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AIRBORNE EXPRESS

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March 16, 2004

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

References:
1) Docket No. 70-143; SNM License 124
2) Letter from B.M. Moore to NRC, License Amendment Request for the Oxide Conversion Building and Effluent Processing Building at the BLEU Complex, dated October 23, 2003 (21G-03-0277)
3) NRC Licensing Review to Support License Amendment Request for the Oxide Conversion Building and Effluent Processing Building, conducted on February 9-12, 2004

Subject: Commitment Letter to Address NRC Licensing Review Questions Pertaining to Chemical Safety for the OCB and EPB

Dear Sir:

Nuclear Fuel Services, Inc. (NFS) hereby submits responses to `questions raised during the licensing review that was conducted in Rockville, Maryland (Reference 3). These responses reflect the discussions with your staff during the licensing review that was conducted in the referenced meeting.

As noted in the attached responses, safety basis documents supporting this licensing review for the Oxide Conversion Building (OCB) and Effluent Processing Building (EPB) will be updated. As such, this submittal contains commitments that will be incorporated in the Integrated Safety Analysis Summary for the OCB and EPB located at the BLEU Complex.

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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-04-0041) in any correspondence concerning this letter.

Sincerely,

NUCLEAR FUEL SERVICES, INC.

B.M.Moore

B. Marie Moore
Vice President
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JSK/lsn
Attachment

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Attachment

NRC Licensing Review Questions Pertaining to Chemical Safety for the OCB and EPB

Questions to NFS: OCB/EPB Amendment

General

NRC *Question 1:* *Describe the accident sequence involving an operator error allowing the concentration of ammonium nitrate to increase above 92% (detonation level).* Include calculations about the period of time required to increase the concentration up to this level and justify conclusions.

1. **Explain how is the formation of ammonium nitrate possible in process pipelines or unit operations (e.g., heat exchanger, TK-21, and TK-23) and how it is avoided.**

NFS Response: Ammonium nitrate is formed in the precipitation system as a normal part of the chemical ADU process. It is present throughout the process in concentrations of <15% in water. The pump explosion accident scenario (the only credible ammonium nitrate explosion scenario in the OCF) occurs when a pump is deadheaded over a long period of time. The two known occurrences took much more than a day to develop to the point of explosion in the pump. The controls provided that prevent the scenario (open pump discharge path and temperature alarms on the pump body) provide high reliability and a large degree of margin for this very slow developing scenario.

NRC *Question 2:* *Provide information on the time of reaction of the operator to* response to the hydrogen (H_2) alarms.

NFS Response: Currently, the hydrogen detectors alarm at 25% of LEL and interlock to shut off the hydrogen at 50% of LEL. This will give the operator a varying degree of time to respond (before the interlock kicks in) to the unlikely event of a large release of H_2 to the room, depending on the extent of the break.

NRC Question 3: Provide additional information on whether personnel will respond to a release of ammonia (NH_3). (See questions 14, 15, 23, 26, and 27.)

NFS Response: If the ammonia detectors alarm in the EPB, the operators follow procedures to respond to find and correct the leak. If the ammonia concentration is high enough, interlocks shut down the ammonia recovery process.

NRC Question 4: Describe standards and criteria used to determine compatibility of materials with the solutions, solids, or gases used in the main processes. (e.g., heat exchanger) (See questions 7, 8, and 16).

NFS Response: Materials of construction are chosen based on 30 years operating experience of an ADU oxide conversion facility owned by FRA-ANP and located in Richland, Washington. The design basis of the ADU oxide conversion facility to be operated at the BLEU Complex relies heavily on the design attributes/operating experience of the FRA-ANP facility located in Richland, Washington. In addition, the materials of construction were supported by guidance from chemical resistance guides such as those provided in Perry's Chemical Engineer's Handbook.

NRC Question 5: Explain commitments and procedures to report chemical releases.

Response: In accordance with 40 CFR Part 112, NFS maintains a Spill Prevention Control and Countermeasure (SPCC) Plan. This Plan incorporates notification requirements for reportable quantities (RQ) of chemicals as defined by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, amendments to this Act, and the Superfund Amendment and Reauthorization Act (SARA) of 1986. In addition to the SPCC Plan, methods for spill response are described in NFS implementing procedures NFS-GH-35 (*"Reporting of Incidents Involving Spills of Oils, Chemicals or Radioactive Material"*), NFS-HS-E-05 (*"Reporting Spills of Oil and Other Hazardous Substances to Off-Site Agencies"*) and NFS-HS-A-50 (*"Guidelines for Government Agency Notification"*). These procedures establish guidelines for identifying and reporting spill incidents so that timely response can be achieved and timely notification to regulatory agencies can be made if material spilled or released has exceeded reportable limits. The procedures provide guidance on the handling of incidents involving the release of potentially hazardous chemicals to the confined work area (generally includes inside buildings) or the environment (generally includes outside buildings). These guidelines apply to any spill incidents involving the following:

- chemical spills of more than four (4) liters outside of secondary containment, or if the volume cannot be estimated to be less than four (4) liters with a high confidence;
- chemical spills to the environment of any amount

Under CERCLA, a release of a hazardous substance into the environment is reportable if it equals or exceeds the RQ, whether or not it remains entirely within the boundaries of the facility (40 CFR Section 302.6 (a)). Under EPCRA, a release is not reportable if it results in exposure to persons solely within the boundaries of the facility (40 CFR Section 355.40 (a) (2) (i)). "Facility is defined under EPCRA to be all buildings, equipment, structures, and other stationary items that are located on a single site or on contiguous or adjacent sites and which are owned and operated by the same person."

The appropriate details of a chemical release incident are internally documented in the *Problem Identification Resolution and Correction System* (PIRCS).

NRC Question 6: Describe in detail the methodology to determine the consequences of chemical releases (indoors/outdoors) including the source term calculation, estimate of wind speed, etc. (Note: Justify and provide all the assumptions.)

NFS Response: The methodology used to determine the consequences of chemical releases are described in detail in the Chemical Accident Consequence Evaluation document. This document contains the complete set of analyses that were performed for credible upsets that were identified during the Process Hazards Analysis process. This document should be useful during the licensing review to understand the underlying assumptions and methods used to assess potential accidents that involve the release of chemicals. To assist in your review, this document is available for review at NFS' office located at 1700 Rockville Pike, Suite 400, Rockville, MD.

Uranium Precipitation Process

NRC Question 7: **Provide information about the properties of the construction materials (e.g., stainless steel) used in the uranium precipitation process (Section 3.1.1) in terms of their resistance to corrosion. Corrosion is mentioned as a cause for leaks in tanks resulting in release of chemicals.**

NFS Response: Over 30 years of experience of an ADU oxide conversion facility owned by FRA-ANP and located in Richland, Washington was used to select the 304L stainless steel as proper materials of construction. In fact, the design basis of the ADU oxide conversion facility located in Richland, Washington was used to ensure that safety was designed into the ADU oxide conversion facility that will be located at the BLEU complex. The vast majority of corrosive chemical lines and vessels are made from 304L. Other materials are used based on the service (carbon steel for 50% NaOH for example).

NRC Question 8: **Provide additional information on the standards used to ensure the integrity of the ammonium hydroxide supply header (e.g., materials of construction, welding). Also, provide additional information on the frequency of the inspections to ensure the integrity of the equipment and that the system components are properly maintained.**

NFS Response: The IROFS for scenarios such as 2.24.1.1 will be changed in the next revision of the ISA Summary as follows: The primary defense against the unacceptable consequences of chemical leaks is the integrity of the piping. Two independent means to ensure that this integrity is maintained will be listed as IROFS in the scenario table in the next ISA Summary revision. The first is the correct installation of the piping and tanks: selection of materials, fabrication methods, and hydrotesting. The second is the maintenance program, which controls routine work on and around the pipelines and tanks to ensure the integrity of containment is maintained. These two controls are independent. The ammonium hydroxide header is constructed using 304L stainless steel piping, following our P3 pipe code for fabrication and hyrdrotesting. Routine inspections (a management measure) will be performed at a frequency appropriate to the system and will be specifically listed in the ISA file for this IROFS.

NRC Question 9: **Section 3.1.2.2, Chemical Process Hazards and Controls - Worker (Uranium Precipitation), page 59, Nuclear Fuel Services (NFS) mentions that the uranium precipitation process contains connections to other plants processes through the tank vent system piping and that hazardous chemical reactions may occur if solutions enter in contact with the tank vent system. Provide additional information about:**

1. **the potential chemical reactions that can occur;**
2. **the amount of time the operator has to prevent/respond to this event; and**

3. **the availability and reliability (quantitatively or qualitatively) of the ventilation system and the safety features to prevent the interaction of chemicals.**

NFS Response: The process description in Section 3.1.2.2 was written early in the design and safety review process. Further study has shown that there are no "Potentially hazardous interactions" which could occur by solutions backing up into the vent system. This paragraph will be amended in the next ISA Summary revision.

NRC Question 10: Describe in more detail the function of the different components of the ventilation systems in terms of remotion of hazardous materials and the impact of materials of construction on safety.

NFS Response: The ventilation system was not credited in any chemical release accident scenario. It does provide considerable defense in depth because all radiological control areas in the OCB have a minimum 7 air changes per hour. The materials of construction of the HVAC system have no impact on the safety of the system.

Uranium Dryer/Calciner System

NRC Question 11: Provide additional information on the controls used to maintain the H_2/nitrogen (N_2) atmosphere in the calciner at a non-explosive level and to avoid the entrance of air or oxygen into the system.

NFS Response: Under normal process conditions there is no oxygen in the calciner. Only leaks past the calciner seals can cause oxygen in the calciner and its offgas system. An oxygen monitor in the offgas line detects the presence of oxygen, and above an alarm setpoint (% oxygen setting TBD), will shut down the hydrogen to the calciner. Further, defense in depth is provided by pressure control on the calciner that prevents the in-leakage of oxygen (or escape of hydrogen) by maintaining a slight negative on the calciner.

NRC Question 12: Provide additional information on the expected particle size of uranium dioxide in the calciner, dryer units, blending system, and filtration system. Explain if burnback is possible and its impact on the integrity of the system.

NFS Response The basic UO_2 particle size is in the 1-10 micron range. These micro-particles are typically present in ~100 micron agglomerates. Burnback (spontaneous oxidation of UO_2 to U_3O_8) can only occur in the presence of oxygen, as found in the pneumatic transfer system. There is no safety consequence in the unusual case that the UO_2 was to burnback in the transfer line since the powder is very dilute and we use all stainless steel materials of construction in the transfer line.

NRC Question 13: On page 69, Section 3.2.1, it is mentioned that the off-gas dryer filters are heated and insulated to prevent condensation and then they are blown back to the filter using N_2. Provide the temperature at which the filters are heated and explain how the

entrance of air or oxygen into the system is avoided.

NFS Response: The offgas filters in both the calciner and dryer offgas lines are heated to >300 F to ensure that condensation does not occur. The vessels and all associated piping are constructed using high integrity seals (typically flange gaskets) at all joints.

NRC Question 14: On page 72, "Chemical Hazards" section, the applicant stated that small amounts of NH_3 liberated in the dryer will not be enough to create the potential for intermediate or high consequences to the worker. Provide the maximum credible amount of ammonia that can be released from the dryer.

NFS Response: This statement was based on the fact that we modeled the worst case release of ammonia to the room – a complete rupture of the off gas piping with all the ammonia going into a sealed room as the dryer continues to operate. Under that scenario, [redacted] of ammonia is released with the off gas. The resulting ammonia concentration in 5 minutes is [redacted] which is below ERPG-1. Since the worst case accident would not have the potential for intermediate or high consequences, no smaller releases would either.

NRC Question 15: In the case of a release from the off-gas system, the off-gas systems will contain other hazardous gases such as NH_3 which is a by-product from the reaction of ammonium diuranate (ADU) with H_2. Explain how ammonia is monitored and/or detected in the room and provide safety features to prevent and/or mitigate this accident.

NFS Response: Calciner pressurization high enough to cause release of gases such as ammonia is a significant deviation from normal operating levels and as such triggers multiple pressure alarms and interlocks. Further, ambient monitors for hydrogen would alert operators to a significant release of calciner gases. Finally, ammonia releases are easily detected by smell at levels well below hazardous levels.

NRC Question 16: On Page 79, Section 3.2.2.5, NFS mentions that process upsets, as a major leak of the off-gas, in the calciner/dryer process can potentially impact the worker (Section 3.2.2.2, page 72) and the public (Section 3.2.2.5, page 79) resulting in an intermediate consequence for both receptors to NH_3 produced as a by-product in this process. The first layer of defense against this accident is the use of compatible materials of construction to ensure the integrity of the system in conjunction with periodic inspections. Provide additional information regarding materials of construction used, possible safety/construction standards to maintain the integrity, and the frequency of the inspections (e.g., maintenance procedures) for the off-gas system of this process.

NFS Response: Calciner offgas piping and vessel materials are 304L stainless steel, which has proven to be very effective in this service in ADU oxide conversion facility located in Richland, Washington. As previously noted, the design basis of this ADU oxide conversion facility was relied on heavily to ensure that the selected materials of construction would be adequate to perform their intended safety function. As such, periodic inspections are not necessary since any loss of integrity in the system will be readily detected by air leakage into the system (which is operated at a negative pressure) by rising levels of oxygen. Configuration control and maintenance procedures are two management measures used to maintain the integrity of the system.

NRC Question 17: On Page 90, Section 3.3.2.2, NFS mentions that the heat released during the A normal exothermic reaction is "well below that which could reasonably be expected to cause damage to vessel containment". Clarify this statement and provide the basis for this assumption including the safety margin considering the heat of reaction and the design temperature of the system.

NFS Response: The oxidation operation in the V-34 oxidizer vessel is identical to that used daily in Richland for more than 5 years. No failures of these four vessels have occurred. The batch oxidation is run under nearly adiabatic conditions, at as fast a rate that is possible, and under these worst case conditions, peak temperatures (max temp < 850 degrees F) are well below the maximum service temperature of the vessel (nominally [redacted], made of 304L SS). Further margin is provided because of the low stress on the vessel: pressure in the vessel is essentially atmospheric because it is vented through sintered metal filters to the HVAC exhaust. So, because the process stays within the design parameters of the vessel and there is minimal stress placed on the vessel, we expect no worse performance from this vessel than its equivalents in the ADU oxide conversion facility located in Richland, Washington.

Uranium Recovery Dissolution Process

NRC Question 18: On page 115, Section 3.5.1, NFS states that (to prevent over-pressurization of TK-76R or inadvertent backflow of low enriched uranium (LEU) solution to another area, TK-76R is equipped with continuous level monitoring high-high level interlock.) Explain how the safety margin is selected considering the maximum pressure that the vessel can withstand.

NFS Response: The high-high interlock setpoint is chosen to ensure that the feed into the tank will be shut off soon enough to prevent overflow of the tank under expected worst case situations. This is calculated taking into account the volume of the tank between the setpoint and the overflow point vs the reasonable worst case flowrates and reaction time of the interlock. The maximum pressure of the tank ([redacted]) is not relevant because the tank is vented and has an overflow.

NRC Question 19: On page 114, Section 3.5.1, NFS states that (the dissolver tanks are flushed with nitric acid solution and deionized water prior to shut down the system). Clarify if an operator is performing this task manually; if this is the case, how the exposure of chemicals (e.g., nitrogen oxides (NOx)) is limited during this process.

NFS Response: Flushing is performed with the tanks closed by an operator using remote controls. There is no operator exposure to any chemicals in this operation.

NRC Question 20: Describe in detail scenario 38.25.1.1, page 271, regarding potential airborne and personnel contamination due to UO_3 spill. Include procedures for spill instructions, procedures for drum handling, and expected uranium exposure for this accident.

Response:
Scenario 38.25.1.1 is defined as a potential employee intake of airborne uranium caused by a failure (breach) of a 55-gallon drum, resulting in a potential spill of [redacted] of natural UO_3 powder. The initiator for this scenario is human error during drum handling operations. The scenario is precluded and/or mitigated by the system design as follows:

- Drum lids are always secured when drums are outside secondary containment.
- Drums containing natural UO_3 powder are handled using equipment designed for the job - fork truck with drum adapter, roller conveyers, lifting equipment, etc.
- Drums are stored in secure location where accidental damage by traffic is unlikely.
- Drum handling operations are performed in a hood which protects operators from airborne contamination - *IROFS DRM-1*.
- Proximity switch interlock - disables crane operation if 55-gallon drum is not detected – IROFS ODS-6

Although not expected, uranium exposures were evaluated based on the entire contents of a drum being spilled (i.e., [redacted] of natural UO_3 powder). The [redacted] was conservatively based on the maximum drum crane capacity, while the average per drum is [redacted] The calculated occupational exposure for this scenario is 1.79E+01 Rem (worker dose – combined internal/external exposure – low consequence) and 1.56E+02 mg (soluble uranium intake – high consequence). The calculated environmental exposures are 4.73E-04 Rem (offsite TEDE – low consequence), 6.81E+00 (sum of fractions for 24 hour average of Appendix B value – low consequence) and 9.24E-02 mg. (soluble uranium intake – low consequence). Evaluation details can be found in the *Radiological Accident Consequence Evaluation – Oxide Conversion Building Dissolvers*, Revision 0, document # 21T-03-0975, Appendices D and K.

Job specific procedures and training are being developed for the receipt, storage and processing of the natural UO_3 powder. If a spill were to occur during the handling of this material, existing procedures for containment and cleanup would be followed as applicable:

- NFS-GH-01 (*Contamination Control*)
- NFS-GH-03 (*Radiation Work Permits*)
- NFS-GH-07 (*Respiratory Protection Program*)
- NFS-GH-19 (*Protective Clothing and Personal Protective Equipment*)
- NFS-GH-28 (*Personal Monitoring*)
- NFS-GH-35 (*Reporting of Incidents Involving Spills of Oils, Chemicals or Radioactive Material*)
- NFS-GH-65 (*Problem Identification*)

NRC Question 21: For the dissolution process, provide an estimate of the quantity of NOx produced (e.g., ppm) and heat released during the reaction of uranium oxide with nitric acid during normal and upset conditions (worst case).

NFS Response: Under normal conditions, the reaction of UO2 and nitric acid would produce NOx at [redacted] ([redacted]) assuming all NOx as NO2. The heat from the reaction is 4938 kcal/h. (That value is not particularly meaningful in a physical sense. It should be noted that we do not need to heat the tanks to maintain our reaction temperature, so the heat released is not excessive.)

The worst case accident that we modeled was complete rupture of the tank and continued flow of reactants. In this case, the NOx produced would be the same rate and would build up to [redacted] in the room after 5 minutes. This is well above the ERPG-3 level and is considered to have potential for a high consequence event. The heat released would be the same as in the dissolver, but the heat release is a very minor effect compared with the NOx release.

Ventilation Systems

NRC Question 22: Describe the controls in place to monitor or prevent possible interactions of chemicals in the Miscellaneous Uranium Storage Tank (TK-47B).

NFS Response: No controls are needed because analysis has determined that there are no unsafe mixture of chemicals that can occur in these tanks.

NRC Question 23: On page 135, NFS mentions that a spill from the condensate tank of the ventilation system could have high consequences to the worker due to exposure to NH_3 and that operator training will prevent them. Explain how operator training will avoid the potential exposure to NH_3. Also, explain the entrance procedures to the stripping column area in the ammonia recovery process during normal operations, shut down, and off-normal operations.

NFS Response: The drain valves are sealed shut with a tamper-indicating seal and tag that the operators are trained to remove only under supervisory direction. The ammonia recovery stripper column exclusion area can only be entered during normal operation with appropriate respiratory protection (typically a fresh air system). The area is monitored for ammonia concentration so entry into the area during shutdowns is based on that sensor reading and operator perception of ammonia in the air. During repair work, respiratory protection is provided based on the safety technician's assessment of the work and the room air conditions.

Liquid Waste Process

NRC Question 24: Explain in more detail chemicals hazards associated with the liquid waste process. Also, explain scenario 25.2.1.1.2.

NFS Response: The reference to "liquid waste piping" in the Summary is unfortunate and will be changed to clarify the actual accident scenario. It is in fact a rupture of the line carrying dilute nitric acid that is used to neutralize the liquid waste. The rupture modeled was outside the EPB and resulted in a large release of acid close to the site boundary. It was misleadingly referred to as liquid waste piping because it belongs to that system and that was the section of the HAZOP where the scenario was identified. The reason that we calculated high consequences was partly because we assume no operator action resulting in a very large spill and partly because the nitric acid ERPG-1 level is extremely conservative (low). There are no chemical hazards associated with the liquid waste system, which is simply processing a slightly basic sodium nitrate salt solution.

Chemical Safety Risk Assessment

NRC Question 25: A description of the chemical hazards is offered on Table 4-10. Seems to be that some scenarios rely on the action of the operator located in the Central Control System (CCS). Clarify if the CCS is expected to be like a control room or if the facility is expected to have a control room. If that is the case, describe the safety features to maintain the control room under an habitable atmosphere to ensure that the operator will perform his/her function when needed under plant off-normal conditions.

NFS Response: The CCS is the Central Control System whose operator workstations are distributed throughout the three buildings, from any of which it is possible to operate the entire facility. The control room in the OCB is on a separate HVAC system from the main process area, so it is isolated from any kind of gas release in the process areas.

NRC Question 26: Explain in more detail scenario 7.17.9.2, page 239, in which personnel is exposed to NH_3 fumes resulting from a release from the off-gas system.

NFS Response: In scenario 7.17.9.2, the postulated failure mode is an operator inadvertently opening the drain valve below TK-38, spilling its content on the floor. TK-38 contains dilute ammonia solution which under an (extreme) worst case scenario could result in a high consequence exposure of an operator to ammonia fumes. This is not a likely scenario because there is no reason for an operator to make this kind of mistake – the valve is rarely used and is in a location/arrangement that would make operator confusion with other valves very unlikely (hence the -2 initiating event frequency). Any spill of ammonia-bearing solutions is easy to detect and respond to because of the strong smell of ammonia vapor. The solution in the tank is not very corrosive. For defense in depth, the closed valve will be fitted with a tamper-indicating seal and tag. Also, leak detection is provided in the catch pan below V-38.

NRC Question 27: Explain more in detail over-pressurization scenarios such as scenario 27.1.4.1 or 27.9.1.1, pages 255 and 256, over-pressurization of stripper column in the ammonia recovery process.

NFS Response: Both scenarios relating to ammonia recovery stripper column (27.1.4.1 and 27.9.1.1) were developed early in the design phase, assuming the column operated under pressure (30 psig nominal) like the column installed in the ADU oxide conversion facility located in Richland, Washington. The final design for the ADU oxide conversion facility located at the BLEU Complex ended up with the column running at atmospheric pressure. These scenarios are probably no longer valid, will be evaluated, and are expected to be deleted from the next revision of the ISA Summary.

NRC Question 28: For scenarios such as leak or rupture of feed tanks (i.e., scenarios 47.16.1.1 and 49.21.2.1, pages 264 and 265, respectively), NFS considers the compatibility of construction materials, periodic inspections, and maintenance procedures as the safety features necessary to prevent chemical releases. Clarify if a change on the tank contents has been considered for these scenarios as a safety feature.

NFS Response: Change of tank contents (putting NaOH in the HNO3 tank, for example) is not allowed without going through the NFS configuration and change control procedures. Thorough safety analysis of such changes is mandated before they can be implemented.

<u>Consequence Levels</u>

NRC Question 29: Considering the changes on the previous amendment, BPF, concerning uranium exposure limits for high and intermediate consequences for the worker, explain how this change affects the classification of scenarios involving uranium toxicity in the analysis performed for this amendment.

NFS Response: The accident scenarios for evaluation are provided on tables developed by an ISA team during a Process Hazard Analysis (PHA). Multiple types of consequences can result from the same event (item number); therefore the analysis is conducted for the most severe consequence for each item number. Upon completion of the analysis, each credible accident scenario is assigned an unmitigated, uncontrolled consequence severity category based on 10 CFR 70.61 as shown below:

- A high consequence as defined by 10 CFR 70.61 is one that results in an acute chemical exposure to an individual from licensed material or hazardous chemicals produced from licensed material that could endanger the life of the worker. NUREG/CR-6410 section 5.8.3.1 *Exposure to Soluble Uranium* specifies that the threshold level, as referenced in NUREG-1391, to cause permanent renal damage to a 70-kg (154 lb) individual by inhalation is 40 mg soluble uranium due to chemical damage. While this intake would be limited to irreversible or serious long-lasting health effects and not life endangerment, it is protective for use as an intake level for high consequences. Therefore, events that result in a worker acute intake of 40 mg or more of soluble uranium are designated as high consequence.

- An intermediate consequence as defined by 10 CFR 70.61 is one that results in an acute chemical exposure to an individual from licensed material or hazardous chemicals produced from licensed material that could lead to irreversible or other serious, long-lasting health effects to a worker. A 30 mg intake is specified in 10 CFR 70.61 as a high consequence for soluble uranium intake to an individual located outside the controlled area based on the individual developing irreversible or other serious long-lasting health effects. As documented in DOE-STD-1136-2000, *Guide of Good Practices for Occupational Radiological Protection in Uranium Facilities* (Table 5-13) and ANSI HPS N13.22-1995, *Bioassay Programs for Uranium, An American National Standard*, an acute intake of $\gtrsim$ 30 mg of soluble uranium could result in renal damage, an irreversible, or serious long-lasting health effect. While not identical to the 40 mg threshold for similar effects given in NUREG/CR-6410, the 30 mg threshold is consistent and protectively lower. Therefore, events that result in a worker intake of less than 40 mg but $\geq$ 30 mg are designated as intermediate consequence.

__Effects on OCB Occupational Soluble Uranium:__

OCB-RWC-12 goes from an intermediate consequence to a high
- Calculation bounds Accident Sequence Number 38.7.1.2
- 38.7.1.2 was already designated as a high consequence due to NO_x if enriched material were added.
- IROFS ODS-5 and ODS-8 apply

OCB-RWC-15 goes from an intermediate consequence to a high
- Calculation bounds Accident Sequence Number 38.25.1.1
- 38.25.1.1 was designated as an intermediate consequence with DRM-1 assigned as the IROFS.
- One additional IROFS is needed (only one initially provided when scenario had just intermediate consequences). An Active Engineered Control, a proximity switch interlock, ODS-6 is assigned. This will be detailed in the next ISA summary revision.

NRC Question 30: Explain and justify the methodology used to determine high and intermediate consequences for hydrogen and nitrogen. Also, provide calculation of the time needed to reach 19.5% O_2 (v/v) considering the worst case scenario for a nitrogen and/or hydrogen release. (Note: Hydrogen and nitrogen are considered asphyxiating gases. Hydrogen is also a flammable gas.)

NFS Response: There are H_2 detectors in relevant sections of the OCB that detect H_2 concentrations well below that needed to present an asphyxiation risk. A full blown N_2 leak was evaluated and found that unsafe levels of N_2 could not be reached in a credible amount of time in the areas that N_2 is used. Defense in depth is provided by nitrogen line pressure monitors and flowmeters that would quickly alert an operator to loss of N_2 pressure due to a significant leak. Further, the HVAC system provides 7 air changes per hour minimum in all process areas.

NRC Question 31: On page 354, Table 7-3, Chemical Exposure Standards for OCB/EPB, the intermediate consequence and the high consequence for the public for NOx gases is >25 ppm NOx for both consequence levels. Establish a specific threshold value or range for each consequence level and explain the methodology to set such values or ranges when ERPGs are the same.

NFS Response: This was true before, but our new NOx limits should resolve the problem. We will substitute new NO2 limits for the NOx limits that used to be in the NFS accident consequence analysis procedure. The new limits are 1, 15 and 30 ppm for ERPG-1, 2 and 3 respectively. The update will have the side benefit of providing discrete levels for differentiating between different consequence events.

Commitments from meetings with NFS from 2/9-12/2004

1) Materials of Construction

NFS has selected materials of construction as Items Relied on for Safety (IROFS) but a clear description of the selection of materials of construction is not included either in the Integrated Safety Analysis (ISA) or the ISA Summary. NFS will include a write up in each process description section mentioning the selection process for materials of construction and that the documentation related to materials of construction will be available for review. NFS should be sure that these documents are available for any review.

NFS Commitment: As specified in Section 2.12.1.2 Design Requirements, NFS is committed to establish documents for the design of new facilities. In addition, the design bases are established in accordance with procedures to meet regulatory requirements and to ensure that process operations perform the desired function in accordance with requirements from individual safety functions. Through the Internally Authorized Change program, written approval of the recommended design basis by the safety review committee is required prior to startup of new processes.

NFS interprets these requirements to apply to specifying materials of constructions for IROFS as a design basis. As such the design basis, as they apply to materials of construction, are required to be incorporated into the ISA prior to startup. These files will be available for inspection during the NRC Readiness Assessment that is expected to be conducted in July 2004.

2) Commitments and procedures to report chemical releases

NFS mentions management measures in general but does not make reference to management measures and procedures in the ISA Summary related with chemical releases.

NFS will cross-reference the procedure(s) and management measures associated with commitments and procedures to report chemical releases.

NFS Commitment: As specified in Section 2.12.6 *Incident Investigations and Corrective Actions* of SNM-124, NFS is required to maintain a corrective action program to investigate, document and report events as required by 10 CFR 70.50, 70.62, and 70.74. These requirements are also contained in internal procedures to ensure that any releases of licensed materials are properly evaluated and reported in accordance with applicable regulatory requirements. These procedures are currently available for your review.

3) **Procedures to respond to ammonia releases, hydrogen releases, uranium spills, etc. Procedures to perform inspections and maintenance Procedures related with IROFS as well as procedures related with chemical releases will be available for the readiness review. Procedures will also be available to the technical reviewer or NRC representative for his/her review to ensure that procedures are in place to prevent chemical release events.**

NFS Commitment: As noted, NFS currently is required to investigate, document and report events in accordance with 10 CFR 70.50, 70.62 and 70.74. These procedures are currently available for inspection.

4) **Uranium chemical high consequence limit**

NFS will use the same quantity of soluble uranium committed for the Blended Low Enriched Uranium (BLEU) Preparation Facility (BPF) as the high consequence limit for uranium releases and/or spills in the oxide conversion building (OCB) and the effluent process building (EPB).

NFS Commitment: NFS commits to using the same threshold as it applies to soluble uranium for defining a high consequence event (10 CFR 70.61) that was approved for the BPF for the OCB/EPB licensing action.

5) **Fire hazard analysis (FHA) change IROFS.**

For some FHA scenarios, IROFS1 is the combustible loading program and IROFS2 is fire protection test, maintenance, and inspection activities. During the fire protection discussion (2/9/2004), NFS committed to change one of the IROFS for the sprinkler system. During the chemical safety discussion (2/11/2004), NFS committed that the fire protection test, maintenance, and inspection activities will be part of the combustible loading program.

NFS Commitment: NFS commits to include as part of the combustible loading program, the aforementioned fire protection test, maintenance, and inspection activities. This change will be in conjunction with implementing appropriate active or passive engineered controls as the second IROFS for the relevant scenarios.

6) Scenarios that increased their consequence levels

NFS has committed to update the ISA Summary and provide the reviewer(s) a list of scenarios that have increased their consequence level (e.g., intermediate to high) with their correspondent IROFS. NFS will also verify the accuracy of the ISA Summary by cross-referencing and assuring consistency in the text and tables.

NFS Commitment: NFS commits to revising the ISA Summary to include a list of IROFS that have been affected by the change to revised consequence thresholds. As such, the revised list of IROFS will be compliant with the requirements in 10 CFR 70.65(b)(6). The revised ISA Summary will be available for your review prior to startup of the processes located at the OCB/EPB.

7) Liquid Waste Process (Scenario 25.21.1.2)

NFS will verify the description of scenario 25.21.1.2 on Chemical Safety Evaluation tables and any applicable section of the document. NFS will also verify the selection and description of defense-in-depth features since they appear to be the same as the IROFS. NFS also committed to verify any other scenarios with the apparent same description of defense-in-depth and IROFS.

NFS Commitments: NFS commits to verify and distinguish between IROFS and controls designated as "Defense-in-Depth". A brief listing of IROFS will be contained in the ISA Summary as required under 10 CFR 70.65(b)(6). A description of the controls designated as "Defense-in-Depth" will also be contained in the ISA Summary.

8) Chemical reaction in the Uranium Oxide Blending System

NFS will provide typical peak temperature, based on the heat of reaction, and maximum temperature that the oxidizer equipment can withstand. NFS will justify the safety margin for this equipment.

NFS Commitment: A description of peak temperatures to demonstrate a margin of safety is provided in response to Question 17 above.

9) Scenario 27.9.1.1

NFS will eliminate this accident sequence because design changes. NFS will update the ISA Summary and the ISA.

NFS Commitment: NFS will eliminate this accident sequence due to changes in the design.

10) Scenarios with apparently same defense-in-depth features and IROFS (e.g., scenario 49.21.2.1)

The defense-in-depth features and the IROFS are apparently the same. NFS will review this scenario including defense-in-depth, IROFS, and management measures.

NFS Commitment: As noted in response to Commitment No. 7, NFS commits to verify and distinguish between IROFS and controls designated as "Defense-in-Depth". A brief listing of IROFS will be contained in the ISA Summary as required under 10 CFR 70.65(b)(6). A description of the controls designated as "Defense-in-Depth" will also be contained in the ISA Summary.

11) Consequence Limits

In the case that high and intermediate consequence limits for a compound, reactant, or element are the same, NFS will treat the scenario as a high consequence and will have IROFS in place for a high consequence accident.

NFS Commitment: In instances where a high and intermediate consequence is defined by the same level of exposure, NFS commits to conservatively applying controls that apply to a high consequence event.