

- Flood: The Process Hazards Analysis found no credible accident scenario resulted from flooding because the storage tanks are bolted in place and the facility is approximately 15 feet above the 100 year floodplain Base Flood Elevation.

  The City of Erwin participates in the National Flood Insurance Program (NFIP) created by Congress in 1968. Communities that participate in NFIP adopt and enforce floodplain management ordinances that provide flood loss reduction building standards for new and existing development. The lowest floor elevation for buildings that are located in the 100-year floodplain must be at least one foot above the Base Flood Elevation. The UNB is not located in the 100-year floodplain, thus a large margin of safety exists nevertheless.

NFS Bulk Chemical Storage Accidents: The consequences that are typical of Scenario 9, NFS Bulk Chemical Storage Accident, would mo[redacted] be bounded by scenarios [redacted]drogen storage vessels. Approximatel[redacted]of the UNB, there is a [redacted]liquid hydrogen tank and a backup bank of six (6) horizontal tanks containing gas[redacted] (each tube is approximately 54 cubic feet). In the same area, there is a [redacted]iquefied propane gas (LPG) tank. Also, the delivery truck routes for both hydrogen and propane are approximately [redacted]eet from the UNB.

The primary exposure from these tanks and delivery trucks is from a BLEVE (boiling liquid expanding vapor explosion). A BLEVE creates a large rising fireball of short duration, which presents a radiant heat and burn injury exposure to people who may be outside and not in fire-rated protective clothing. A BLEVE does not produce remote overpressures and presents an insignificant thermal exposure from a property damage standpoint.

A hydrogen unconfined vapor cloud explosion (UVCE) is not a credible event due to the vapor density and dispersion characteristics of hydrogen. The LPG tank size ([redacted] gallons), and location (in the open), makes the likelihood of an UVCE highly unlikely. The outside hydrogen and propane tanks present an insignificant exposure to process operations inside the UNB.

<u>Studsvik Bulk Chemical Storage Accident:</u> This type of accident would most likely be bounded by Scenario 9, NFS Bulk Chemical Storage Accident.

Studsvik uses bulk NaOH inside their process facility building. In addition, liquid nitrogen and oxygen tanks are located at their process facility.

<u>Railroad Accident causing Explosion or Fire:</u> For clarification, the CSXT railroad yard is approximately 220 feet from the UNB. The rail yard speed limit is 10 mph. All trains stop in the rail yard; there are no tracks that pass straight through. The bounding fire from a radiant heat exposure to UNB would be an LPG railcar BLEVE. As stated above, a BLEVE creates a large rising fireball of very short duration, which presents a radiant heat and burn injury exposure to people who may be outside and not in fire-rated protective clothing. A BLEVE does not produce remote overpressures and would present an insignificant thermal exposure to UNB from a property damage standpoint

LPG rail cars have very strict design and operational requirements. In addition to the mechanical standards common to all freight cars, they must also meet the requirements of both DOT 49 CFR Part 179 and the Association of American Railroads (AAR) Specifications for Tank Cars. Builders must seek design approval from the AAR Tank Car Committee before building a tank car. Repairs must be performed only by facilities certified by the AAR. Normally, maximum LPG rail car inventory is [redacted] gallons (approx. 85% fill density).

Thermal insulation systems are installed to aid LPG tank cars in resisting the effects of fires in derailments. Heat shields are required to minimize damage to the tank car heads. Thermal protection, not to be confused with insulation, is installed on LPG tank cars to protect the tank from flame impingement. It is designed to keep tank metal temperatures below 800°F for 100 minutes (pool fire impingement) and 30 minutes from direct torch fire impingement.

Since the implementation of stricter design standards (required for new cars beginning in 1978 - retrofit of existing cars was completed in 1981), there have been no reports of major BLEVE or vapor explosion incidents involving these cars although a number of derailments have occurred.

Based on an LPG tank car being parked in the CSXT rail yard, with no loading or unloading operations, and based on the very strict tank car designs with no BLEVEs or vapor cloud explosions occurring over the last 21 years, the likelihood of having an LPG tank car BLEVE or explosion exposing UNB is considered highly unlikely.

Propane Storage Tank Fire: This scenario was evaluated in the PHA (refer to ISA Summary Table B, scenario 22). This external event was deemed of no or low consequence because of the distance from the UNB and the fact that the system is designed and built to applicable codes (specifically NFPA 58).

Appendix B (High and low ambient temperatures): These variations were evaluated in the HAZOP portion of the PHA and resulting scenarios are included in that document (and carried forward into the ISA Summary in the case of scenarios 1.106.1 and 1.111.1, for which IROFS are clearly identified). Further, regarding the statement that "the average January (31 days) daily minimum temperature is 23.8 F", if the daily minimum temperature is 24 F, then the average daily temperature is considerably higher. The calculation was done assuming an average temperature of 24 F for 37 days, which given the above information, is very improbable. Thus in fact a large safety margin does exist. The heating systems are designed to exceed the minimum heating performance required for the function of the IROFS. The design specifications and performance calculations will be placed in the permanent records file for each of these systems.

Appendix B (Lightning): The UNB has lightning protection per the applicable building codes (specifically NFPA 780, as stated in Section 1.4 of the ISA Summary).

Emergency Capabilities: The control of access to licensed material and hazardous chemicals produced from licensed materials is accomplished by the following security measures at the BLEU Complex as described in NFS' Physical Security Plan for a CAT III facility.

Planned evacuation routes, which minimize risk from all potential hazards, for example chemical, industrial, and radiation, control potential exposure to licensed material and hazardous chemicals at the BLEU Complex during evacuation of on-site personnel. A description of the evacuation routes are described in NFS' Emergency Plan.

The risk of potential exposure to on-site and off-site emergency responders is controlled by the use of NFS' Emergency Response Organization structure and responsibilities. The Emergency Control Director (ECD), with the support of Emergency Response Organization members, directs all emergency response measures, including approval for off-site agency personnel and vehicles (e.g., Fire Department and Ambulance Service) to enter the facility.

The following items are addressed in the Emergency Plan to ensure control of the evacuation of on-site personnel:

- A criticality detection system is present and maintained in accordance with the requirements of 10 CFR 70.24.
- The location of an assembly area outside the immediate evacuation zone for the BLEU Complex is identified and posted. The immediate evacuation zone is identified using Health Physics dose projection calculations.

- When an evacuation is initiated, all personnel within the immediate evacuation zone will evacuate without hesitation by planned evacuation routes to the assembly area whereupon timely accountability and radiological assessment is initiated.
- Sufficient exits from the immediate evacuation zone are provided to enable rapid and unobstructed evacuation of personnel to the assembly area.
- Criticality evacuation training and drilling for all employees are provided on an annual basis.

Utility Services: To clarify measures needed to demonstrate compliance with 10 CFR 70.64(a)(7) *Utility Services*, NFS will add the following text to the beginning of Appendix A(a)(7) of the UNB ISA Summary:

> *There is only one utility in the UNB that could be considered an "essential utility service" – the water supply to the fire suppression system. The "continued operation" of this system is assured because the water supply meets all relevant NFPA requirements for such a system. All other utilities, whether supplied from offsite (electricity, natural gas, etc.) or generated onsite (compressed air, DIW, etc.) are not considered "essential".*

Criticality Control: The original assessment of accident scenario 1.5.1 of the PHA specified that this was not a credible scenario based on the extensive criticality safety controls at Savannah River (SRS), plus the fact that all of their handling of the LEUN is in unfavorable geometry tanks (if the LEUN received at the UNB could go critical in the UNB, it would have done so at SRS before the material was shipped). In the June meeting, the NRC stated that they would not accept the SRS safety controls as both legs of double contingency. As a result, scenario 1.5.1 was added to the ISA Summary as a credible scenario and was assigned a suitable initiating event frequency (very low, but not "highly unlikely"). Two IROFS were selected that render the accident scenario "highly unlikely". The first is that LEUN will not be transferred into the UNB until the sample results from SRS are received and verified to meet safety specifications. The second is that LEUN will not be transferred until independent sample results from Framatome's analysis in Richland are received and verified to meet safety specifications.

> Safe preparation of LEUN at SRS: The downblending and loading of the LEUN at SRS is very tightly controlled to meet product specifications and to maintain concentration control for criticality safety.

- Double contingency: The IROFS for scenario 1.5.1 at the UNB are administrative controls, which are maintained as reliable and available by applying the applicable management measures as listed in Section 4.8 of the UNB ISA Summary.

Instrumentation & Controls: To clarify measures needed to demonstrate compliance with 10 CFR 70.64(a)(10) *Instrumentation and Controls*, NFS commits to revising Appendix A of the ISA Summary as follows:

> *Instrumentation & Controls: The design must provide for inclusion of instrumentation and control systems to monitor and control the behavior of IROFS.*
>
> *Active engineered controls are used extensively for safety purposes in the UNB facility. Section 4.8 of the ISA Summary addresses the requirements for inspection, periodic functional checks, and maintenance to maintain the effectiveness of IROFS. This type of IROFS is typically implemented through the Central Control System (CCS). The CCS provides extensive internal diagnostic checks that will detect component failures and trigger alarms and in appropriate cases will send the outputs to a safe state. This is true for individual field instruments up through the controllers themselves and all communication links in between.*

Environmental & Dynamic Effects: In general, equipment items and systems that are included in IROFS are protected from environmental and dynamic events by design as necessary to assure they are available and reliable to perform their required safety function by application of good engineering practice. Further, their continued function is maintained by the management measures listed in Section 4.8 of the ISA Summary.

10 CFR 70.65 - Additional Contents of the Application

NFS presented information needed to support the methods that will be used to demonstrate compliance with 10 CFR 70.61, *Performance Requirements* to the NRC[4]. As discussed with NRC staff, NFS' application of IROFS failure indices and the use of definitions for *unlikely* and *highly unlikely,* as contained in the ISA Summary for the UNB, are sufficient to fulfill the 10 CFR 70.61 regulatory requirements. These methods are used to assess high and intermediate consequences for credible nuclear criticality, radiological and chemical accident sequences. The following summary clarifies the manner in which NFS evaluates potential accident sequences with respect to the *Performance Requirements* (10 CFR 70.61).

Failure of IROFS and Definitions of *Unlikely* and *Highly Unlikely*: NFS stated in the November teleconference that an assignment of an IROFS failure index is conservatively based on failure of the IROFS function. That is, it is expected that the IROFS function will not fail outside the bounds established by the assigned index with the applied management measures. As such, the IROFS equipment and utility boundaries are established to support this function and its respective assigned index.

The following bulleted items discuss adaptation of Tables A-9 and A-10 of the NRC's Standard Review Plan (SRP) to Tables 3 and 4 of the UNB ISA Summary.

- NFS has performed a qualitative risk assessment as provided for in the SRP. That is, a qualitative input produces a qualitative output.
- Initiating event failure frequencies are derived from Table A-9 and presented in Table 3 of the UNB ISA Summary. A conservative safety envelope is established by assuming that the initiating event occurs and then applying the IROFS failure index.
- IROFS failure indices are adapted from Table A-10 and presented in Revised Table 4 of the UNB ISA Summary. The allowed IROFS failure indices provided for in Table A-10 spreads over two orders of magnitude. Table 4 of the ISA Summary, contains indices that appear to be non-conservative. However, the definition of Highly Unlikely and Unlikely were also shifted one order of magnitude to a –4 index, effectively removing the non-conservative bias. If NFS had used the less conservative values and used an index of –5 to define Highly Unlikely, the same safety envelope would have been established.
- The justification for defining indices for initiating events that are not credible is based on both Tables A-9 and A-10 of the SRP. In both tables, there are two orders of magnitude between the two lower indices. For example, Table A-9 goes from –4 to –6 and Table A-10 allows for the same spread. Therefore, NFS

[4] NFS presented risk analysis methodologies to the NRC during both of the referenced "On-site Reviews", at a meeting at NRC Headquarters, Rockville, Maryland on September 30, 2002 and during a teleconference on November, 2002.

provided the same two order of magnitude spread in adapting Table A-10 of the SRP.

- NFS believes these adaptations clearly meet the intent of the SRP.

The title provided for Table 4 of the ISA Summary (page 45) will be changed to "IROF Failure Index" to remove the ambiguity surrounding the use of frequency indices for IROFS failures. Table 4 will also be revised to be consistent with the BLEU Prep. Facility ISA Summary submitted to the NRC in October 2002. In addition, NFS will submit definition changes substituting "an index of –4 / event" for "10^{-4} per accident per year" and, an index of "–3/event" for "10^{-3} per accident per year"." This latter change is required to emphasize the use of a qualitative analysis.

As discussed in the referenced early November 2002 teleconference, it is NFS' understanding that these issues are readily resolvable and NRC staff acknowledged that the methods used to demonstrate compliance with 10 CFR 70.61 are adequate.

<u>10 CFR 70.65(b)(6)</u>

NFS discussed the type of IROFS (as specified in the ISA Summary) that will be used to comply with the *Performance Requirements* (10 CFR 70.61) during the Onsite Reviews conducted on June 11-13, 2002 and October 22-23, 2002. NFS has clarified its position regarding the manner in which these IROFS will be maintained reliable. To reflect the discussions held at these two On-site Reviews, additional commitments are included to bring resolution of these issues, as noted below.

<u>Alarm and Interlock Setpoints</u>: A formal calculation of each safety setpoint will be performed for active engineered controls and enhanced administrative controls (e.g., the density alarm setpoint in IROFS UNB-J). This calculation will be documented in the equipment file for each applicable IROFS. Calculations will follow good engineering practice, which is advised by, but not dictated by standards such as ISA-S67.04, which is intended for application in nuclear power plants (with their vastly higher safety risks).

<u>Management measures for enhanced administrative controls:</u> Section 4.8 of the ISA Summary (and specifically Table 8) will be amended to clearly include the management measures to be applied for this category of device. Thus the use of an IROFS failure index of -1 is appropriate and in fact conservative considering the protective function of this particular IROFS (UNB-J). Refer to Table 9 of the ISA Summary.

<u>Support systems for storage tank density measurement, part of IROFS UNB-J:</u> As with the freezing scenarios, the evaporation scenarios 1.76.1, 1.106.1, and 1.115.1 take a very long time in a failed condition to reach unsafe uranium concentrations in the storage tanks. Thus, no credible power outage will lead to a loss of the protective function of this IROFS.

<u>Active engineered controls</u>

- <u>Common failure mode:</u> There is no common mode of failure for the indepe[redacted] safety controls as implemented in the UNB (for example, reference IROFS [redacted]

[redacted] These controls are designed to fail safe – on loss of air and/or electric power (which both systems rely on for normal operation), the valves close, which is the safe position. Thus the IROFS do not fail in their safety function if these common utilities are lost.

- Failure indices for active engineered controls: The IROFS failure index of -2 is appropriate and conservative considering both the management measures applied to these controls and the protective function that is being performed by the specific IROFS. Typically, these controls fail safe and thus availability of support systems such as electric power is not required to assure capability of these controls to perform their required function.

  Appropriate management measures will be applied to support systems, even though they are not required for safety reasons. This will be done at NFS' discretion for process availability and economic reasons and will not be documented in the ISA Summary or related reports.

Freezing protection IROFS [redacted] and [redacted]

- Independence: The main heating system (part of IROFS [redacted] is powered by the main electrical supply. The backup heating system (part of IROFS [redacted] is powered through the backup power supply (the diesel generator if main power is lost). These electric systems do have a potential common mode failure in the improbable situation of a transfer switch failure that disables both systems. However, it is not credible that this situation could continue long enough under the necessary circumstances for either of the IROFS to fail as defined in Table 9 of the UNB ISA Summary. The time period is greater than two weeks, and the conditions are the extremely unusual weather that would lead to the building to be less than 35°F for this entire time. Thus, there is no credible common mode failure for the protective functions provided by IROFS [redacted] and [redacted]

- IROFS Failure Index: Considering the protective function and its failure definition per Table 9 of the UNB Summary, the IROFS failure index of -2 is fully justified and is in fact conservative.

IROFS failure index of fire alarm and suppression systems

- These systems are designed and built to appropriate NFPA codes and as such an IROFS failure index of -2 is justified as an active engineered control.

Gas Supply /Heater Supply System: Specific responses to the RAI will be discussed with the NRC during the subject meeting on December 18-19, 2002.

Management Measures

NFS has clarified issues regarding use of Management Measures to maintain IROFS reliable as noted below. In some instances, NFS interprets Management Measures in a manner that differs from NRC staff (as described in Request for Additional Information).

NFS has included commitments that are believed necessary to clarify the types of Management Measures that will be implemented for administrative controls.

Listing Management Measures as IROFS: NFS does not establish management measures as IROFS based on the following NRC guidance and regulations.

- The definition of management measures as specified in Chapter 11 of the SRP, Section 11.1 states, " Management Measures are functions, performed by the licensee, generally on a continued basis, that are applied to items relied on for safety (IROFS) to provide reasonable assurance that the IROFS are available and able to perform their functions if needed."
- Chapter 3 of the SRP, Section 3.4.3.1(3) states, "The applicant commits to establish management measures (which are evaluated using SRP Chapter 11) that comprise the principle mechanism by which the reliability and availability of each IROFS is ensured."
- 10 CFR 70.62(d) states, " Each applicant or licensee shall establish management measures to ensure compliance with the performance requirements of 70.61". The measures applied to a particular engineered or administrative control may be graded commensurate with the reduction of risk attributable to that control or control system. The management measures shall ensure that engineered or administrative controls and control systems that are identified as items relied on for safety pursuant to 70.61(e) of this subpart are designed, implemented, and maintained, as necessary, to ensure they are available and reliable to perform their function when needed, to comply with the performance requirements of 70.61 of this subpart.
- Management measures are measures applied to ensure the IROFS are available and reliable to perform their function. The management measures are therefore not IROFS and are not designated as such. The management measures applied to ensure an engineered or administrative IROFS function is available and reliable are presented in Section 4.8 of the Blended Low Enriched Uranium (BLEU) Project, Uranyl Nitrate Building (UNB), Integrated Safety Analysis Summary, dated August 2002. The management measures are graded based on risk as provided for in 10 CFR 70.62 (d). The management measures provided in Section 4.8 address each category, as required in Chapter 11 of the SRP.

  The ISA Summary (Table 8 of Section 4.8) provides management measures, as applicable, for active engineering, passive engineering and administrative IROFS assigned to prevent or mitigate an accident sequence to meet the performance criteria specified in 10 CFR 70.61. Enhanced administrative control management measures were not presented in Table 8. However, NFS commits to revising Table 8 to clarify management measures that will be implemented for enhanced or augmented administrative controls as requested in RAI Question 3.1.

Fire Protection

Specific responses to the RAI will be discussed with the NRC during the subject meeting on December 18-19, 2002.

10 CFR 70.66 - Additional Requirements for Approval of the License Application

As discussed with NRC staff, NFS commits to submit changes to Part I of NRC Material License No. 124 by February 28, 2003 that describes management measures to be implemented at the UNB.

ATTACHMENT III

**NFS Response to NRC Request for Additional Information (RAI)
Regarding Blended Low-Enriched Uranium (BLEU) Project
Uranyl Nitrate Building (UNB) Revised Integrated Safety Analysis (ISA) Summary
(Letter dated November 29, 2002, TAC No. L31688)
(Errata Fax dated December 16, 2002, TAC No. L31688)**

(50 Pages to follow)

Nuclear Fuel Services (NFS) Response to Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) Regarding Blended Low-Enriched Uranium (BLEU) Project Uranyl Nitrate Building (UNB) Revised Integrated Safety Analysis (ISA) Summary (Letter dated November 29, 2002, TAC No. L31688) (Errata Fax dated December 16, 2002, TAC No. L31688)

GENERAL RAI TOPICS:

The following general topics are mentioned in several RAI questions.

Definition of IROFS

Item(s) Relied On For Safety (IROFS) – Designated engineered or administrative functions that provide reasonable assurance through preventive or mitigative measures, that the safety performance requirements of 10 CFR 70.61 are met. Equipment, actions or process controls that ensure that the IROFS function is reliable and available to meet the performance criteria may consist of engineered controls with or without a design time constant or operator actions in response to normal or abnormal events. Controls on IROFS may consist of active, passive, administrative or enhanced administrative controls, which ensure the IROFS perform the intended safety function. In addition, utility subsystems required to maintain the reliability and availability of the IROFS are bounded within the IROFS function. Utilities not required to meet the performance criteria, such as in fail-safe controls or equipment, do not require inclusion in the IROFS functional boundary. The IROFS functional boundary equipment and subsystems must be:

- Designed to prevent or mitigate specific, potentially hazardous events. Each identified potential hazard will have corresponding, specific protection strategies.

- Independent so that there is no dependence on components of other protective layers associated with an identified hazard. There must also be no linkage between the initiating event and the ability of the IROFS to perform as required.

- Dependable so that they can be relied on to operate in the prescribed manner. Both random and specific failure modes will be considered in the assessment if there is a probability of protection layers failing on demand or failing during their mission. If human intervention is included as an IROFS, the response time and corresponding human error probability must be considered.

- Auditable in that they are designed to facilitate regular validation (including testing) and maintenance of their protective functions.

This definition will be incorporated into Revision 2 of the UNB ISA Summary.

UNB Code Compliance

The UNB and related systems are being designed and built per the applicable portions of the building and fire codes. The following steps will be taken to ensure that the commitments made in the UNB ISA Summary to meet these codes are met:

- Design drawings and specifications call out applicable code requirements.
- Suppliers and vendors will certify that supplied equipment and systems comply with the drawings and specifications, and other relevant codes. For instance, the building supplier provides certification that the building structure was designed to the Standard Building Code (SBC).
- Construction/installation will be per the design specifications and drawings by qualified contractors. For example, the building is being constructed by trained construction personnel; the construction contractor has many years of experience with industrial and commercial construction projects; and the contractor will provide certification that the building was constructed per the design.
- Construction progress is reviewed daily by qualified Framatome ANP engineering personnel.
- Multiple inspections are performed by the Town of Erwin inspectors as part of the Building Permit process (plumbing, electrical, building, etc.). A Certificate of Occupancy will be issued only when the last inspection has been completed satisfactorily.
- The internal Acceptance Test Procedures will have signoff/checklists that document the as-built verifications that the various installations meet code requirements, where applicable.
- Walkdowns of the facility will be conducted as part of the internal Operational Readiness Review process to ensure the building construction and equipment installation was completed properly.
- Any future change to the facility, structures, processes, systems, equipment, components, computer programs, procedures, etc. shall be processed as an NFS Internally Authorized Change (IAC) per License Condition S-25 criteria. The change will be reviewed against the approved safety bases, to include the Standard Building Code and other applicable codes.

Management Measures

NFS acknowledges receipt of Errata Fax dated December 16, 2002, TAC No. L31688 that deleted language about management measures being designated as IROFS as specified in RAI Questions 1.2.3.F, 1.2.11, 1.2.13, 2.5.3.B, 2.5.3.C (iii), 2.7.J, and 2.7.L. The Errata Fax did not address the language in Question 1.2.3.E, therefore NFS is providing the following explanation.

RAI Question 1.2.3.E requests that management measures be listed as IROFS. NFS does not establish management measures as IROFS based on the following NRC regulation:

> 10 CFR 70.62 (d) states, " Each applicant or licensee shall establish management measures to ensure compliance with the performance requirements of 70.61. The measures applied to a particular engineered or administrative control may be graded commensurate with the reduction of risk attributable to that control or control system. The management measures shall ensure that engineered or administrative controls and control systems that are identified as items relied on for safety pursuant to 70.61(e) of this subpart are designed, implemented, and maintained, as necessary, to ensure they are available and reliable to perform their function when needed, to comply with the performance requirements of 70.61 of this subpart."

Management measures are measures applied to ensure the IROFS are available and reliable to perform their function. The management measures are, therefore, not IROFS and are not designated as such.

<u>Central Control System</u>

This statement will be incorporated into Revision 2 of the UNB ISA Summary.

<u>SPECIFIC RAI TOPICS:</u>

1. NRC QUESTION:

1.0 <u>10 CFR 70.64(a) Baseline Design Criteria</u>
Section 70.65(b)(4) requires the ISA Summary to contain information that demonstrates compliance with the requirements of 70.64 – Baseline Design Criteria (BDC). Listed below are questions for several of the BDC criteria. Revise Appendix A to the ISA Summary to address the following comments:

1.1 <u>70.64(a)(1) Quality Standards and Records</u>

This section requires that the design be developed and implemented in accordance with management measures to provide adequate assurance that items relied on for safety will be available and reliable to perform their intended function when needed. Section 4.8 of the ISA Summary contains a list of management measures that will be applied to administrative, passive engineered, and active engineered IROFS. Provide quality standards for specification of the materials and equipment that will be IROFS.

NFS RESPONSE:

As stated, 10 CFR 70.64(a)(1) requires the use of appropriate management measures to assure the availability and reliability of items relied on for safety. The management measures listed in Section 4.8 of the UNB ISA Summary have been programmatically used by NFS since 1996 to successfully maintain items relied on for safety. The successful implementation of this management measure program is verified by NFS through regularly scheduled internal quality assurance audits and has been rigorously scrutinized by the NRC since its inception. As required by the latter part of 70.64(a)(1), appropriate program records have been and will continue to be maintained by NFS. Concerning materials and equipment specifications, NFS defines and confirms upon procurement the applicable design specifications prior to materials and equipment use. When standard off-the-shelf components are identified as items relied on for safety, the appropriate management measures (e.g., functional testing, inspections, calibration) are implemented to assure their availability and reliability.

Functional testing of IROFS is scheduled, performed, tracked, and documented for review per NFS' Safety Related Equipment (SRE) Program. Functional testing is performed to ensure that the IROFS is reliable and available to perform its intended safety function. Functional testing is conducted using approved procedures with process compensatory measures being applied while the test is being performed. The functional testing periodicity is established by risk assessment and operational safety discipline evaluations.

The testing frequency is initially bounded by an assigned duration of failure index, assuming the IROFS fails to perform its function on demand. The duration of failure index specifies the length of time the system or process is vulnerable to failure of the second IROFS and thus a high consequence event. The bounding time to identify and remove this vulnerability subject to the performance criteria specifies the bounding IROFS failure duration and thus, functional testing periodicity. The periodicity may be adjusted by the safety disciplines to account for operational requirements not related to the performance criteria. However, the adjustment will be made in a conservative direction. That is, functional testing periodicity will not exceed the periodicity established to meet the performance criteria.

NFS will add these statements to Section 4.8.9 in Revision 2 of the UNB ISA Summary.

Table 8 specifies that records management and QA requirements will be adhered to as management measures to ensure the IROFS reliability and availability, and that when demanded the IROFS prevents or mitigates the accident sequence to meet the performance requirements. These management measures will be applied to the design, construction, operations, maintenance and change control of

IROFS functional boundaries and identified subsystems. All IROFS boundary equipment and essential utilities will be purchased, inventoried and installed in accordance with engineering design specifications to ensure they are reliable and available to perform their intended function and meet the performance criteria. Management measure Category A IROFS as specified in Table 8 will require functional testing. Documentation of the above steps will be maintained in the ISA files for individual IROFS.

2. NRC QUESTION:

1.2 <u>70.64(a)(2) Natural Phenomena Hazards</u>

NFS COMMENT:

The Baseline Design Criteria requirement is:

<u>Natural Phenomena Hazards</u>: The design must provide for adequate protection against natural phenomena with consideration of the most severe documented historical events for the site.

Based on discussions with the NRC on December 18 and 19, 2002, at NRC Headquarters, the UNB facility and components will be designed and constructed to the Standard Building Code and other applicable codes. This meets the requirements of 10 CFR 70.64 (a)(2), and the performance criteria of 10 CFR 70.61 are not applicable. Furthermore, this requirement does not dictate that IROFS are protected from natural phenomena hazards, but that the facility is designed to prevent unsafe conditions arising from natural phenomena.

1.2.1 **This section requires that the design provide for adequate protection against natural phenomena with consideration of the most severe documented historical events for the site. Discuss the design of each IROFS that is an engineered control, or an administrative control that depends on instrumentation to notify an operator when an administrative action is needed, to ensure that adequate protection is provided against natural phenomena.**

NFS RESPONSE:

The UNB facility and components will be designed and constructed to the Standard Building Code and other applicable codes. There are no IROFS in the UNB that are applied to protect against hazards associated with natural phenomena. Further, IROFS are designed and maintained per the management measures listed in the Summary and engineering and operations experience. No credible natural phenomenon has been identified that would compromise the safety of the UNB operation by causing any of the IROFS to fail (as defined in Table 9 of the UNB ISA Summary).

3. **NRC QUESTION:**

1.2.2 During the ISA Summary onsite review, the staff and licensee discussed the seismic qualification of onsite electrical system components (automatic transfer switch, diesel generator, uninterruptible power supply, and motor control center). Confirm that these components will be seismically qualified for Zone 2A seismic conditions.

NFS RESPONSE:

The UNB facility and components will be designed and constructed to the Standard Building Code and other applicable codes. The electrical supply systems listed in this question are not IROFS, nor are they necessary to prevent failure of any IROFS because of the failsafe design implemented throughout the facility (see exceptions below). They are, however, necessary for proper and efficient operation of the facility.

4. **NRC QUESTION:**

1.2.3 <u>Appendix B, Scenario 1, Earthquake</u>

This event scenario is described as having the potential to rupture multiple tanks in the UNB, causing radiological contamination extending outside of the building. The scenario gives the seismic design for the tank restraint system and alludes to the strength of the tanks to resist seismic motions.

For this scenario, please provide the following additional information:

A. Based on discussions of other hazards in Section 3.4, discuss NFS' calculation of the level of consequences for a rupture of multiple tanks in the UNB.

B. The ISA mentions in Appendix B, scenario 1, that the UNB and UN storage tank restraint system is designed to meet or exceed Zone 2A seismic requirements with a seismic specification of 0.1g for the effective peak horizontal ground acceleration. Provide justification

for not identifying this restraint equipment as an IROFS. If IROFS are identified, provide the design bases.

C. **The ISA mentions in Appendix B, scenario 1, that similar tanks performed acceptably during a 1994 California earthquake. The ISA mentions in Section 3.2.1 that the UNB and UN storage tanks are designed with a seismic specification of 0.1g for the effective peak horizontal ground acceleration. Since NFS is relying on all UNB tanks to contain UN during a seismic event, please provide justification for not identifying these, and other similar tanks as IROFS. If IROFS are identified, provide the design bases.**

D. **Given that the UN and other similar tanks will be resting on raised pedestals, and that the tanks, restraint systems, and pedestals will be simultaneously subject to seismic motion, please provide justification for not identifying these pedestals as IROFS. If IROFS are identified, provide the design bases.**

E. **Given that the UN and other similar tanks, pedestals, isolation valves, tank legs, and restraint systems will be resting on the building floor, and given that all equipment resting on the building floor will be simultaneously subject to the movement of the floor caused by seismic ground motion, please provide justification for not identifying the building foundation <u>and</u> floor as IROFS. If other IROFS are identified, such as management measures, please describe.**

F. **Given that the UN similar tank isolation valves be connected to equipment that is resting on the building floor, and given that all equipment resting on the building floor will be simultaneously subject to movement of the floor caused by seismic ground motion, please provide justification for not identifying the tank isolation valves and related hardware as IROFS. If other IROFS are identified, describe them and the management measures that will assure their reliability and availability.**

G. **NFS states in this scenario, "the probability of earthquake damage severe enough to cause failure of major structural components of the building and subsequent catastrophic damage to multiple tanks is Low." This statement may be true if the building is built to the seismic design specified by the standard building code at the proposed site. If the building were not built to the code, then the likelihood of failure and subsequent catastrophic damage may increase. This building failure likelihood increase may increase overall risk and may not be unacceptable. Therefore, the staff views the seismic design of the building to be important to its function. Please provide justification**

for not identifying the building as an IROFS. If IROFS are identified, provide the design bases.

H. Provide an analysis of the ability of the UN and other similar tanks to resist the load imposed by the failure of the building structure during a seismic event (provide analysis only if the building is not identified as an IROFS).

I. Identify the proper risk category for this scenario. Identify the likelihood category. Explain how the current design meets the performance requirements of 10 CFR 70.61.

NFS RESPONSE:

The UNB facility and components will be designed and constructed to the *Standard Building Code* and other applicable codes. The building and tank restraint system are designed to meet the seismic requirements of SBC Zone 2A, as stated in the UNB ISA Summary.

5. NRC QUESTION:

1.2.4 <u>Appendix B, Scenario 2, Storm – High Winds</u>

This event scenario is described as having the potential for building damage and subsequent rupture of multiple tanks in the UNB, causing radiological contamination extending outside of the building.

For this scenario, please provide the following information:

A. NFS states in this scenario, "the probability of wind damage severe enough to cause failure of major structural components of the building and subsequent catastrophic damage to multiple tanks is Low." This statement may be true if the building is built to the standards specified by the standard building code at the proposed site. If the building were not built to the code, then the likelihood of failure and subsequent catastrophic damage may increase. The overall risk may be unacceptable. Therefore, the staff views the design of the building to be important to its function. Please provide justification for not identifying the building as an IROFS. If specific IROFS are identified, provide the design bases (such as design wind load, pressure, etc.)

B. Provide an analysis of the ability of the UN and other similar tanks to resist the load imposed by the failure of the building structure during a high wind event (provide analysis only if the building is not identified as an IROFS).

C. **Identify the likelihood category. Identify the proper risk category for this scenario. Explain how the current design meets the performance requirements of 10 CFR 70.61.**

NFS RESPONSE:

The UNB facility and components will be designed and constructed to the Standard Building Code and other applicable codes. As stated in Section 1.4 of the UNB ISA Summary, the building is designed per building code requirements with a design wind load of 80 mph.

6. NRC QUESTION:

1.2.5 Appendix B, Scenario 3, Tornado

This event scenario is described as having the potential for building damage and subsequent rupture of multiple tanks in the UNB, causing radiological contamination extending outside of the building.

A. **NFS has given credit to the strength of the building to resist tornado loads without identifying the building structure as an IROFS. NFS has already identified the design basis for the building structure as the loads imposed by the standard building code. Similar to Scenarios 1 and 2, provide justification for not identifying the building as an IROFS. If IROFS are identified, provide the design basis. Identify the likelihood category. Identify the consequence category. Identify the proper risk category for this scenario. Explain how the current design meets the performance requirements of 10 CFR 70.61.**

B. **Provide an analysis of the ability of the UN and similar tanks to resist the load imposed by the failure of the building structure by a tornado event (provide analysis only if the building is not identified as an IROFS).**

NFS RESPONSE:

The likelihood of a building on the NFS site sustaining any damage from a tornado is low. Therefore, Section 1.5 of the UNB ISA Summary will be replaced with the text shown below. The revised section will be included in Revision 2 of the UNB ISA Summary.

Tornadoes

The only tornado reported in Unicoi County in the last 50 years occurred July 10, 1980. According to NOAA event data, no deaths occurred and only 12 injuries were reported. According to the Johnson City Press, high winds caused damage *in the north side of Erwin, and in the Limestone Cove area northwest of Unicoi. These areas are more open than the NFS Site, which is in a fairly narrow valley. The adjacent Tennessee counties of Washington and Carter reported two tornadoes each in the last 50 years, which is also very infrequent.*

The annual average number of tornadoes per 10,000 square miles for the State of Tennessee from 1950 – 1995 as reported by NOAA is 2.9. This equates to an average probability of 6.4 E-6 per square mile per year. Since the NFS Controlled Area is 0.047 square miles, the average probability is 3.0 E-7 per year for a direct hit at the NFS Controlled Area. This probability is considered conservative since the NFS Controlled Area (0.047 sq. miles) is not an open area, but bounded by mountain ranges that run in a southwest to northeast direction indicative of the east Tennessee topography. The NOAA statistics bound the entire state of Tennessee, of which a majority of the area is more open topography than east Tennessee. Therefore, the probability of a tornado occurring is even less at the NFS Controlled Area site.

Considering the low probability of a tornado striking the NFS Site, of tornadoes developing in the Unicoi County area, and even lower probability of a tornado developing at the NFS Site, a damaging tornado is not considered a significant concern for site operations. In the event that a tornado did occur on site, protective actions would be implemented in accordance with the NFS Emergency Plan.

7. NRC QUESTION:

1.2.6 <u>Appendix B, Scenario 4, Hurricane</u>

This event scenario is considered by the licensee to be not credible. However, the licensee has not provided an analysis of the maximum expected rain scenario for the site (for example, rain rate, duration, roof load rating, max. puddle depth on roof, etc.). The staff expects that any IROFS be identified including the design basis(es). The staff requires an evaluation of how the design will meet the performance criteria required by the regulation.

NFS RESPONSE:

The Process Hazards Analysis determined that damage from a hurricane was not credible, based on historic data for the Erwin, TN area. The roof of the UNB is sloped with no parapet walls, therefore heavy rain damage to the building is bounded by snow loading, against which the building is designed per building code requirements.

8. NRC QUESTION:

1.2.7 Appendix B, Scenario 5, Flood

The licensee has not provided information on IROFS credited with reducing the probability or consequences of an accident to unlikely or highly unlikely. Provide an analysis of the accident and categorize the consequences. The licensee must then provide the IROFS necessary to meet the performance criteria. A once-per-100 hundred-year flood is at a frequency of 10E-2. Describe and justify the IROFS that reduce the consequences of the event.

NFS RESPONSE:

The Process Hazards Analysis found no credible accident scenario resulted from local area flooding because the storage tanks are bolted in place and the facility is well above the 100-year floodplain Base Flood Elevation. The Town of Erwin participates in the National Flood Insurance Program (NFIP) created by Congress in 1968. Communities that participate in NFIP adopt and enforce floodplain management ordinances that provide flood loss reduction building standards for new and existing development. The lowest floor elevation for buildings that are located in the 100-year floodplain must be at least one (1) foot above the Base Flood Elevation. The UNB is not located in the 100-year floodplain, and the lowest floor elevation is fifteen (15) feet above the Base Flood Elevation, thus a large margin of safety exists.

9. NRC QUESTION:

1.2.8 Appendix B, Scenario 9, NFS Bulk Chemical Storage Accident

The licensee's description of the unmitigated consequence is simply a "potential off-site fire that could spread to the UNB" [emphasis added]. Please verify:

A. The location, contents, and estimated volumes and pressures, of the chemicals stored in the bulk chemical storage area,

NFS RESPONSE:

The following table presents the location, contents, and estimated volumes and pressures of the chemicals stored in the NFS Bulk Chemical Storage Area.

Bulk Chemical Storage
(From Table 1-3 of NFS Emergency Plan)

Chemical	Quantity (gallons)	Storage Location	Classification	Pressure	Comments

Chemical	Quantity (gallons)	Storage Location	Classification	Pressure	Comments

BCSA: Bulk Chemical Storage Area (Section 15.10.5.3 of License SNM-124)

B. Justify why the unmitigated consequence does not include an overpressure event and convective and radiation heat transfer loads to the proposed facility.

C. Provide an analysis for the likelihood (frequency) and consequences (overpressure magnitude, heat load, etc.) for the limiting bulk storage explosion and fire accident, or justify why this is an incredible event, or provide a statement that this type of accident is bounded by another accident scenario and name the scenario.

NFS RESPONSE:

Scenario 9, NFS Bulk Chemical Storage Accident, would most likely be bounded by scenarios involving hydrogen storage vessels. Approximately [redacted] feet north of the UNB, there is a [redacted] gallon liquid hydrogen tank and a backup bank of six (6) horizontal tanks containing gaseous hydrogen (each tube is approximately 54 cubic feet). In the same area, there is a [redacted]-gallon liquefied propane gas (LPG) tank. Also, the delivery truck routes for both hydrogen and propane are approximately [redacted] feet from the UNB.

The primary exposure from these tanks and delivery trucks is from a BLEVE (boiling liquid expanding vapor explosion). A BLEVE creates a large rising fireball of short duration, which presents a radiant heat and burn injury exposure to people who may be outside and not in fire-rated protective clothing. A BLEVE does not produce remote overpressures and presents an insignificant thermal exposure from a property damage standpoint.

A hydrogen unconfined vapor cloud explosion (UVCE) is not a credible event due to the vapor density and dispersion characteristics of hydrogen. The LPG tank size ([redacted] gallons), and location (in the open), make the likelihood of an UVCE highly unlikely. The outside hydrogen and propane tanks present an insignificant exposure to process operations inside the UNB.

10. NRC QUESTION:

1.2.9 <u>Appendix B, Scenario 13, Studsvik Bulk Chemical Storage Accident</u>

This accident scenario is described as a "potential off-site <u>fire</u> that could spread to UNB" [emphasis added]. Please answer the questions posed in 1.2.8 above as they may apply to the Studsvik facility or provide a statement that this type of accident is bounded by another accident scenario and name the scenario.

NFS RESPONSE:

Scenario 13, Studsvik Bulk Chemical Storage Accident, would most likely be bounded by Scenario 9, NFS Bulk Chemical Storage Accident.

Studsvik uses bulk NaOH inside the process facility building, and liquid nitrogen and liquid oxygen tanks located on the west side of their process building. In addition, a diesel fuel tank is located on the south east side of their process facility. Below are the tank sources, capacities, pressures and locations relative to the Studsvik process facility.

11. NRC QUESTION:

1.2.10 <u>Appendix B, Scenario 15, Railroad Accident Causing Explosion or Fire</u>

This accident scenario is described as an off-site explosion and fire that spreads to the UNB.

A. Provide a more detailed analysis of the likelihood (frequency). If this is a credible accident, discuss the consequences (overpressure magnitude, heat load, etc.) that may be expected for this type of accident, include all references. Identify IROFS as appropriate.

B. In reference to NFS' statement on pg. 8 of the August 2002 letter, please provide information and calculations confirming the statement that both fire and explosion scenarios are bounded by on-site fire and explosion scenarios. Compare and contrast your calculations with the staff's analysis of the vapor cloud explosion on the siding due to a tank car containing [redacted] gallons of propane (10% of which is assumed involved in the explosion) resulted in a higher TNT equivalent yield, and a higher overpressure at the UNB, than other scenarios.

NFS RESPONSE:

Section 1.8.2 of the UNB ISA Summary will be replaced with the text shown below. The revised section will be included in Revision 2 of the UNB ISA Summary.

<u>CSX Transportation Railroad Yard</u>

The railroad is approximately 220 feet from the UNB. The rail yard speed limit is 10 mph. All trains stop in the rail yard; there are no tracks that pass straight through. The bounding fire from a radiant heat exposure to the UNB would be an LPG railcar BLEVE. As stated above, a BLEVE creates a large rising fireball of very short duration, which presents a radiant heat and burn injury exposure to *people who may be outside and not in fire-rated protective clothing. A BLEVE does not produce remote overpressures and would not present a significant thermal exposure to the UNB from a property damage standpoint.*

LPG rail cars have very strict design and operational requirements. In addition to the mechanical standards common to all freight cars, they must also meet the requirements of both DOT 49 CFR Part 179 and the Association of American Railroads (AAR) Specifications for Tank Cars. Builders must seek design approval from the AAR Tank Car Committee before building a tank car. Repairs must be performed only by facilities certified by the AAR. Normally, the maximum LPG rail car inventory is [redacted] gallons (approx. 85% fill density).

Thermal insulation systems are installed to aid LPG tank cars in resisting the effects of fires in derailments. Heat shields are required to minimize damage to the tank car heads. Thermal protection, not to be confused with insulation, is installed on LPG tank cars to protect the tank from flame impingement. It is designed to keep tank metal temperatures below 800°F for 100 minutes (pool fire impingement) and 30 minutes from direct torch fire impingement.

Since the implementation of stricter design standards (required for new cars beginning in 1978 - retrofit of existing cars was completed in 1981), there have been no reports of major BLEVE or vapor explosion incidents involving these cars although a number of minor derailments have occurred.

Based on an LPG tank car being parked in the CSX rail yard, with no loading or unloading operations, and based on the very strict tank car designs with no BLEVEs or vapor cloud explosions occurring over the last 21 years, the likelihood of having an LPG tank car BLEVE or explosion exposing UNB is not considered a significant concern for site operations..

12. NRC QUESTION:

1.2.11 Appendix B, Scenario 22, BLEU Complex 250 Gallon Propane Storage Tank Fire

This accident scenario is described as "fire destroys the propane storage tank area – spreads to UNB." Provide a more detailed analysis of the likelihood (frequency). If this is a credible accident, discuss the consequences (overpressure magnitude, heat load, etc.) that may be expected for this type of accident, include all references. Identify design bases (such as compliance to NFPA 58, "Standard on Liquified Petroleum Gases") as appropriate. Describe the management measures to be applied to ensure its proper design, construction, and installation. Identify IROFS that will ensure compliance with the performance requirements, and describe management measures that will be applied to ensure their availability and reliability.

NFS RESPONSE:

This scenario was evaluated in the PHA (refer to UNB ISA Summary Appendix B, Scenario 22). This external event was deemed of no or low consequence because of the distance from the UNB and the fact that the system is designed and built to applicable codes (specifically the applicable portions of NFPA 58).

12. NRC QUESTION:

1.2.12 Appendix B

Add, or provide justification for not adding, high and low temperature events to the list of natural phenomena, fire, and external event scenarios. Discuss historical high and low temperatures and periods in greater detail than provided on pg. 31 of the August 2002 submittal. Discuss impact on design basis for HVAC and building insulation systems. Justify why the insulation system for the UNB is not identified as an IROFS. If appropriate, identify the insulation value as a design basis. The staff notes that on pg. 31 of the August submittal, NFS states that it would take 37 days with a constant outside temperature of 24°F to cool the UN to freezing temperatures. It goes on to say that the average January (31 days) daily minimum temperature is 23.8°F (less than 24°F). Please provide support for the statement that "a large margin of safety exists." Clarify that the design basis for the IROFS heater and backup heater will be both reliable and sufficiently sized to maintain temperatures at or above 35°F when exposed to the worst case atmospheric conditions (for example, the equipment can maintain design temperature for an atmospheric condition of 23.8°F and sustained winds of 50 mph for the appropriate number of hours/days).

NFS RESPONSE:

These variations were evaluated in the HAZOP portion of the PHA and resulting scenarios are included in that document (and carried forward into the UNB ISA Summary in the case of scenarios 1.106.1 and 1.111.1, for which IROFS are clearly identified). Further, regarding the statement that "the average January (31 days) daily minimum temperature is 23.8°F", if the daily minimum temperature is 24°F, then the average daily temperature is considerably higher. The calculation was done assuming an average temperature of 24°F for 37 days, which given the above information, is very improbable. Thus, in fact, a large safety margin does exist. The heating systems are designed to exceed the minimum heating performance required for the function of the IROFS. The minimum design basis for the building temperature control system in UNB-M and the backup system in UNB-Q are indicated by the failure definition in the IROFS Table 9. The design specifications and performance calculations will be placed in the permanent records file for each of these systems.

13. NRC QUESTION:

1.2.13 Appendix B

Add, or provide justification for not adding, lightning events to the list of natural phenomena, fire, and external event scenarios in Appendix B. In Section 4.2.2 of the August 2002 submittal, it states that considerations included lightning. Your August 2002 submittal provides a statement that the UNB has a moderate to severe risk of being damaged by lightning. Discuss lightning event scenario frequency and consequences. If applicable, justify why equipment or engineered and administrative controls to assure the compliance to NFPA 780, "Standard for the Installation of Lightning Protection Systems, 2000 Edition" is not identified as IROFS.

NFS RESPONSE:

The UNB has lightning protection per the applicable building codes (specifically the applicable portions of NFPA 780, as stated in Section 1.4 of the UNB ISA Summary).

14. NRC QUESTION:

1.3 70.64(a)(6) Emergency capability

This section requires that the design provide for emergency capability to maintain control of (i) Licensed material and hazardous chemicals produced from licensed material; (ii) Evacuation of on-site personnel; and (iii) Onsite emergency facilities and services that facilitate the use of available offsite services. Section (6) of Appendix A to the ISA Summary refers to the Emergency Plan, however, the Emergency Plan is an operational document, not design. Describe how the UNB design provides for these required emergency capabilities.

NFS RESPONSE:

(i) Licensed material and hazardous chemicals produced from licensed material;

The design basis for the planned measures at the BLEU Complex, which will control access to licensed material and hazardous chemicals produced from licensed materials are:

1. NRC Category III facility security requirements . These requirements are described in Chapter 2 of NFS' Security Plan, NFS-SEC-C3-PSP.

2. An evacuation system in accordance with applicable sections of ANSI Standard 8.23, *Nuclear Criticality Accident Emergency Planning and Response.*
3. An Emergency Response organization in accordance with ANSI Standard 8.23, *Nuclear Criticality Accident Emergency Planning and Response.*
4. A chain of command system similar to the Incident Command System used by FEMA and all major response organizations.

A system established in accordance with ANSI Standard 8.23, *Nuclear Criticality Accident Emergency Planning and Response*, provides measures to control potential exposure to licensed material and hazardous chemicals at the BLEU Complex. The specific item in the standard is "*Sufficient exits from the immediate evacuation zone which provide rapid and unobstructed evacuation of personnel.*" The number of exits in the UNB meets the requirements of the Life Safety Code.

The ERO system as described in Chapter 4 of the Emergency Plan reduces the risk of potential exposure to on-site and off-site emergency responders. The ERO System follows a chain of command structure. The Emergency Control Director (ECD) with the support of Emergency Response Organization members who have the necessary training and expertise, directs all emergency response measures, including approval for off-site agency personnel and vehicles (e.g., Fire Department and Ambulance Service) to enter the facility.

(ii) Evacuation of on-site personnel;

The design basis for the items addressed in the Emergency Plan to ensure control of the evacuation of on-site personnel is:

1. A criticality detection system in accordance with requirements of 10 CFR 70.24.
2. An evacuation system, in accordance with ANSI Standard 8.23, *Nuclear Criticality Accident Emergency Planning and Response*, including the following elements:
    a. Timely evacuation. When an evacuation is initiated, all personnel within the immediate evacuation zone shall evacuate without hesitation by planned evacuation route to an established assembly area.
    b. Equipment and personnel are available for radiological assessment of the assembly location and evacuated personnel.
    c. Sufficient exits from the immediate evacuation zone are provided to enable rapid and unobstructed evacuation of personnel.
    d. Evacuation route and assembly area are clearly posted.

   e. Evacuation route minimizes the total risk considering all potential hazards.

3. A dose level for determination of a safe evacuation assembly area based on ANSI Standard 8.3, *Criticality Accident Alarm System*, and its definition for an excessive radiation dose is 12 rad.
4. An assembly area accessible by emergency agencies for triage and transport of victims.

(iii) Onsite emergency facilities and services that facilitate the use of available offsite services.

The design basis for the items addressed in the NFS Emergency Plan to ensure control of the onsite emergency facilities and services that facilitate the use of available offsite services is found in applicable sections of ANSI Standard 8.23, *Nuclear Criticality Accident Emergency Planning and Response*. The elements include the following;

1. An Emergency Response Organization and support teams with appropriate expertise and experience. Regular training and exercises provided to the team members.
2. The emergency facilities, which support the BLEU Complex located outside the immediate evacuation zone.
3. Appropriate monitoring equipment, emergency response documents, and protective clothing/equipment housed in the emergency facilities.
4. Contents of the emergency facilities inspected on a regular frequency.
5. Letters of agreement for support by off-site agencies.
6. Training and orientation to off-site agencies occurring on an annual basis.
7. An emergency message information system for timely notification to off-site agencies established.

The design basis for our selection of our offsite Emergency Facilities is as follows:

1. Timely response
   a. The performance of the Erwin Fire Department to area fires indicates that they can respond in less than 10 minutes.
   b. Unicoi County Hospital is located five minutes away.
   c. Johnson City Medical Center (JCMC) is located approximately 20 minutes by ambulance and less than 15 minutes by air transport.
2. Sufficient trained personnel
   a. Our primary fire-fighting agency is the Erwin Fire Department who routinely sees response of about 15 persons to a fire event. The agency has cooperative agreements with nearby county agencies (volunteer and paid) for further support.

   b. Quality Care Ambulance Service- The agency has two ambulances with available additional resources from neighboring counties and states. Quality Care works with Wings Air Rescue for air transports. The neighboring counties and states would be able to respond in 30 to 45 minutes. The agency has a dispatch system for acquiring sufficient support.
3. Hospital with Level One Trauma Center Capabilities
   a. Johnson City Medical Center is rated as a Trauma One Center. Oak Ridge's Radiation Emergency Assistance Center Training Site (REAC/TS) has reviewed JCMC capabilities and has stated that they would be an appropriate hospital for victims of criticality and radiation accidents.
4. Hospitals equipped for radioactive contaminated persons
   a. Both JCMC and the local hospital, Unicoi County Hospital, have a program, trained staff and equipment to respond to a radiation accident.

15. NRC QUESTION:

1.4 <u>70.64(a)(7) Utility Services</u>

1.4.1 **This section requires that the design provide for continued operation of essential utility services. NFS identified a number of accident sequences/scenarios that depend upon electrical power for the functioning of IROFS, examples are Scenarios 1, 111.1, 1.109.1, 1.26.2, and 1.76.1, and Non-Process Hazards Scenario A. Revise Appendix A to demonstrate that the design of the backup electrical system provides for its continued operation. If the backup electrical system is an IROFS, then provide adequate management measures to assure its availability and reliability. Expand the discussion in Appendix A to identify any other essential utilities and to address their continued operation.**

NFS RESPONSE:

Appendix A (a)(7) of the UNB ISA Summary will be amended to read as shown below. The revised text will be included in Revision 2 of the UNB ISA Summary.

References to the description of UNB-M will also be changed in the NCSE as applicable.

<u>Utility Services</u>: The design must provide continued operation of essential utility services. The new process is designed to be compatible with existing utility services.

There is only one utility in the UNB that could be considered an "essential utility service" – the water supply to the fire suppression system. The "continued operation" of this system is assured because the water supply meets all relevant NFPA requirements for such a system. All other utilities, whether supplied from offsite (electricity, natural gas, etc.) or generated onsite (compressed air, DIW, etc.) are not considered "essential". Systems such as the fire alarm system and criticality monitors have dedicated sources of emergency power in the event power is lost. Accident scenarios related to the loss of primary and backup power and the effects on other service utilities have been evaluated. Further, the effect of loss of power on the effectiveness of IROFS was evaluated. No unsafe conditions were identified resulting from loss of power. The entire facility is designed fail safe so that loss of power causes control devices to fail into a safe state. An exception is the building temperature control system, which is only a safety consideration in extremely cold, extremely long power outage situations which are highly unlikely to occur. A full discussion of this situation can be found in Section 3.2.4. Finally, fire detection systems, criticality monitors/alarms, and building evacuation alarms are located in areas where they are not susceptible to damage.

16. NRC QUESTION:

1.5 70.64(a)(9) Criticality Control

A. **Provide justification for the conclusion that the event described under scenario 1.5.1 is highly unlikely. Under this scenario NFS states "...there are high quality process control and safety systems in place at SRS that make the filling of a shipping container with unsafe solution composition highly unlikely." However, no information about the loading, sampling and sealing processes are provided. The justification may include a description of how NFS will verify the sample collection at SRS, the sample analysis at SRS, and the sample analysis at Framatome. This information is necessary to show that this scenario is highly unlikely, as required by 10 CFR 70.61(b).**

NFS RESPONSE:

Safe preparation of LEUN at SRS: The downblending and loading of the BLEU UN at SRS is very tightly controlled to meet product specifications and to maintain concentration and enrichment control for criticality safety.

B. Provide justification that scenario 1.5.1 meets the double contingency principle. In addition, provide justification that each of the contingencies, contingency # 1 and contingency # 2, are unlikely and independent. This information is necessary to show that this scenario meets the double contingency principle, as required by 10 CFR 70.64(a)(9).

NFS RESPONSE:

Double contingency: Refer also to the discussion in response to 1.5 A. above. The IROFS for scenario 1.5.1 at the UNB are administrative controls, which are independent and unlikely to fail.

C. **Describe the power supply to the criticality accident detectors and alarms.**

NFS RESPONSE:

NFS is required by SNM-124 to have a criticality accident detection and alarm system that meets the guidance in ANSI/ANS-8.3. This standard discusses the requirements for power supplies and alarms.

The criticality detection and alarm system for the UNB are not IROFS, so the license requirements dictate the minimum necessary actions to ensure reliable operation of the system. Further, we have rendered a criticality from any source "highly unlikely", so a failure of the criticality detection system due to loss of power (due to a freak failure of equipment and external power supply) coincident with a criticality accident is not credible. Further, we have alarms that indicate if the detection system has failed, which trigger appropriate responses per site SOP's.

The criticality annunciator system is also powered via the UPS as described above.

17. NRC QUESTION:

1.6 <u>70.64(a)(10) Instrumentation and Controls</u>

1.6.1 This section requires that the design provide for the inclusion of instrumentation and control (I&C) systems to monitor and control the behavior of items relied on for safety. Identify and describe the I&C needed to monitor and control IROFS.

NFS RESPONSE:

Appendix A (a)(10) of the UNB ISA Summary will be amended to demonstrate compliance with 10 CFR 70.64 (a)(10) as shown below. The revised text will be included in Revision 2 of the UNB ISA Summary.

<u>Instrumentation & Controls</u>: The design must provide for inclusion of instrumentation and control systems to monitor and control the behavior of IROFS.

Active engineered controls are used extensively for safety purposes in the UNB facility. Section 4.8 of the ISA Summary addresses the requirements for inspection, periodic functional checks, and maintenance to ensure the effectiveness of IROFS. This type of IROFS is typically implemented through the Central Control System (CCS). The CCS provides extensive internal diagnostic checks that will detect component failures and trigger alarms and in appropriate cases will send the outputs to a safe state. This is true for individual field instruments up through the controllers themselves and all communication links in between.

18. **NRC QUESTION:**

1.7 <u>70.64(b)(4) Environmental and Dynamic Effects</u>

This section requires that the design provide for adequate protection from environmental and dynamic effects associated with normal operations, maintenance, testing and postulated accidents that could lead to loss of safety functions.

1.7.1 Discuss the design of each IROFS that is an active engineered control or an administrative control that depends on instrumentation to demonstrate that adequate protection is provided against environmental and dynamic effects.

NFS RESPONSE:

The text in UNB ISA Summary Appendix A (a)(4) will be modified as indicated below to broaden the examples of environmental and dynamic events that are considered in the application of IROFS.

Environmental & Dynamic Effects: The design must provide for adequate protection from environmental conditions and dynamic effects associated with normal operations, maintenance, testing, and postulated accidents that could lead to loss of safety functions.

The UNB facility is designed to minimize problems from variations (both normal and from credible upsets) in the ambient and process conditions under which the IROFS equipment is expected to operate. Consideration in the design of the facility and equipment is given to the following to prevent loss of safety functions:

- *Protection of piping and vessels from vehicles and forklifts.*
- *Protection of fittings from external impact.*
- *Corrosion protection.*
- *Vibration from pumps/fans etc.*
- *Water discharge from sprinkler systems (or other splash).*
- *Weather.*
- *Other facility siting factors including the railway, air traffic patterns, and the nearby commercial facilities.*

19. NRC QUESTION:

2.0 <u>10 CFR 70.65 – Additional Content of Applications</u>

2.1 70.65(b)(4) requires that the application contain information that demonstrates compliance with the performance requirements of 70.61. In Section A.8 of Appendix A to Chapter 3 of the SRP, frequency index

numbers are discussed in terms of IROFS failures and their consequences. The first paragraph on Page 45 of the revised ISA Summary states, "The Failure Frequency is defined as the probability that the identified controls will prevent or mitigate the accidental consequence given the initiating event (or set of conditions) occurs." Discuss this apparent conflict with the SRP.

NFS RESPONSE:

10 CFR 70.65(b) states, "The integrated safety analysis summary must contain: ... (4) Information that demonstrates the licensee's compliance with the performance requirements of 70.61, including a description of the management measures; the requirements for criticality monitoring and alarms in 70.24; and if applicable, the requirements of 70.64;"

NFS complies with this section of the rule as demonstrated in Section 4 of the UNB ISA Summary, "Compliance with 10 CFR 70.61". Management measures are provided in Section 4.8 of the Summary. Appendix A of the UNB ISA Summary provides the Baseline Design Criteria of 10 CFR 70.64.

Table A-9 of SRP Chapter 3, Appendix A corresponds to Table 3 on page 44 of the UNB ISA Summary. Table 4 on page 45 of the UNB ISA Summary will be revised as shown at the end of this response to be consistent with the BPF ISA Summary submitted in October 2002. Table A-10 of Appendix A corresponds to the revised Table 4.

Section A-9 specifies that, "The values of index numbers in accident sequences are assigned considering the criteria in Tables A-9 through A-11. Each table applies to a different type of event. Table A-9 applies to events that have frequencies of occurrence, such as initiating events and <u>certain</u> IROFS failures." The limited data history of IROFS failures limits the applicability of Table A-9 to assign index numbers for IROFS failures based on frequency. Therefore, this table, as adapted, is only used to assign failure frequency indices to initiating event occurrences. The table presented below provides a comparison of Table A-9 of Appendix A to Table 3 of the UNB ISA Summary for initiating event frequency index assignment. Index assignment to process upset initiating events is typically assigned as a 0 or a –1 unless justified by analysis or sound engineering judgment. Thus, the initiating event is assumed to occur frequently or regularly during plant lifetime. Sound engineering judgment will be used as applicable. For example, it is not expected that a 6-inch Process Off-Gas vent line would plug as a single initiating event. It might occur during plant lifetime, but it is not expected. Therefore, sound engineering judgment would assign an initiating event failure expectancy index of –2. Based on the above discussion, NFS believes compliance with the SRP is established and the safety basis for assigning initiating event index numbers is conservative.

RAI Response Table 1

SRP Table A-9	Based on Evidence	NFS Table 3 (p. 44)	NFS Failure Frequency	NFS Description
-6	External event with freq < 10^{-6}/yr			
		-5	1 Failure/100,000 years	Not credible
-4		-4	1 Failure/10,000 years	Physically possible, but not expected to occur
-3		-3	1 Failure/1,000 years	Not expected to occur during plant lifetime
-2	No failures of this type in this facility in 30 years	-2	1 Failure/100 years (Loss of cooling (redundant cooling water pumps)) (Loss of Power (redundant power supplies))	Not expected, but might occur during plant lifetime
-1	A few failures may occur during facility lifetime	-1	1 Failure/10 years	Expected to occur during plant lifetime
0	Failures occur every 1 to 3 years	0	1 Failure/year (Loss of Cooling) (Loss of Power)	Expected to occur regularly during plant lifetime
1	Several occurrences per year	1	Several occurrences per year	A frequent event
2	Occurs every week or more often			

IROFS failure indices are assigned based on the probability index numbers of Appendix A Table A-10 as allowed by the SRP. The table presented below provides a comparison of Appendix A Table A-10 to revised Table 4 of the UNB ISA Summary.

RAI Response Table 2

SRP Table A-10	Based on Type of IROFS	NFS Revised Table 4 (p. 45)	NFS IROFS Failure Index
-6			
-4 or -5	Exceptionally robust passive engineered IROFS (PEC), or an inherently safe process, or two redundant IROFS, more robust than simple admin. IROFS(AEC, PEC, or enhanced admin.) robust	-4	Protected by an exceptionally robust passive engineered control (PEC). Exceptionally Robust Management Measures to ensure availability.
-3 or -4	A single passive engineered IROFS (PEC) or an active engineered IROFS (AEC) with high availability	-3	Protected by an inspected single PEC or exceptionally robust AEC with a trained operator backup. Adequate Management Measures to ensure availability.
-2 or -3	A single active engineered IROFS, or an enhanced admin. IROFS, or an admin. IROFS for routine planned operations	-2	Protected by a single functionally tested AEC. Protected by a trained operator performing a routine task with an approved procedure, an enhanced administrative control, or an administrative control with large margin. Adequate Management Measures to ensure availability.
-1 or -2	An admin. IROFS that must be performed in response to a rare unplanned demand	-1	Protected by a single administrative control or a trained operator performing a non-routine task with an approved procedure.
		0	No protection

Assignment of an IROFS failure index is based on failure of the IROFS function. That is, it is expected that the IROFS function will not fail outside the bounds established by the assigned index with the applied management measures. As such, the IROFS equipment and utility boundaries are established to support this function and its respective assigned index. In addition, the definition of what constitutes an IROFS function failure is also provided. This is provided in Table 9 of the UNB ISA Summary along with the applicable management measures.

As illustrated by RAI Response Table 2 above, the allowed IROFS failure indices spread over two orders of magnitude. NFS has performed a qualitative risk assessment as provided for in the SRP. That is, a qualitative input produces a qualitative output. As shown in Table 2 above, the indices shown appear to be less conservative. However, the definition of Highly Unlikely and Unlikely were also shifted one order of magnitude to a –4 index, effectively removing the non-conservative bias. If NFS had used the less conservative values and used an index of –5 to define Highly Unlikely, the same safety envelope would have been established. The justification for establishing indices to initiating events that are not credible is based on both Tables A-9 and A-10 of the SRP. In both tables, there are two orders of magnitude between the two lower indices. For example, Table A-9 goes from –4 to –6 and Table A-10 allows for the same spread. Therefore, NFS provided the same two orders of magnitude spread in adapting Table A-10. NFS believes this method meets the intent of the SRP. In addition, a conservative safety envelope is established by assuming that the initiating event occurs, except as previously discussed, and then applying the IROFS failure index.

The title provided for Table 4, page 45 of the UNB ISA Summary, will be changed to "IROFS Failure Index" to remove the ambiguity surrounding the use of frequency indices for IROFS failures. The revised Table 4 as shown below will be included in Revision 2 of the UNB ISA Summary.

Table 4 IROFS Failure Index

Effectiveness of Protection Index	Type of IROFS**
-4* ***	Protected by an exceptionally robust inspected passive engineered control (PEC). Exceptionally Robust Management Measures to ensure availability.
-3*	Protected by an inspected single PEC or exceptionally robust functionally tested AEC with a trained operator backup. Adequate Management Measures to ensure availability.
-2*	Protected by a single functionally tested AEC. Protected by a trained operator performing a routine task with an approved procedure, an enhanced administrative control, or an administrative control with large margin. Adequate Management Measures to ensure availability.
-1	Protected by a single administrative control or a trained operator performing a non-routine task with an approved procedure.
0	No protection

*Indices less than (more negative than) "-1" should not be assigned to IROFS unless the configuration management, auditing and other management measures are of high quality, because without these measures, the IROFS may be changed or not maintained

**The index value assigned to an IROFS of a given type may be one value higher or lower than the value given. Criteria justifying assignment of the lower value should be given in the narrative describing ISA methods. Exceptions require individual justification.

***Rarely can be justified by evidence. Further, most types of single IROFS have been observed to fail.

20. **NRC QUESTION:**

2.2 70.65(b)(9) requires the ISA Summary to contain a description of the definitions of unlikely, highly unlikely, and credible as used in the evaluations of the ISA. In Section 9.0 of the ISA Summary, NFS provided definitions of "highly unlikely", "unlikely", "credible" and "not likely" that do not meet the commitments in NFS' ISA Plan. They also do not meet the acceptance criteria in Section 3.4.3.2 item (9) or NUREG-1520, to which NFS committed in their ISA Plan. Revise the definitions to meet the acceptance criteria, or provide alternative definitions and a discussion to demonstrate that the alternative definitions will provide equivalent conformance to the SRP and the performance requirements.

NFS RESPONSE:

The SRP is an NRC guidance document that presents an adequate method to meet the requirements specified in the rule. Page iii of the SRP clearly states, "The SRP is not a substitute for NRC regulations and compliance is not required." NFS has, however, made every attempt to incorporate the SRP guidance in its ISA program development as illustrated by the provided UNB ISA Summary and the above discussion.

The acceptance criteria is specified in 10 CFR 70.61, in that IROFS must be in place to prevent or mitigate a high consequence event so that the likelihood of event occurrence is highly unlikely, and to prevent or mitigate an intermediate consequence event to an unlikely occurrence. The rule specifies that the licensee provide these definitions to the NRC. NFS stated in its ISA Plan that these definitions would be provided in ISA Summaries and that the SRP would be used as the guidance document for assigning these definitions. These definitions are provided in Section 9 of the UNB ISA Summary. Page 3.23 of Chapter 3 of the SRP specifies that, "Qualitative methods require qualitative definitions." NFS has incorporated the SRP into a qualitative ISA program as previously discussed. Therefore, NFS believes the provided definitions meet the intent of the rule and the SRP.

Section 9 of the UNB ISA Summary will be revised as follows to emphasize the use of qualitative analysis. The definition for Highly Unlikely will read "an index of -4" rather than "10^{-4} per accident per year". The definition for Unlikely will read "an index of –3" rather than "10^{-3} per accident per year". The revised definitions will be included in Revision 2 of the UNB ISA Summary.

21. **NRC QUESTION:**

2.3 NFS' definition of "highly unlikely" includes a statement that, for nuclear criticality safety purposes, a system that possesses Double Contingency protection is considered Highly Unlikely, provided that the performance

requirements specified in 10 CFR 70.61 are fulfilled. Revise this definition to show that each of the contingencies will be unlikely and independent.

NFS RESPONSE:

The definition of double contingency principle as defined in 10 CFR 70.4 states "that process designs should incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality accident is possible". NFS believes that by stating double contingency will be adhered to, in addition to meeting the performance criteria, provides the requested commitment in the definition.

22. NRC QUESTION:

2.4 <u>10 CFR 70.65(b)(6)</u>

70.65(b)(6) requires the application to include a list briefly describing each IROFS in sufficient detail to understand their functions in relation to the performance requirements.

2.4.1 Under "Reliability and Availability Qualities" on Page 3-25 of the SRP, the staff identifies "safety margin in the controlled parameter, compared with the process variation and uncertainty" as a quality related to the characteristics of individual IROFS. As discussed during the onsite review, confirm that a formal setpoint calculation will be performed for each setpoint associated with an active engineered or augmented administrative control. Discuss any intent to use an appropriate industry standard such as ISA-S67.04, "Setpoints for Nuclear Safety-Related Instrumentation."

NFS RESPONSE:

A formal calculation of each safety setpoint will be performed for active engineered controls and enhanced administrative controls (e.g., the density alarm setpoint in IROFS [redacted] This calculation will be documented in the equipment file for each applicable IROFS. Calculations will follow good engineering practice, which is advised by, but not dictated by standards such as ISA-S67.04, which is intended for application in nuclear power plants (with their vastly higher safety risks).

Section 4.8 of the UNB ISA Summary (and specifically Table 8) is amended as shown in the response to Question 3.1 to clearly include the management measures to be applied for this category of device. Thus the use of an IROFS failure index of -1 is appropriate and in fact conservative considering the protective function of this particular IROFS [redacted] Refer to Table 9 of the UNB ISA Summary. The response to RAI Question 2.1 contains additional details related to risk indexing methods.

23. NRC QUESTION:

2.4.2 In Table 9 of the revised ISA Summary, IROFS UNB-J is described as an administrative control with a failure frequency index of –1. Assuming that this index follows the SRP guidance (see Question 2.4.1 above) and truly represents the frequency of this IROFS failing to perform its intended safety function, discuss (in more detail that that provided in the first paragraph on Page 4[redacted] revised ISA Summary and relating to the failure description under [redacted] in Table 9 of the revised ISA Summary) how this failure frequency index was determined. Include in this discussion consideration of the failures of any supporting equipment or systems which, according to NRC staff review, are not provided with any management measures to ensure their reliability and availability. (Note: Section A.8 of the SRP states that assigning of failure index values based solely on Table A-9 and the type of IROFS should be done with caution.)

NFS RESPONSE:

As with the freezing scenarios, the evaporation scenarios 1.76.1, 1.106.1, and 1.115.1 take a very large amount of time in a failed condition to reach unsafe uranium concentrations in the storage tanks. Thus, no credible power outage will lead to a loss of the protective function of this IROFS. Refer to Table 9 of the UNB ISA Summary for the failure description for UNB-J. The response to RAI Question 2.1 contains additional details related to risk indexing methods.

24. NRC QUESTION:

2.4.3 In Table 9 of the revised ISA Summary, several IROFS are described as independent controls. For these controls discuss the following:

A. Describe the independence of power supplies for these controls. If these controls do not have independent power supplies, justify the claim that these controls are independent in their capability to perform their safety function and not subject to a common mode failure as mentioned under controls in Table 9 of the revised ISA Summary.

NFS RESPONSE:

There is no common mode of failure for the independent safety controls as implemented in the UNB (for example, reference IROFS [redacted] and [redacted] (independent temperature interlocks)). These controls are designed to fail safe – on loss of air and/or electric power (which both systems rely on for normal operation), the valves close, which is the safe position. Thus the IROFS do not fail in their safety function if these common utilities are lost.

B. Table 1 of the revised ISA Summary shows that each of these IROFS fails to perform its safety function with a failure frequency of –2. As in Question 2.b above, discuss how these failure frequency indices were determined. Include in that discussion consideration of the failures of the electrical supplies for these controls which, according to our review, are not provided with management measures to ensure their reliabilities and availabilities.

NFS RESPONSE:

The IROFS failure index of -2 is appropriate and conservative considering both the management measures applied to these controls and the protective function that is being performed by the specific IROFS. Typically, these controls fail safe and thus availability of support systems such as electric power is not required to assure capability of these controls to perform their required function. The response to RAI Question 2.1 contains additional details related to risk indexing methods.

Appropriate management measures will be applied to support systems, even though they are not required for safety reasons. This will be done at NFS' discretion for process availability and economic reasons and will not be documented in the UNB ISA Summary or related reports.

25. NRC QUESTION:

2.4.4 In Table 9 of the revised ISA Summary, IROFS [redacted] and [redacted] are described as active engineered controls. For these IROFS discuss the following:

A. Describe the independence of the power supplies for these IROFS including the automatic transfer switch. If these two IROFS do not have independent power supplies and have a common mode failure such as the failure of the transfer switch, justify the discussion of these IROFS under Scenarios 1.111.1 and 1.109.1 which states that these IROFS are independent and no common mode failure exists.

NFS RESPONSE:

The main heating system (part of IROFS UNB-M) is powered by the main electrical supply. The backup heating system (part of IROFS [redacted] is powered through the backup power supply (the diesel generator if main power is lost). These electric systems do have a potential common mode failure in the improbable situation of a transfer switch failure that disables both systems. However, it is not credible that this situation could continue long enough under the necessary circumstances for either of the IROFS to fail as defined in Table 9 of the UNB ISA Summary. The time period is greater than two weeks, and the conditions are the extremely unusual weather that would lead to the building to be less than 35 degrees for this entire time. Thus, there is no credible common mode failure for the protective functions provided by IROFS [redacted] and [redacted]

B. **Table 1 of the revised ISA Summary shows that each of these IROFS fails to perform its intended function (as described in Table 1) with a failure frequency index of –2. As in Question 2.b above, discuss how these failure frequency indices were determined. Include in that discussion consideration of the failures of the electrical supplies for these IROFS which, according to our review, are not provided with management measures to ensure their reliabilities and availabilities.**

NFS RESPONSE:

Considering the protective function and its failure definition per Table 9 of the UNB ISA Summary, the IROFS failure index of -2 is fully justified and is conservative. The response to RAI Question 2.1 contains additional details related to risk indexing methods.

26. NRC QUESTION:

2.4.5 **In Table 9 of the revised ISA Summary, [redacted] is described as an active engineering control with a failure frequency index of –2. Discuss how this failure frequency was determined. Include in the discussion consideration of the failures of any support systems such as electrical power supplies which, according to NRC staff review, are not provided with any management measures to ensure its reliability and availability.**

NFS RESPONSE:

1. The IROFS Description for UNB-V from Table 9 will be changed in Revision 2 of the UNB ISA Summary to remove references to the fire alarm:

   UNB Fire Suppression (Sprinkler) Systems will prevent any credible fire scenario from causing more than one tank to fail. The system includes fire detection and sprinkler systems.

2. The corresponding failure definition in Table 9 will be changed as follows:

   The fire suppression automatic sprinkler system fails to activate during a fire or is found to be non-functional during routine testing.

   Similar wording changes will be made in other references in the UNB ISA Summary to this IROFS to clarify that the fire alarm system is not part of the IROFS.

27. NRC QUESTION:

2.5 <u>10 CFR 70.65 Additional Content of Applications – Gas Heater/Supply System</u>

NFS COMMENT:

The UNB ISA Summary was submitted on August 23 before the fire hazards analysis (FHA) was completely finished. In the last stages of the FHA, it was decided that a natural gas fire and a natural gas explosion should be considered as separate accident scenarios instead of being considered together as had been done in the UNB ISA Summary Scenario 29. It was then determined that the fire scenario was a low consequence event, but the explosion was deemed a high consequence event. The next revision of the UNB ISA Summary will reflect this change and will include modifications to Scenario 29 as discussed below.

2.5.1 Clarify the description of the gas heater and its location relative to the UN tanks, the block wall installed for shielding, and any other relevant pieces of equipment.

NFS RESPONSE:

The main process area ventilation system uses a natural gas burner heating system. The 375,000 BTU/hr rated burner, burner controls, and heat exchanger are located in the mechanical room as part of the air handling unit.

A 12" CMU block wall separates the mechanical room from the main process area. The nearest storage tank is approximately 15 feet from the burner.

28. NRC QUESTION:

2.5.2 Clarify the scope/extent of the hazard from the gas heater. Describe the energy release of the event (TNT equivalent or other method) postulated in the scenario.

NFS RESPONSE:

NFS considers a natural gas explosion in the UNB Mechanical Room a high consequence event regardless of magnitude and has implemented appropriate controls to render this risk "highly unlikely". See 2.5.3 for a description of the IROFS to be applied to this scenario.

29. NRC QUESTION:

2.5.3 Section 6.0, Table 9, of the August 2002 submittal, lists an IROFS titled "[redacted]" In the description of [redacted] NFS stated, " The gas supply system is equipped with controls that will prevent leakage of gas making a fire or explosion unlikely."

A. Describe the codes and standards that will be used for the design, installation, and operation of natural gas equipment. NFS commits to following applicable NFPA codes in Chapter 6.0 of the current license application. Discuss intent to use appropriate NFPA codes such as NFPA 54, "Natural Fuel Gas Code," 2002, including Annex H.

B. Describe the management measures to be applied to ensure its proper design, construction, and installation.

C. Section 6.0, Table 9, of the August 2002 submittal, lists an IROFS titled "[redacted]" In the description of the [redacted] NFS stated, "The block wall installed for shielding between the UNB process area and the mechanical room will prevent serious damage to storage tanks in worst case fire/explosion scenario. [emphasis added]" ***(Note: If appropriate, reference answer to RAI question 4.1.1 listed below.)***

i) Provide an analysis that confirms that this block wall is of the appropriate construction to mitigate the consequences of the explosion to the UN tanks and other equipment.

ii) Describe the management measures to be applied to ensure its proper design and construction.

NFS RESPONSE:

As mentioned above, non-process accident Scenario 29 in the UNB ISA Summary (natural gas explosion) will list active engineered IROFS, plus added defense in depth controls. Refer to the revised description for Scenario 29 in the response to RAI Question 4.1.1.

30. NRC QUESTION:

2.6 Heating Ventilation and Air Conditioning (HVAC) System

2.6.1 Based on the discussion provided in Table 1 of the ISA Summary, Rev. 1, please describe the role that the HVAC system plays in mitigating an event at the nearby Studsvik facility (see Scenarios 11 and 12).

2.6.2 If the HVAC is being relied upon to perform a function in an event, and the event has intermediate or high consequences, precisely define the HVAC system function, define acceptable performance, and identify IROFS if applicable. If no IROFS are identified, provide a basis for crediting this system with preventing a credible interaction with process equipment or UN solutions.

NFS RESPONSE:

The external event scenarios 11 and 12 were deemed of "low consequence" without regard to the building HVAC system. The latter was mentioned because of the mitigating effects the air dilution and circulation system would have, but is in no way considered an IROFS for these scenarios.

31. NRC QUESTION:

2.7 Based on answers to the question contained in this RAI, clarify the list of IROFS given on pages 57-59 of the revised ISA for UNB submitted on August 23, 2002. The staff expects NFS to specifically clarify any changes that may have been made to the IROFS status of plant equipment. The list should address but may not be limited to, the following items:

A) seismic tank restraints; B) UN and other tanks; C) tank pedestals; D) building foundation; E) floor; F) tank isolation valves; G) building structure; H) building roof; I) insulation value of building; K) equipment to mitigate lightening strike; and, M) heating ventilation and air conditioning equipment (including HEPA filters).

NFS RESPONSE:

The UNB facility and components will be designed and constructed to the Standard Building Code and other applicable codes. The only changes to the IROFS listed in the UNB ISA Summary since the August 23 submittal are the replacement IROFS for Scenario 29, now the natural gas explosion scenario, as listed in item 2.5.3 above.

32. NRC QUESTION:

3.0 <u>Management Measures</u>

3.1 **Section 70.65(b)(4) requires the ISA Summary to contain information that demonstrates compliance with the performance requirements of 70.61, including a description of the management measures. Table 8 of the ISA Summary assigns management measures to IROFS graded according to their control type, whether active engineered, administrative, or passive. This Table did not include management measures for administrative controls (enhanced or augmented) that depend on instrumentation, such as alarms, to notify an operator when an administrative action is needed. Include a commitment to applying appropriate management measures to this distinct group of administrative IROFS that rely on instrumentation, and revise Table 9 to correctly identify this type of IROFS.**

NFS RESPONSE:

Table 8 in Section 4.8 of the UNB ISA Summary will be replaced with the table shown below to incorporate the risk-graded management measures applied to Enhanced Administrative Controls. The revised table will be included in Revision 2 of the UNB ISA Summary.

Table 8
Management Measures for IROFS

CONTROL TYPE / Measures	RISK REDUCTION LEVEL	
	A IROFS credited with a high level of Risk Reduction for High or Intermediate consequence events	B IROFS credited with a moderate level of Risk Reduction for Intermediate consequence events
ACTIVE ENGINEERED CONTROLS		
Periodic Functional Test	x	
Verification After Maintenance	x	
Calibration	x	x
Controlled Listing Identification	x	
Drawing Identification	x	
Procedural Identification	x	x
Pre-operational Audits or Tests	x	x
Periodic Audits	x	x
Training and Qualifications	x	
Records Management, Investigations, and QA	x	
PASSIVE CONTROLS		
Verification After Maintenance	x	
Controlled Listing Identification	x	
Procedural Identification	x	x
Pre-operational Audits or Tests	x	x
Independent Installation Verification	x	
Periodic Audits or Inspections	x	x
Vendor Specifications	x	
Training and Qualifications	x	
Records Management, Investigations, and QA	x	
ADMINISTRATIVE CONTROLS		
Procedural or Posting Identification	x	x
Pre-operational Audits	x	x
Periodic Audits	x	x
Training and Qualification	x	
Testing of Training Effectiveness	x	
Records Management, Investigations, and QA	x	
ENHANCED ADMINISTRATIVE CONTROLS		
Periodic Functional Test	x	
Verification After Maintenance	x	
Controlled Listing Identification	x	x
Drawing Identification	x	x
Procedural or Posting Identification	x	x
Pre-operational Audits	x	x
Periodic Audits	x	x
Training and Qualification	x	
Testing of Training Effectiveness	x	
Records Management, Investigations, and QA	x	

Note. The Management Measures identified for each risk reduction level are minimum if applicable. For example, it is not possible to calibrate certain types of active engineering controls The controls may be increased based on the specific IROFS involved, the credited risk reduction, industry standards, vendor specifications, or engineering recommendations.

32. NRC QUESTION:

4.0 Fire Protection

Provide additional information to clarify and understand safety basis assumptions described in the NFS UNB ISA Summary:

4.1 IROFS, Consequences, and Hazards Analysis

4.1.1 **Accident sequences, Fire Scenario 29, Natural gas explosions (Table 1, page 28) identify the block wall between the mechanical room and the UNB tanks as a "Preventive IROFS [redacted] However, the FHA (page A-24) identified the block wall as control for fire event #5 (also an explosion) and concluded that the block wall would not be effective control or serve to protect against an explosion. Provide additional information on the following:**

C. **Expected performance of the block wall (i.e., the design basis for the IROFS [redacted]**

D. **Descriptions of specific explosions over pressures for which the block wall will be design to withstand;**

E. **Describe the range of over-pressures expected from a deflagration or detonation involving natural gas in the mechanical room enclosure; and,**

F. **Descriptions of key design and construction requirements of the block wall to achieve its designed safety performance.**

NFS RESPONSE:

This scenario was changed after the August 23, 2002 submittal from a fire / explosion to just an explosion scenario based on the FHA, which was finalized after August 23. It was determined that the only scenario relating to natural gas that could exceed the performance criteria was an explosion (not a fire). The description of Scenario 29 in Section 3.4 will be changed as shown below. The revised text will be included in Revision 2 of the UNB ISA Summary.

PHA Non-Process Hazards Scenario 29

This scenario consists of loss of U containment due to a natural gas explosion in the mechanical room that causes at least high level consequences due to environmental and health physics effects resulting from the failure of more than one of the storage tanks in the UNB. Refer to Scenario 29 in Appendix B for more detail on this scenario.

33. **NRC QUESTION:**

4.1.2 Accident Sequences, Fire Scenario A, FRP Tank Fire (Table 1, page 28) identifies the UNB suppression and automatic fire sprinkler system as "Preventative IROFS 1." Provide the following:

A. Clarify what is "UNB fire suppression;"

NFS RESPONSE:

UNB Fire suppression: the wording was redundant – the fire suppression is the automatic sprinkler system. This wording will be corrected in the next revision.

B. Provide detail description on your assumptions and basis for the reliability and availability of city water supply at the UNB site;

NFS RESPONSE:

The water supply is described in Section 6 of the FHA. It is our understanding that the Town of Erwin water supply meets American Water Works Association (AWWA) requirements for municipal water supplies. In addition, the following will be added to Revision 2 of the UNB ISA Summary:

To enhance the reliability of the water supply for the sprinkler system, the water supply pressure to the fire suppression system will be monitored and will alarm in the CCS if the pressure drops below sprinkler system design requirements. In the event that pressure is lost, impairment procedures will be activated.

C. **Provide information on the margin between available water supply and estimated sprinkler system design demand during peak water usage (e.g., include your estimated comparison of water supply demand, include hose stream requirement, and available water supply);**

NFS RESPONSE:

The design of the sprinkler system was based on preliminary pressure/flow data and a good measure of conservatism. A flow test per the NFPA requirements will be performed as part of the functional testing of the fire suppression system. Design calculations will be available on-site for review.

D. **Describe expected unavailability and allowable time for system maintenance or unexpected outages that you considered in your basis for the reliability of this IROFS;**

NFS RESPONSE:

The failure frequency used for the protective function of IROFS [redacted] takes into account system hardware reliability and management measures, which include taking compensatory actions during system outages for any reason. Failure of the sprinkler system is not an initiating event; however, impairment procedures will be implemented within 30 minutes of the beginning of a water outage.

E. **Provide descriptions of seismic requirements for water supply piping, design and installation of pipes in ground, and bracing required at the base of the sprinkler system riser;**

NFS RESPONSE:

Specifications, drawings, and installation requirements will be available on-site for review. Section 6 of the FHA also includes additional information.

F. **Provide a discussion of seismic capability of the existing city water supply system and associated equipment, including water supply storage tank and pump systems.**

NFS RESPONSE:

There are no NFPA code requirements for seismic capabilities of the water supply so none were applied to the municipal water supply system. Further, there is no credible fire accident scenario with consequences exceeding the performance criteria that would result from a seismic event. Thus a seismic event that resulted in a disruption of the city water supply would not result in unsafe conditions in the UNB.

34. NRC QUESTION:

4.1.3 **Fire Event #3 – Empty Tank, Unmitigated (FHA): Provide the following:**

A. **Description of NFS' analysis and assumptions on whether flashover would or would not occur in the enclosure housing the UN tanks;**

B. **Additional supporting basis (i.e., "analysis" that shows this scenario potentially involves 2 tanks" page A-16 of the FHA) for the conclusion that this scenario will not cause loss of content of more than one tank;**

C. **Clarify what prevents the fire from spreading to more than one tank;**

D. **Description of NFS' safety assumptions regarding damage to tank support systems from fire exposure and whether this was considered in your description of the overturning at the base for rupture in Initiating Fire Event #2 in the FHA and in this scenario;**

NFS RESPONSE:

NFS assumed a generic fire would involve one or more tanks as shown in Accident Scenario A in the UNB ISA Summary. Appropriate IROFS were applied to meet the performance criteria, rendering the scenario "highly unlikely" regardless of the cause of the fire. When the event is assumed to be a high consequence event, a detailed analysis is generally not performed. In the event that an analysis is performed, the information will be located in the ISA file on-site.

E. **Additional descriptions regarding safety performance of intumescent fire-retardant latex coating in preventing fire spread (i.e., clarify the safety function, if any, in your assumption in limiting fire spread);**

NFS RESPONSE:

The intumescent coating is applied to the UNB tanks as a "good engineering practice" enhancement in case of a fire, and should be considered "defense in depth" in this situation. Its general performance is described in Sections 3.3 and 5.1.2 of the FHA. Also refer to the response to RAI Question 4.2.1.

F. **Additional information regarding specific potential radiological consequences resulting in intermediate (or high) consequences from the loss of content of one <u>and</u> more than one tank; and,**

NFS RESPONSE:

NFS assumed a generic fire would involve one or more tanks as shown in Accident Scenario A in the UNB ISA Summary. Appropriate IROFS were applied to meet the performance criteria, rendering the scenario "highly unlikely" regardless of the cause of the fire. When the event is assumed to be a high consequence event, a detailed analysis is generally not performed. In the event that an analysis is performed, the information will be located in the ISA file on-site.

G. Information on whether a nuclear criticality could be caused by a fire described in this postulated scenario <u>and</u> if the content of more than one full tank is lost.

NFS RESPONSE:

Section 4.1.4 of the UNB NCSE deals with this scenario and concludes that "the FRP tanks do not contain a sufficient amount of fuel to provide enough energy to concentrate the stored solution from 210 g U/l to 283 g U/l and exceed a slab depth of 30 inches".

35. NRC QUESTION:

4.1.4 Provide additional information regarding potential for flashover in the enclosure housing the UN storage tanks from a fire in adjacent spaces (i.e., describe severity of fire propagating from Load/Download Area, Electrical Room, or Officer Area that is unmitigated by fire walls).

NFS RESPONSE:

This subject is dealt with extensively in Section 5.2 of the FHA. Specific questions resulting from these analyses can be addressed as needed.

36. NRC QUESTION:

4.1.5 Provide additional information on types of training or programmatic requirements that enable operators to recognize, prevent, or mitigate accident scenarios related to fire scenarios (i.e., as IROFS ID# [redacted] administrative control).

NFS RESPONSE:

Operators working in the UNB facility will receive training regarding recognition of potential fire hazards along with response/notification actions to be taken in the event a fire occurs. Procedures governing fire safety will be provided to address control of combustibles, emergency response, fire protection equipment maintenance and inspection, and actions to be taken with regard to fire system impairments.

Work involving welding, cutting, and other flame/spark producing activities will also be addressed by procedure. This procedure will include protection of adjacent combustible materials, pre-job notification of appropriate safety and operations personnel, and requirements for fire watch personnel. These issues will be addressed through a "hot-work" permit process. Persons acting in a fire-watch capacity will be provided "hands-on" training on fire extinguisher use.

37. NRC QUESTION:

4.1.6 Scenario 29 (ISA Summary Page 33): Provide additional information regarding what are the potential "high level consequences due to environmental and health physics effects from the failure of more than one storage tank" in the UNB. Provide references (i.e., analyses) that describe and support your conclusions regarding unmitigated consequences.

NFS RESPONSE:

Refer to reply in Section 4.1.3 above.

38. NRC QUESTION:

4.1.7 Review ISA Summary and FHA to verify the consistency regarding IROFS and list all other IROFS related to fire and explosion that has been left out in the IROF Table and discussion in the ISA Summary.

NFS RESPONSE:

The source of the inconsistencies between the FHA and UNB ISA Summary are explained in Section 4.1.1 above. No IROFS relating to fire and explosion have been left out of the Summary.

39. **NRC QUESTION:**

4.2 Material Information:

4.2.1 Provide the following manufacture data and information regarding the performance of intumescent coating material:

A. Describe in detail, the fire safety performance that can be achieved;

NFS RESPONSE:

Expected performance: this coating is not relied on for safety (at least in the sense of an IROFS) and as such has not been analyzed in detail beyond what is presented in the FHA.

B. Describe the exposure temperatures and durations at which the intumescent coating will remain effective;

C. Describe assumptions for the duration before degradation of coating and estimated duration when sufficient heat transfer begins to effect FRP material (i.e., thermal degradation temperatures);

D. Manufacture data sheets with information on intumescent tank coating material related to UL or FM approval, fire tests performed, material composition, types of field applications, restrictions on applications, required method of application to achieve desire safety performance, maintenance and inspections required, effective life of application, and shelf-life of coating.

NFS RESPONSE:

This information will be provided by January 10, 2003.

40. **NRC QUESTION:**

4.2.2 For UN storage tanks provide manufacturer data on the following:

A. Composition and fabrication of material of construction;

B. Data on fire hazard characteristic and performance in fire tests of material; and,

C. Manufacture data supporting your assumptions and conclusion for mechanical properties and erosion resistant capabilities.

NFS RESPONSE:

Tank characteristics: Refer to Section 5.1.2 of the FHA. Additional information will be provided by January 10, 2003.

41. NRC QUESTION:

4.3 <u>Baseline Design Criteria</u>

4.3.1 Description in Item (3), page 62, does not clearly or comprehensively describe the baseline design criteria for fire protection in the design of the UNB. For example: the facility and various systems are designed in accordance with 1999 Standard Building and Mechanical Code and various NFPA codes referenced in the FHA Section 7.1. The compliance with applicable with requirements of codes and standards contributes to achieving adequate fire protection against fires and explosion. However, NFS' current description appears to only refer to codes and standards for IROFS (i.e., fire alarm and sprinkler system). Provide the following:

A. Include all codes and standards indicated in Section 7.1 of the FHA as part of the baseline design of the UNB, in addition to those identified for design and installation of all IROFS;

B. Review ISA Summary and FHA to verify the consistency regarding IROFS and list all codes and standards that are applied for other IROFS related to fire and explosion that has been left out in this section; and,

NFS RESPONSE:

Appendix A (a) (3) of the UNB ISA Summary will be amended to list all appropriate codes and standards that apply to the UNB fire alarm and suppression systems.

C. Clarify, in writing, whether the fire alarm has been designated as a necessary protection system to perform safety functions in mitigating potential intermediate or high consequences for postulated fire scenarios or it was intended to provide defense-in-depth fire protection.

NFS RESPONSE:

The fire alarm system is not part of an IROFS, but is in fact part of the defense in depth of our fire protection system.

42. **NRC QUESTION:**

4.3.2 Although building codes and NFPA standards are discussed as basis for design and installation of systems throughout the ISA Summary and supporting FHA, neither the ISA Summary Appendix A, or Reference 9, the FHA, clearly state or commit to meeting established building codes or industry standards as baseline design criteria for adequate fire protection. The FHA Section 7.1, Codes and Standards, only states that "the following codes and standards should be complied with." The statement "should" is not an acceptable commitment to applicable requirements in codes and standards as minimal requirements for design of the UNB or installation of systems for adequate fire protection. To establish a clear commitment to codes and standards, include, in the ISA Summary, the following descriptions:

A. Statements in Appendix A, (a) (3), that must identify codes and standards indicated in Section 7.1 of the FHA along with other codes and standards for IROFS not currently described,

B. Statements to clearly establish a commitment to these referenced code and standards as baseline design criteria for the facility design and systems installation that provide adequate fire protection, and

C. Clearly identify the FHA as a reference document that provides the design basis assumptions for adequate overall fire protection.

NFS RESPONSE:

NFS will amend Appendix A (a) (3) to clearly state its commitment to the codes to be listed in that section (see 4.3.1 above). Further, the FHA will be more clearly identified as the fire safety design basis for the facility.

43. **NRC QUESTION:**

5.0 <u>10 CFR 70.66 – Additional requirements for approval of license application.</u>

5.1 Section 70.66 (a) states that an application for a license from an applicant subject to subpart H will be approved if the Commission determines that the applicant has complied with the requirements of Sections 70.21, 70.22, 70.23, and 70.60 through 70.65. Section 70.62(d) requires each applicant or licensee to establish management measures to ensure compliance with the performance requirements of 70.61. Section 4.8 of the ISA Summary contains a discussion of management measures that NFS will apply to the UNB. However, since the ISA Summary is not part of the license, the management measures discussed in the ISA Summary are not license commitments. Revise Chapter 2 of the license renewal application to include

commitments that address the acceptance criteria in Chapter 11 (Section 1.4) of the Standard Review Plan.

NFS RESPONSE:

NFS commits to submit page changes to Part I of SNM-124 by January 24, 2003 that describe its management measures.