US NRC
October 8, 2015

Attachment 2

SNM-1097 Chapter 3

CHAPTER 3.0
INTEGRATED SAFETY ANALYSIS

3.0 Introduction

The Integrated Safety Analysis (ISA) identifies process hazards associated with the fuel manufacturing facility operated at Global Nuclear Fuel –Americas LLC (GNF-A), located in Wilmington, North Carolina.

The analysis determines potential accident sequences and provides reasonable assurance that adequate controls are in place to prevent and/or mitigate accidents in accordance with the performance requirements of 10 CFR Part 70.61. Items Relied On For Safety (IROFS) are identified for each accident sequence that could fail to meet the performance requirements of 10 CFR 70.61.

The primary scope of the analysis focuses on consideration of the effects of relevant hazards on radiological safety, prevention of nuclear criticality accidents, or chemical hazards directly associated with NRC-licensed radioactive material.

The ISA covers all major equipment associated with the fuel manufacturing facility. Utilities (e.g., cooling water, plant air) supporting the facility were considered only to the extent that (1) failure or improper operation of the utility systems could cause significant hazards in the facility or (2) upsets in the facility and manufacturing process systems could cause significant hazards in the utility systems.

Facility operating experience, including unusual event and incident reports, is considered in the process hazards analysis of the fuel manufacturing facility and its associated process systems. Consideration is also given to related nuclear operations at other fuel fabrication facilities. These allow the team to consider how additional problems might occur and whether similar incidents could occur again.

3.1 Integrated Safety Analysis

Integrated Safety Analysis is a systematic analysis to identify facility and external hazards and their potential for initiating accident sequences, the potential accident sequences, their likelihood and consequences, and the IROFS. Figure 3.1 provides an overall process flow diagram of the ISA methodology applied to licensed activities.

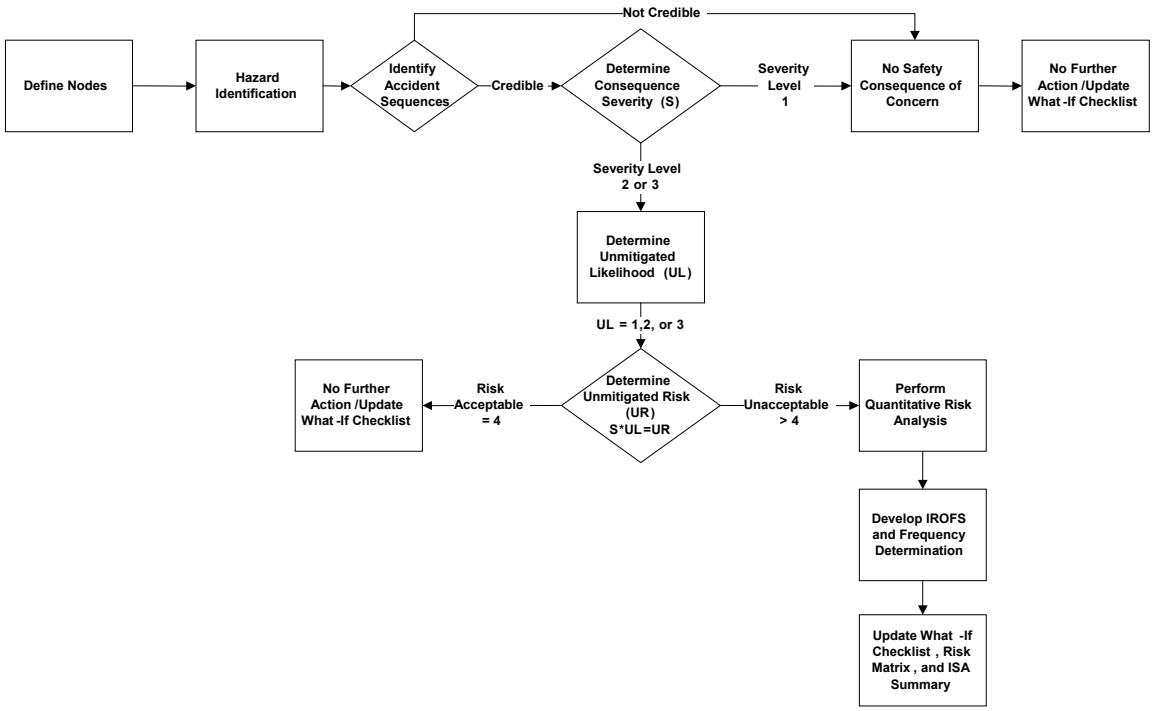

Figure 3.1 – ISA Process Flow Diagram (Typical)

3.2 Hazards and Risk Evaluation Methods used at GNF-A

To identify hazards and evaluate accident sequences, GNF-A in general uses methodologies identified in the following references: NUREG-1520 Rev. 1 (May 2010), *Standard Review Plan (SRP) for the Review of a License Application for a Fuel Cycle Facility,* NUREG-1513 (May 2001), *Integrated Safety Analysis Guidelines Document, Guidelines for Hazard Evaluation Procedures, Second Edition*, and *Layer of Protection Analysis, Simplified Process Risk Assessment.*

Several methods, which are routinely used in industry, are approved for use at GNF-A. Approved methods include the following:

- Checklist
- What-If Analysis
- Hazards and Operability Analysis (HAZOP)
- Failure Modes and Effects Analysis (FMEA)
- Fault Tree Analysis
- Event Tree Analysis
- Human Reliability Analysis
- Layer of Protection Analysis (LOPA)

One or more of these methods may be used to qualitatively analyze the hazards of the process or operation being studied. Methods such as HAZOP, what-if, checklist, or a combination of two or more of these methods are used to conduct the process hazard analyses.

Methods such as event tree analysis, fault tree analysis, human reliability analysis, and LOPA are approved for quantitatively determining the risks of a process or operation. Other methods consistent with industry or regulatory guidance, including semi-quantitative methods, may also be used. These methods can be used to determine the overall likelihood of an accident sequence previously identified during the process hazard analysis.

3.3 Conducting the Process Hazard Analysis

The focus of the process hazard analysis is to identify the hazards associated with the fuel manufacturing facility, identify credible accident sequences and their causes, and determine the unmitigated risks of these hazards. The results of the process hazard analysis are input to the GNF-A ISA database and are documented in the ISA reference report. GNF-A procedures require that the ISA Reference Report (also referred to as the process hazard analysis [PHA]) be maintained as a living document and supplemented with additional sections as changes are made to the facility and subsequent ISA studies are completed. Changes to the ISA PHA document are documented with an ISA Change Report and included in a Change Request.

3.3.1 Selecting the Analysis Method

GNF-A procedures require that the process hazard analysis method chosen be commensurate with the degree of complexity of the process or operation and the severity of hazards posed. Other factors to consider when selecting the analysis technique include the perceived risks associated with the process and the skill and knowledge of the personnel doing the analysis (which includes their process knowledge, experience, and knowledge of the process hazard analysis technique being used). The ISA leader selects an appropriate process hazard analysis technique, giving due consideration to these factors. Regardless of which method is used, the study must (1) include consideration of nuclear criticality, radiological, chemical/toxic, fire, and explosion hazards and (2) provide the required output for input into the GNF-A ISA database.

HAZOP

The ISA teams used the HAZOP analysis approach to identify and evaluate process hazards for complex systems and processes such as the uranium hexafluoride (UF_6) feed and conversion processes. This technique is a systematic method for identifying ways the process equipment can malfunction or be improperly operated, leading to undesirable conditions. The HAZOP technique is typically used to analyze complex processes and operations. This technique focuses on both safety hazards and operability issues. It may be used both during and after the process design phase. It is applicable for both continuous and batch flow processes.

HAZOP uses the synergy of an interdisciplinary team and a systematic approach to identify hazards and operability problems resulting from deviations from the process's design intent that could lead to undesirable consequences. Typically a fixed set of guide words (e.g., no/not, more, less, as well as) are combined with process parameters (e.g., flow, temperature, pressure, level) to create deviations from the design intent, which are applied to the specified points (nodes) to evaluate potential outcomes.

What-if/Checklist Analysis

This is a hybrid approach that combines the best features of what-if creative brainstorming with the discipline of checklist analysis. It depends on an experienced team. It is very effective for the simpler, straightforward processes where a high degree of resolution is not required (e.g., powder blending, pellet pressing, grinding, etc.). It can be used at every stage in the life of the process.

The what-if analysis technique is a brainstorming approach that builds on the synergy of an experienced group. While inherently not as structured as some techniques such as HAZOP, it is flexible and effective for the more simple processes (e.g., mechanical steps of assembling a fuel bundle, scanning). It can be used at every stage in the life of the process; however, analysis reliability is increased by experience.

Checklist analysis is a simple and effective technique for verifying the status of a system. It is highly disciplined and effective for verifying compliance (e.g., lockout-tagout, fall prevention, rod storage). It can be used at any stage of a process's lifetime but is dependent upon the experience and knowledge of those preparing the checklist.

3.3.2 Define the Node/Area to Be Studied

The first step of the ISA, identifying the hazards, is initiated by systematically breaking down the process system or operation being studied into well-defined sections or nodes (e.g., major vessels, columns, interconnecting process piping) in which the ins, outs and internal activity/flows can be defined, in order to allow interactions to be studied. All licensed operations are treated in this manner so that the entire facility is evaluated in a logical flow approach. This approach is also used to (1) evaluate the hazards associated with a new process or operation and (2) identify any new hazards that may result from modifications made to an existing process or operation.

In defining the node it is necessary to identify the bounding assumptions and initial conditions that the analysis will be based on. These terms are defined as follows:

Initial Conditions – Important aspects of a process and associated equipment, process operating parameters (e.g., temperature, pressure, flow rate), material throughput, and characteristics of the facility in which the process resides (e.g., design features) that establish the normal operating conditions from which the process hazard analysis is performed.

Bounding Assumptions – Identified assumptions about a process or material characteristics that bound the credible conditions of the process. These assumptions are based on the process chemistry, applicable scientific principles, facility-specific experimental data, operational history, and/or facility construction requirements. In determining the bounding assumptions for process parameters or material characteristics, no credit may be taken for controls placed on those parameters.

The bounding assumptions and initial conditions considered in the analyses shall be documented.

Preparation for the process hazard analysis begins by gathering process safety information on the process system and/or operation to be studied. Information typically used for the analysis included, but is not limited to, the following:

- Piping and instrumentation diagrams (P&IDs)
- Process flow diagrams
- Equipment arrangement drawings with general equipment layout and elevations
- Design temperatures and pressures for major process equipment and interconnected piping

- Materials of construction for major process equipment and interconnected piping
- Operating procedures for normal operations, as well as procedures for startup, shutdown, sampling, emergency shutdown, and any on-line maintenance
- Material safety data sheets (MSDSs) for any chemicals involved in the process (including any intermediate chemical reaction products) and other pertinent data for the chemicals or process chemistry (e.g., chemical reactivity hazards)
- Nuclear Safety Release/Requirements (NSR/Rs),
- Data for process alarms, interlocks, or trips
- Incident reports for the specific area being studied

3.3.3 Identify Credible Accident Sequences

The goal is to identify credible accident sequences by analyzing single initiating events. Using one or more of the approved methods, the ISA team identifies accident sequences associated with a process or operation, including possible unmitigated consequences and causes. Consequences of interest included nuclear criticality accidents, radiological material releases, radiation exposures, chemical/toxic exposures from licensed material or hazardous chemicals produced from licensed material, fires, and explosions.

As required by 10 CFR 70.62, the ISA must consider credible external events, including natural phenomena, for the potential hazardous consequences that they can cause. Natural-phenomenon events, such as hurricanes, tornadoes / high winds, seismic events, and external events, such as aircraft crashes, are addressed separately in GNF-A ISA Summary.

In considering accident sequences at this facility, it is necessary to determine those that are considered not credible and those that are credible. When conducting the process hazard analysis, the ISA team considers each accident sequence as credible, unless it can be determined to be not credible. Accident sequences that do not meet the definition of *not credible* are therefore considered *credible* and treated in accordance with 10 CFR 70.61.

Any one of the following three independent criteria is used to define an event as not credible:

(1) An external event for which the frequency of occurrence can conservatively be estimated as less than once in a million years.

(2) A process deviation that consists of a sequence of many unlikely events or errors for which there is no reason or motive. In determining that there is no reason for such errors, a wide range of possible motives, short of intent to cause harm, must be considered. Necessarily, no such sequence of events can ever have actually happened in any fuel cycle facility.

(3) Process deviations for which there is a convincing argument, based on physical laws, that they are not possible, sound engineering or technical data that the deviations are not possible, or are unquestionably extremely unlikely. The validity of the argument must not depend on any feature of the design or materials controlled by the facility's system of IROFS or management measures.

The bounding assumptions and initial conditions for the node under evaluation may also be considered when identifying credible accident sequences and initiating events. Justification that an accident sequence is not credible shall be documented.

3.3.4 Identify Accident Causes

When analyzing accident sequences, the ISA team considers process deviations, human errors, internal facility events, and credible external events. The team evaluates common mode failure and systems interaction. The team documents postulated accident sequences considered not credible. In addition to normal conditions, the team considers abnormal conditions including start-up, shutdown, maintenance, and process upsets.

3.3.5 Determine the Unmitigated Consequence Severity

For each credible accident sequence identified, the ISA team assigns a severity rank for the unmitigated consequences using the consequence severity rankings shown in Table 3.1 and documents the assigned severity rank in the GNF-A ISA database. Assigning a severity rank allows each accident sequence to be categorized in terms of the performance requirements set forth in 10 CFR 70.61 (b), (c), and (d). A severity rank of 3 corresponds to "high consequences"; a severity rank of 2 corresponds to "intermediate consequences." When estimating the possible unmitigated consequences of an accident sequence, the ISA team members use plant experience, guidance from NUREG/CR-6410, *Nuclear Fuel Cycle Accident Analysis Handbook*, and their best judgment. All credible criticality accident sequences are assigned a severity ranking of 3 "high consequences".

The quantitative standards used to assess the consequence severity from chemical exposures to licensed materials or chemicals produced by licensed materials are shown in Table 3.2. The levels-of-concern values shown are derived from the EPA Acute Exposure Guideline Levels (AEGLs), based on an exposure for up to one hour for each limit. The AEGL-1, -2, and -3 values are used as the threshold concentration levels for establishing a low, intermediate, or high severity consequences as shown in Table 3.1.

The uranium hexafluoride concentration in air is not directly equivalent to soluble uranium intake. GNF-A uses worker intake quantities consistent with NRC FCSE Interim Staff Guidance ISG-14, Rev. 0 "Acute Uranium Exposure Standards for Workers", dated June 15, 2015.

Table 3.1 – Facility Consequence Severity Categories

Severity Ranking	Consequence Description		
	Workers	**Off-site Public**	**Environment**
3	• Radiological dose greater than 1 Sv (100 rem) • 400 mg soluble uranium intake • Chemical exposure greater than AEGL-3 • A criticality accident	• Radiological dose greater than 0.25 Sv (25 rem) • 30 mg soluble uranium intake • Chemical exposure greater than AEGL-2 • A criticality accident	• A criticality accident
2	• Radiological dose greater than 0.25 Sv (25 rem) but less than or equal to 1 Sv (100 rem) • 150 mg soluble uranium intake • Chemical exposure greater than AEGL-2 but less than or equal to AEGL-3	• Radiological dose greater than 0.05 Sv (5 rem) but less than or equal to 0.25 Sv (25 rem • Chemical exposure greater than AEGL-1 but less than or equal to AEGL-2	• Radioactive release greater than 5,000 times Table 2 Appendix B of 10 CFR Part 20
1	Accidents with radiological and/or chemical exposures to workers less than those above	Accidents with radiological and/or chemical exposures to the public less than those above	Radioactive releases to the environment producing effects less than those specified above

*Where Sv = Sieverts; AEGL = acute exposure guideline level

Table 3.2 –Levels of Concern (AEGL)

Chemical	AEGL 1	AEGL 2	AEGL 3
Uranium hexafluoride (UF_6)	3.6 mg/m^3	9.6 mg/m^3	36 mg/m^3
Hydrogen fluoride (HF)	1 PPM	24 PPM	44 PPM

(Note: All values shown are for 60-minute exposures)

3.3.6 Determine the Unmitigated Likelihood

The unmitigated likelihood of an accident sequence occurring is required to be determined for all credible accident sequences assigned a consequence severity of "high" or "intermediate." Unmitigated likelihood is the likelihood or frequency that the initiating event or cause of the accident sequence occurs. The team assigns an unmitigated likelihood level for each accident sequence using the defined categories in Table 3.3 and documents the assigned level in the GNF-A ISA database. When assigning a likelihood category, the team uses process knowledge, accident sequence information, operating history, and manufacturers/product information to determine which category of likelihood is appropriate. For accident sequences where multiple causes have been identified, the team estimates the likelihood for the most credible cause. This helps assure that the accident sequence is screened using the most conservative estimate of risk.

Table 3.3 – Unmitigated Likelihood Categories

	Likelihood Category	Frequency of Occurrence
Not Unlikely*	3	More than or equal to 10^{-3} per-event per-year
Unlikely	2	Between 10^{-3} and 10^{-4} per-event per-year
Highly Unlikely	1	Less than or equal to 10^{-4} per-event per-year

* Default selection in absence of quantitative assessment.

3.3.7 Determine the Unmitigated Risk

Credible accident sequences identified for the facility, which have the capability of producing conditions that fail to meet the performance requirements of 10 CFR 70.61 (b), (c) or (d), require IROFS to be assigned to reduce the overall risk to an acceptable level. For each credible accident sequence, the ISA team uses the unmitigated severity category rank and unmitigated likelihood level to assign an unmitigated risk level. (The unmitigated risk is determined from the product of the severity ranking and the unmitigated-likelihood level.) The ISA teams use the risk matrix in Table 3.4 to determine the unmitigated risk and document the assigned risk in the GNF-A ISA database.

Table 3.4 – Unmitigated Risk Assignment Matrix

Severity of Consequences	Likelihood of Occurrence		
	Likelihood Category 1 Highly Unlikely (1)	**Likelihood Category 2 Unlikely (2)**	**Likelihood Category 3 Not Unlikely (3)**
Consequence Category 3 – High (3)	Acceptable Risk 3	Unacceptable Risk 6	Unacceptable Risk 9
Consequence Category 2 – Intermediate (2)	Acceptable Risk 2	Acceptable Risk 4	Unacceptable Risk 6
Consequence Category 1 – Low (1)	Acceptable Risk 1	Acceptable Risk 2	Acceptable Risk 3

3.4 Conducting the Quantitative Analysis

For each accident sequence having an unmitigated risk of unacceptable, IROFS must be assigned and the overall mitigated likelihood determined for each accident sequence. Approved quantification methods include event tree analysis, fault tree analysis, human reliability analysis, LOPA, and the semi-quantitative index method. Figure 3.2 presents the steps taken to quantify the mitigated likelihood of an accident sequence. Specific details for accomplishing these steps are included in this section, including identifying the initiating events, estimating the initiating event's frequency, identifying enabling conditions and conditional events, selection of IROFS, and estimating the failure probability of each credited IROFS.

Determination of the overall likelihood for an accident sequence is documented in a Quantitative Risk Assessment (QRA) report. The purpose of these reports is to provide sufficient background and operational information to understand and examine all accident sequences that result in unacceptable risks for each accident sequence. Each QRA report provides details concerning an accident sequence's quantification, including method used, initiating-event frequency determination, enabling or conditional event probabilities, the IROFS credited to prevent or mitigate the initiating event(s) being analyzed, the failure probabilities for the credited IROFS, and the overall likelihood estimates. The QRA reports are controlled by Configuration Management and are reviewed and approved when modified as described in Subsection 3.5.1. The quantification results from each QRA are summarized in the GNF-A ISA Summary.

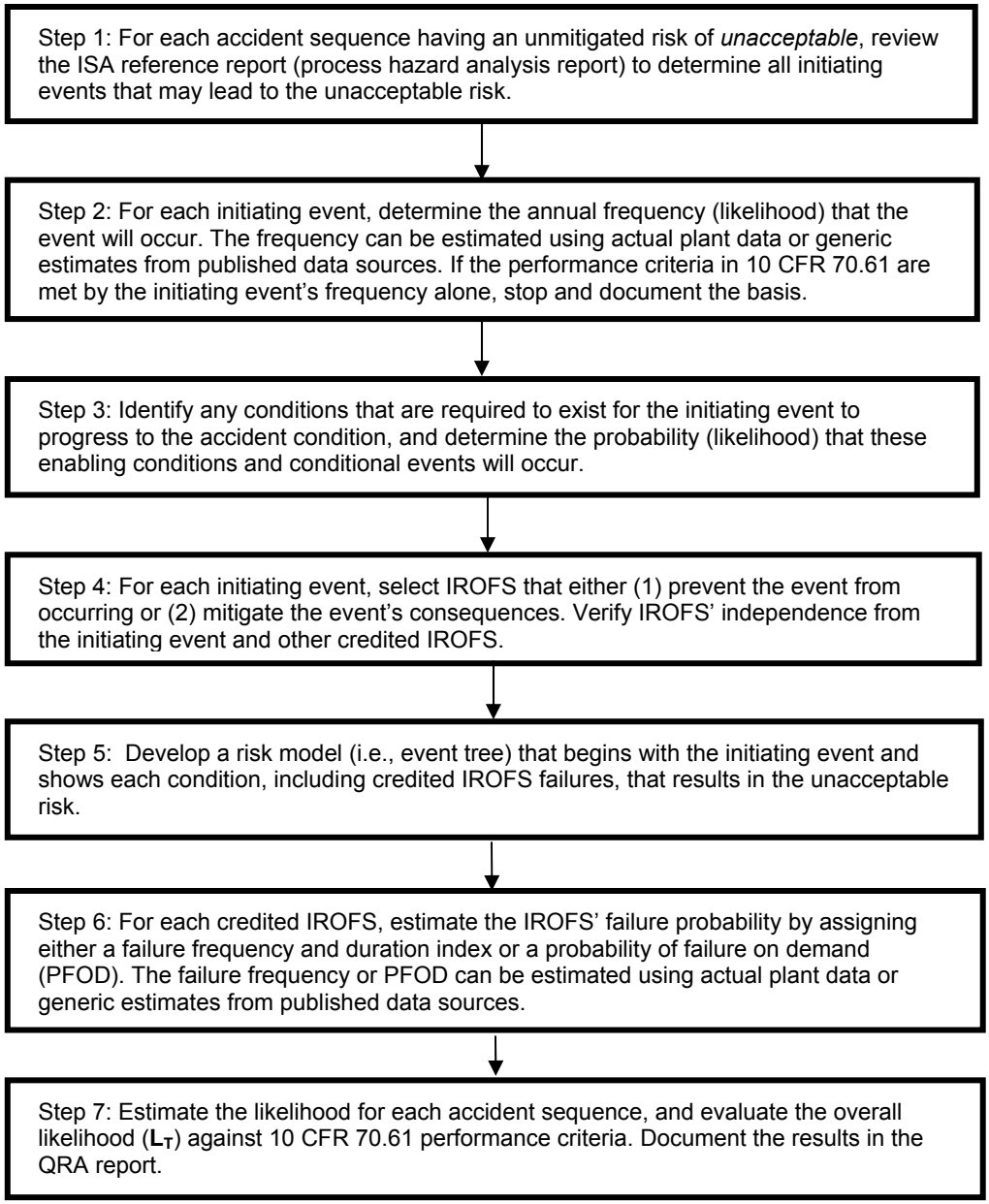

Figure 3.2 – Quantification Methodology

3.4.1 Initiating Events

For each accident sequence requiring quantification, the ISA team member responsible for quantifying the accident sequence first reviews the ISA reference report (process hazard analysis report) to determine all initiating events that may result in an unacceptable risk. The annual frequency of each initiating event is estimated using plant operational experience, industrial performance data, or index values supplied in the GNF-A ISA Summary.

3.4.2 Enabling Conditions and Conditional Events

For each accident sequence, enabling conditions and conditional events that affect the outcome of the accident sequence (i.e., conditions that affect the likelihood of the accident sequence or could mitigate the consequences to either workers or the public) are identified where appropriate.

An enabling condition does not directly cause the accident sequence, but must be present for the initiating event to proceed to the consequences described. Enabling conditions are expressed as annual probabilities, and can include such things as the mode of operation (e.g., percent of annual operational online availability).

Conditional events that affect the probability of the unacceptable risk are also identified. These can include probabilistic consideration of individual or administrative actions that would not be considered IROFS, but would affect the overall likelihood of the accident. For example, if an accident sequence involves personal injury hazards, at least one worker must be present in the affected area at the time of the event for the injury to occur. Thus, the presence of workers in the affected area is a conditional modifier for a consequence involving personal injury. Another example of a conditional event is the probability that a worker can successfully evacuate from an area given that a hazard is present.

3.4.3 IROFS Identification and Evaluation

IROFS are controls or control systems (eg. structures, systems, equipment, components, and activities of personnel) that are relied on to prevent potential accidents at a facility that could exceed the performance requirements of 10 CFR 70.61 or to mitigate their potential consequences. When selecting IROFS, the IROFS must be independent of the initiating event (i.e., occurrence of the initiating event does not cause failure of the IROFS) and other credited IROFS (i.e., failure of one IROFS does not cause failure of another IROFS).

For IROFS that use process control computer systems, such as distributed control systems (DCS) and programmable logic controllers (PLC), GNF-A uses design standards for these systems that result in IROFS with a high reliability and response capability. The architecture design standards for these control systems include the use of mechanically fail-safe final control elements where feasible, security procedures for access and changes to control-system software, separate final elements utilizing separate output modules, and independent control element sensors on separate input modules. When selecting IROFS, GNF-A follows the guidelines from LOPA using the type B methodology for IROFS that use process control computer systems. This methodology limits GNF-A to claiming no more than two IROFS in a single logic controller for any accident

sequence. All control-system IROFS are subject to the applicable management measures as described in the ISA Summary, including periodic verification of IROFS functionality.

GNF-A commits to identify IROFS as a part of the ISA and include the identification of the IROFS in the ISA Summary Report prepared and maintained for the facility. The IROFS are defined in such a way as to delineate their boundaries, to describe the characteristics of the preventive/mitigating function, and to identify the assumptions and conditions under which the IROFS is relied on.

When evaluating accident sequences, the overall likelihood of the accident sequence must be determined and the adequacy of IROFS to prevent or mitigate the accident sequence is clearly identified.

IROFS which are continuous controls may be evaluated by determination of failure frequency and duration. IROFS which are passive controls or only operate when demanded may be evaluated by determining the probability of failure on demand (PFOD). The duration term does not apply when PFOD is used.

3.4.4 Determining the Overall Likelihood

The *overall likelihood* for an accident sequence is the product of the frequency of the initiating event times the probability of any enabling conditions, times the probability of failure for each credited IROFS. Considerations include frequency of the initiating event, IROFS, enabling conditions, conditional events, time period (duration) of the IROFS failed condition prior to detection/response, IROFS testing or surveillance interval, and independence of IROFS which mitigate the progression of the accident sequence.

Several methods are approved for determining the overall likelihood for an accident sequence. Rigorous methods, such as event tree analysis, are used when the accident sequence is complex and issues such as employee evacuation, the size and location of the material release, and timing or order of IROFS failures needs to be considered. Standard quantitative risk assessment techniques were employed in assessing the overall likelihood for accident sequences using the event-tree analysis method. Overall likelihood is evaluated using limits defined in Table 3.5.

Simplified quantitative methods such as LOPA and an index method are approved for estimating an accident sequence's overall likelihood. The index value for the overall likelihood, L_T, can be determined using the following semi-quantitative equation. The index values are $\log_{10}$ values for each of the annual frequencies and probabilities, which are then summed to determine overall likelihood.

This method conforms to the GNF-A ISA methodology, the GNF-A proposed new overall likelihood methodology, and the additional refinements to the GNF-A overall likelihood methodology.

$$L_T = \lambda_{IE} + \sum_{k=1}^{k=M} P_{E,k} + [\sum_{i=1}^{i=N-1} (\lambda_{f,i} + \lambda_{(T/2+MTTR),i}) \bullet \lambda_{IND,i}] + [\lambda_{f,N} + \lambda_{T/2,N}]$$ Where,

L_T= Overall likelihood index value for the accident sequence being reviewed

Each summed index value term is the $\log_{10}$ representation of each probability or frequency where,

λ_{IE} = Index value for the probability of the initiating event occurring for the identified accident sequence (on a per-year basis, per 3.4.1).

$P_{E,k}$ = Index value for probability of the (k^{th}) enabling condition or conditional event, per 3.4.2. Enabling-condition probabilities are expressed on a per-year basis. These terms are optional.

$\lambda_{f,i}$ = Index value for the failure frequency (on a per-year basis) for an individual (i^{th}) IROFS considered in preventing or mitigating the accident sequence.

$\lambda_{(T/2+MTTR),i}$ = Index value for the duration for an individual (i^{th}) IROFS considered in preventing or mitigating the accident sequence. For functionally tested IROFS, use the sum of one-half the testing (or surveillance) interval and the mean time to repair (MTTR) or place the system in a safe configuration.

Note: For IROFS where the Probability of Failure on Demand (PFOD) is used, replace the term ($\lambda_{f,i} + \lambda_{(T/2+MTTR),i}$) with $\lambda_{PFOD,i}$, which represents the index value for the PFOD for the i^{th} IROFS.

$\lambda_{IND,i}$ = Independence factor for an individual (i^{th}) IROFS. If the failure of a particular IROFS in the identified accident sequence is not caused by, or made more likely to occur by, failure of another IROFS, independence is established, and a value of 1 is used; otherwise a value of 0 is used.

$\lambda_{f,N}$ = Index value for the failure frequency (on a per-year basis) for the final (N^{th}) IROFS considered in preventing or mitigating the accident sequence.

$\lambda_{T/2,N}$ = Index value for the duration for the N^{th} IROFS considered in preventing or mitigating the accident sequence. For functionally tested IROFS, use the sum of one-half the testing (or surveillance) interval. For the final (N^{th}) IROFS considered in preventing or mitigating the accident sequence, the mean time to repair term is excluded for *order-dependent* accident sequences, because this IROFS represents the final barrier in the accident sequence.

Qualitative indices are assigned to the initiating-event frequency, the IROFS failure frequencies and duration indices and then "combined" together with factors representing the immunity to common mode failure to assign a score to the overall (total) likelihood. The overall-likelihood index, L_T, is then evaluated against the applicable limit for the corresponding consequence category. The mitigated likelihood of the accident sequence occurring with the preventive or mitigating IROFS in-place must meet the requirements in 10 CFR 70.61, which requires that unacceptable consequences be limited (see Table 3.5 for mitigated overall likelihood limits).

Table 3.5 – Acceptance Criteria for Overall Likelihood

Index Value (L_T)*	Likelihood (per year)	Acceptance Criteria
-6.0	$\leq 1.0 \times 10^{-6}$	Acceptable for high (and intermediate) consequence accidents
-5.0	$\leq 1.0 \times 10^{-5}$	Acceptable for high (and intermediate) consequence accidents
-4.0	$\leq 1.0 \times 10^{-4}$	Acceptable for high (and intermediate) consequence accidents
-3.0	$\leq 1.0 \times 10^{-3}$	Acceptable for intermediate consequence accidents only; not acceptable for high consequence accidents
-2.0	$\leq 1.0 \times 10^{-2}$	Not acceptable for high or intermediate consequence accidents
-1.0	$\leq 1.0 \times 10^{-1}$	Not acceptable for high or intermediate consequence accidents

* L_T determined using the semi-quantitative equation in Subsection 3.4.4

3.5 ISA Management

3.5.1 ISA Change Management

As described in Chapter 11, Management Measures, a formal configuration management process, governed by written, approved practices, ensures that plant design changes do not adversely impact the ISA at GNF-A. Facility, documentation, and temporary changes are initially evaluated by a trained and approved safety reviewer to determine the potential effects to safety disciplines (criticality, radiation, chemical, industrial, fire and/or explosion), the site license and the ISA, and to assure safe implementation and operation of the change.

Changes that require NRC prior approval per 10 CFR 70.72(c) will be submitted with ISA Summary revisions, but are not implemented until NRC approval is obtained. An annual update to the ISA Summary is also submitted for implemented changes that do not require pre-approval by the NRC or otherwise affect the ISA Summary.

Changes that do not require NRC prior approval, but which may affect the ISA, require formal evaluation by the ISA team to determine the effects to any ISA documentation, including the ISA Reference Report, Quantitative Risk Assessment report(s), and the ISA Summary. ISA methods are utilized to evaluate the adequacy of existing IROFS and associated management measures, and to designate new or additional IROFS and appropriate management measures as required. Modifications to existing IROFS are evaluated to ensure that capability, availability, and reliability of the IROFS are at least equal to the original IROFS approved by the NRC.

A trained ISA facilitator is responsible for the development of modifications to the ISA documentation per written, approved procedures. ISA updates are approved prior to operation of any change.

Unacceptable IROFS performance deficiencies will be corrected, and evaluated for potential changes that may be necessary to the ISA.

3.5.2 Training and Qualifications of ISA Teams

3.5.2.1 Process Hazard Analysis

To ensure the adequacy of the results of the ISA, the analyses are performed by teams composed of individuals with expertise in engineering and process operations and in accordance with internal procedures.

Each team consists of persons experienced and knowledgeable in the hazards that are known to exist in the study area (e.g., criticality, radiation, chemical, industrial, fire and explosion).

In addition, the team will include a cognizant engineer with experience and knowledge specific to the process being evaluated and a person directly experienced with the operations.

The team will include a Team Leader determined by management to be knowledgeable in the ISA process and procedures in use at the facility. Management may elect to augment Team Leader skills with a qualified facilitator familiar with the methods being used. The Team Leader assignment will be formally documented in writing.

3.5.2.2 Quantitative Risk Analyst

Technical or safety professionals may be assigned as authors of a Quantitative Risk Assessment (QRA) report, after they have completed fundamental training on Risk Assessment. They are also assigned trained peer reviewers to assess their analysis as it is developed.

3.5.3 Management Measures

Management measures ensure that IROFS are designed, implemented, and maintained, as necessary, to be available and reliable to perform their function when needed. Management measures are applied to IROFS in a graded approach based on the type and robustness of the IROFS and the accident sequences the IROFS is preventing or mitigating. The ISA Summary provides a description of the management measures to be applied to each identified IROFS.

A minimum set of management measures are assigned to a particular grouping of IROFS by the ISA Team depending on whether the IROFS are classified as sole IROFS or if they are active engineered control (AEC), passive engineered control (PEC), augmented administrative control (AAC), or administrative control (AC) IROFS.

Within each of the five general classifications of IROFS (Sole, AEC, PEC, AAC, or AC), the IROFS are then assigned specific elements of the management measures. The selection of specific management measure elements is determined by the operational organization based on consideration of the selection criteria.

All IROFS will have management measures applied. The graded approach does not allow for the application of management measures to be waived, but rather allows for varying levels of the number and type of management measures to be applied, as well as the specific elements of management measures, to provide adequate assurance, commensurate with risk, that the IROFS safety function will be met.

The selection criteria used to identify the appropriate application of management measures (or elements of a specific management measure) includes the following:

- Type of IROFS (AEC, PEC, AAC, AC)
- Number of IROFS (e.g., sole IROFS)
- Failure probability of the IROFS as identified in the quantitative risk assessment
- Failure mechanisms
- Design attributes (redundancy, separation requirements, complexity)
- Applicable codes or standards applicable to the IROFS
- Failure history
- Consequence severity (from PHA)
- Worker, public, or environmental consequences (from PHA)
- Type of risk analysis performed (qualitative, semi-quantitative, quantitative)
- Safety function
- Preventative or mitigative IROFS

The use of the graded approach in assigning management measures to IROFS is documented and provided to the ISA Team performing the ISA review.

The management measures are described in Chapter 11 and in the ISA Summary. The ISA Summary specifies the management measures assigned to each IROFS.

US NRC
October 8, 2015

Attachment 3

SNM-1097 Chapter 11

CHAPTER 11.0
MANAGEMENT MEASURES

11.1 MANAGEMENT MEASURES

11.1.1 REASONABLE ASSURANCE

GNF-A commits to apply *Management Measures* on a continuing basis to IROFS for the purpose of providing reasonable assurance that the IROFS are available and able to perform their function when needed.

11.1.2 GRADED APPLICATION OF MANAGEMENT MEASURES TO IROFS

GNF-A applies *Management Measures* in a graded approach based on unmitigated risk as described in Chapter 3 (See Section 3.5).

11.2 CONFIGURATION MANAGEMENT (CM)

11.2.1 CONFIGURATION MANAGEMENT POLICY

GNF-A commits to maintain a formal configuration management process, governed by written, approved practices, and ensures that plant design changes do not adversely impact safety, health, or environmental protection programs at GNF-A. The following items are addressed prior to implementing a change:

- The technical basis for the change
- The impact of the change on safety, health and control of licensed material
- Modifications to existing operating procedures including any necessary training or retraining before operation
- Authorization requirements for the change
- For temporary changes, the approved duration (expiration date) of the change

- The impacts or modifications to the ISA, ISA Summary and any other component of the overall safety program

The configuration management (CM) program ensures that the information used to operate and maintain safety controls is kept current.

The CM program includes the following activities:

- Maintenance of the design information for the plant
- Identification of all IROFS
- Control of information used to operate and maintain the plant
- Documentation of changes
- Assurance of adequate safety reviews for changes
- Periodic comparison assessment of the conformance of specific safety controls to the documentation of plant design basis

11.2.2 DESIGN REQUIREMENTS

Written plant practices define the development, application, and maintenance of the design specifications and requirements. Plant design specifications and requirements are maintained as controlled information. The specific content of the information depends on the age of the design and the requirements in place at the time of design. As a minimum, the information required for safe operation of the facility is available.

11.2.3 DOCUMENT CONTROL

Documented plant practices define the control system, including creation, revision, storage, tracking, distribution and retrieval of applicable information including:

- Hazards Analysis (ISA reference report), ISA Summary including a listing of IROFS
- Operating procedures
- Drawings for safety related systems, structures and components
- Technical specifications and requirements

- Software for safety controls
- Calibration instructions
- Functional test instructions

The documented plant practices describe the responsibilities and activities that maintain consistency between the facility design, the physical facility, and the documentation. They also describe how the latest approved revisions are made available for operations.

11.2.4 CHANGE CONTROL

GNF-A maintains written plant practices describing the configuration management program for controlling design change, including approval to install and operate facility, process, or equipment design changes. These practices stipulate that a trained and approved safety reviewer determine if the applicable ISA is impacted by the facility change. If there is an impact to the ISA, it is identified and the change is flagged for review and approval by an ISA team in accordance with the process described in Chapter 3.

The written plant practices also prescribe controls and define the distinction between types of changes, ranging from replacement with identical designs that are authorized as part of normal maintenance, to new or different designs that require specified review and approval.

11.2.5 ASSESSMENTS

Planned and scheduled internal and independent audits are performed to evaluate the application and effectiveness of management controls and implementation of programs related to activities significant to plant safety. Audits are performed to assure that operations are conducted in accordance with the operating procedures, and to assure that safety programs reflected in the operating procedures are maintained.

11.2.6 DESIGN RECONSTITUTION

The current plant design was reconstituted in accordance with the requirements specified in 10 CFR 70.62.

GNF-A submitted a plan as required by 10 CFR 70.62 (c) (3) (i) and this plan was approved by the NRC on June 11, 2002 (TAC NO. L31607).

GNF-A performed the design reconstitution in accordance with their approved plan and submitted the completed summary required by 10 CFR 70.62 (c) (3) (ii) on October 12, 2004. Periodic updates as required by the regulations (10 CFR 70.72 (d) (2&3)) are submitted to the NRC.

11.3 MAINTENANCE

The purpose of planned and scheduled maintenance of safety controls is to assure that systems are kept in a condition of readiness to perform the planned and designed functions when required.

Area Managers are responsible for assuring the operational readiness of safety controls in their assigned facility areas.

The maintenance function utilizes a systems-based program to plan, schedule, track and maintain records for maintenance activities. Maintenance instructions are an integral part of the maintenance system for maintenance activities. Key maintenance requirements for safety controls such as calibration, functional testing, and replacement of specified components are derived from integrated safety analyses described in Chapter 3.

Maintenance activities generally fall into the categories described in the following sections.

11.3.1 CORRECTIVE MAINTENANCE

Corrective Maintenance refers to situations where repairs, replacements or major adjustments such as re-calibration take place.

GNF-A commits to promptly perform corrective actions to remediate unacceptable performance deficiencies in IROFS.

The maintenance planning and control system provides documentation and records of systems and components that have been repaired or replaced.

When a component of a specified safety control is repaired or replaced, the component is functionally verified via post maintenance testing to assure that it has the capability to perform its planned and designed function when called upon to do so.

If the performance of a repaired or replaced safety control could be different from that of the original component, the change to the safety control is specifically approved under the configuration management program and pre-operationally tested to assure it is likely to perform its desired function when called upon to do so.

11.3.2 PREVENTATIVE MAINTENANCE

Preventative Maintenance refers to activities that are performed as precautions to help ensure that systems remain operational and avoid unexpected failures. Examples of safety controls included for scheduled preventive maintenance are:

- Radiation Measurement Instruments
- Criticality Detection Devices
- Effluent Measurement & Control Devices
- Emergency Power Generators
- Fire Detection and Control Systems
- Pressure Relief Valves
- Air Compressors
- Steam Boilers

11.3.3 SURVEILLANCE/MONITORING

GNF-A utilizes active engineered controls that are integrated into the routine plant operations to the degree practical. In these systems the IROFS are near continuously monitored by the digital control system as a routine part of the operating process. Degradations or failures in these cases result in immediate safe shutdown of the operations.

IROFS associated with passive engineered systems are typically fixed physical design features to maintain safe process conditions. Assurance is maintained through pre-operational audit and periodic verification of effectiveness as prescribed in the ISA process described in Chapter 3, Table 3.7 and includes consideration of the importance of the IROFS as well as quality and reliability information.

IROFS relying on geometry-based controls, where the geometry is subject to undetected change in routine operation, are periodically verified on a schedule commensurate with the potential for change in the parameters of interest.

- Examples of active engineered controls that are integrated into routine plant operations include all IROFS managed by the distributed control system (e.g. PROVOX) or hardwired interlocks.
- Examples of passive engineered IROFS would include process equipment design features such as physical separation of storage fixtures (floor storage fixtures, installed can-conveyor separation); or other process design characteristic (air breaks, overflows, orifice sizing, restricting vessel feeds, hood physical restraints, etc.).
- Examples of geometry-based IROFS would include design control of process equipment physical dimensions (pellet tray dimensions, boat size, container volume, pipe tank ID, annular tank thickness, slab tank thickness) and/or use of neutron absorbers.

11.3.4 FUNCTIONAL TESTING

GNF-A commits to perform post-maintenance testing to verify that the maintenance activity did not adversely affect the functionality of the IROFS associated with the maintenance work.

GNF-A commits to perform functional tests in accordance with written instructions that define the method for the test and the required acceptable results. The results of the tests are also recorded and maintained.

11.4 TRAINING AND QUALIFICATIONS

11.4.1 ORGANIZATION AND MANAGEMENT OF THE TRAINING FUNCTION

Training programs at the GNF-A facility for personnel who perform activities relied on for safety are provided through shared responsibility between EHS safety disciplines, Operations and Human Resources functional organizations. Area Managers are responsible for the content and effective conduct of training for operations personnel. Records are maintained on each employee's qualifications, experience, training, and retraining.

Facility administrative procedures establish the requirements for indoctrination and training of personnel performing activities relied on for safety and to ensure that the training program is conducted in a reliable and consistent manner throughout all training areas.

Training records are maintained to support management information needs associated with personnel training, job performance, and qualifications. Training records are retained in accordance with records management procedures.

11.4.2 FUNCTIONAL AREAS REQUIRING TRAINING

Training is provided for each individual at GNF-A, commensurate with assigned duties (or roles). Training and qualification requirements are met prior to personnel fully assuming the duties of safety-significant positions, and before assigned tasks are independently performed.

Functional areas requiring training may be grouped into one of three broad categories:

- General Employee Training
- Technical Training
- Developmental Training

The objective of the training program is to ensure safe and efficient operation of the facility and compliance with applicable regulatory requirements. Training requirements shall be applicable to, but not restricted to, those personnel who have a direct relationship to the operation, maintenance, testing, or other technical aspects of the facility IROFS.

Continuing or periodic retraining courses shall be established when applicable to ensure that personnel remain proficient. Periodic training generally is conducted to ensure retention of knowledge and skills important to facility operations. The training may consist of periodic retraining exercises, instructions, or review of subjects as appropriate to maintain the proficiency of all personnel assigned to the facility.

Chapter 8, Radiological Contingency and Emergency Plan, provides additional information on personnel training for emergency response tasks.

11.4.2.1 General Employee Training

General Employee Training (GET) encompasses those quality assurance, radiation protection, industrial safety, environmental protection, emergency response, and administrative procedures established by facility management and applicable regulations. The industrial safety training for GNF-A complies with applicable section of the Occupational Safety and Health Administration (OSHA) regulations such as 29 CFR 1910 and with 10 CFR 19 (Notices, Instructions, and Reports to Workers: Inspection and Investigations). Continuing training is conducted in these areas as necessary to maintain employee proficiency. All persons under the supervision of facility management (including contractors) must participate in GET; however, certain facility support personnel, depending on normal work assignment, may not participate in all topics of this training. Temporary maintenance and service personnel receive GET to the extent necessary to assure safe execution of their duties. Certain portions of GET may be included in new employee orientation program implementation.

GET topics are listed below:

- General administrative controls and procedures and their use
- Quality Assurance policies and procedures
- Nuclear Safety (Criticality/Radiological)
- Industrial, Chemical, Fire, Health and First Aid
- Emergency Plan and implementing procedures
- Fire protection and fire brigade

- New Employee Orientation
- Environmental Protection

11.4.2.2 Nuclear Safety Training

Training programs are established for the various job functions (e.g., operations, radiation protection technicians, contractor personnel) commensurate with criticality safety and radiation safety responsibilities. Visitors to the airborne radioactivity controlled area are trained in the formal training program or are escorted by trained personnel.

Formal Nuclear Safety training includes information about radiation and radioactive materials, risks involved in receiving low level radiation exposure in accordance with 10 CFR 19.12, basic criteria and practices for radiation protection, nuclear criticality safety principles not verbatim, but in general conformance with applicable objectives contained in ANSI/ANS 8.19 and ANSI/ANS 8.20 national consensus standard guidance.

Training policy requires that employees must complete nuclear safety training prior to unescorted access in the airborne radioactivity controlled area. Methods for evaluating the understanding and effectiveness of the training includes passing an initial examination covering formal training contents and observations of operational activities during scheduled audits and inspections.

Such training is typically performed using computer based training, but may be performed by authorized instructors. Training program contents are reviewed on a scheduled basis by the manager of the criticality safety and radiation safety functions to ensure that training program contents are current and adequate.

Previously trained employees who are allowed unescorted access to the airborne radioactivity controlled area are retrained at least every two years. The effectiveness of the training program is evaluated by either initial training exam or re-training exam. Visitors are trained commensurate with the scope of their visit and/or escorted by trained employees.

11.4.2.3 Industrial, Chemical, Fire, Health and First Aid

Industrial, Chemical, Fire Safety, Health and First Aid safety orientation of new or transferred employees is an important part of establishing the proper safety attitude among plant employees and insuring that they are aware of safety procedures, rules and hazards involving assigned duties. New employee orientation in performance of duties may include, as appropriate, the review of:

- OSHA General Duty Clause
- Employee Responsibilities
- Employer Responsibilities
- General Site Safety Rules
- Hazard Communication Training
- Fire Extinguisher Training
- Emergency Evacuation Procedure
- Job Hazards Analysis (JHA)
- Material Safety Data Sheets (MSDS)
- Lock-Out-Tag-Out Awareness

11.4.2.4 Technical Training

Technical training is designed, developed and implemented to assist facility operations and maintenance personnel in gaining an understanding of the applicable fundamentals, procedures, and technical practices common to a nuclear fuel conversion and fabrication facility. Technical training consists of initial training, on-the-job training, continuing training, and special training, as applicable to assigned technical duties of the job function (or role). This may include, but is not limited to, the following topics:

- On-the-Job Training
- Process Specific Training
- Mechanical Maintenance

– Controls, Instrumentation, Electrical Maintenance

– Chemistry

11.4.2.5 Development Training

Developmental Training is a broad category implemented to assist facility operations supervisory, and management personnel in gaining additional understanding of fundamentals and technical practices common to assigned job duties (or roles). Developmental training typically utilizes internal/external professionals via formal workshop, tutorials, and select training programs.

11.4.3 POSITION TRAINING REQUIREMENTS

Operator training is performance based, and incorporates the structured elements of analysis, design, development, implementation, and evaluation commensurate with assigned duties.

Minimum training requirements are developed for positions whose activities are relied on for safety. Initial identification of job-specific training requirement is based on individual employee experience. Entry-level criteria (e.g., education, technical background, and/or experience) for these positions are contained in position descriptions.

Job-specific training is performance based and established with relevant technical EHS safety discipline and operations leadership to develop a list of qualifications for assigned duties (or roles). Changes to facilities, processes, equipment, or job duties are incorporated into revised lists of qualifications.

11.4.4 BASIS OF TRAINING AND OBJECTIVES

The training program is designed to prepare initial and replacement personnel for safe, reliable, and efficient operation of the facility. Emphasis is placed on safety requirements where human actions are important to safety.

11.4.5 EVALUATION OF TRAINEE LEARNING

Trainee understanding and proficiency is evaluated through observation/ demonstration or oral or written examinations, as appropriate. Such evaluations measure the trainee's skill and knowledge of job performance requirements.

Operator training and qualification requirements are met prior to process safety-related tasks being independently performed or before startup following significant changes to safety controls.

11.4.6 CONDUCT OF ON-THE-JOB TRAINING

On-the-Job training (OJT) is a systematic method of providing the required job related skills and knowledge for a position. This training is conducted in the work environment. Applicable tasks and related procedures make up the OJT/qualifications program for each technical area which is designed to supplement and complement training received through formal classroom, laboratory, and/or simulator training. The object of the program is to assure the trainee's ability to proficiently perform job duties as required for the assigned role. Refer to Section 11.4.3.

Completion of on-the-job training is demonstrated through actual task actions using the conditions encountered during the performance of assigned duties (or roles) including references, tools, and equipment conditions reflecting the actual task to the extent practical.

11.4.7 EVALUATION OF TRAINING EFFECTIVENESS

Periodic evaluations of training program content and requirements are performed to assess program effectiveness. The trainees provide feedback after completion of classroom or computer based training session to provide data for this evaluation. These evaluations identify program strengths and weaknesses, determine whether training content matches current job needs, and determines if corrective actions are needed to improve program effectiveness.

Independent audits of EHS safety disciplines may also be used to provide independent evaluations of overall training program effectiveness (see Section

11.6.5 of this Chapter) as it relates to the ISA program, IROFS implementation, protection of the public, worker, and environment.

Evaluation objectives applicable to the overall organization and management of the GNF-A training programs may include, but are not limited to:

- Management and administration of training and qualification programs
- Development and qualification of the matrix organization
- Design and development of training programs, content, and conduct of training, and trainee examinations / evaluations.
- Training program interface with facility configuration management practices
- Training program assessments and evaluations

11.4.8 PERSONNEL QUALIFICATION

The qualification requirements for key management positions are described in Chapter 2, Organization and Administration. Education, experience, training and qualifications are specified in this chapter.

Qualification and training requirements for operations personnel shall be established and implemented in accordance with internal plant procedures (e.g, Human Resource).

11.4.9 RECORDS

The system established for maintaining records of training and retraining of personnel who perform activities relied on for safety is described in Section 11.8.

11.5 PROCEDURES

Licensed material processing or activities will be conducted in accordance with properly issued and approved management control procedures.

11.5.1 OPERATING PROCEDURES

Area Managers are responsible to assure preparation of written, approved and issued operating procedures incorporating control and limitation requirements established by the criticality safety function, the radiation safety function, the environmental protection function and the chemical and fire safety function. Integrated safety analysis results as described in Chapter 3 are used to identify procedures necessary for human actions important to safety. Operating procedures are initiated and controlled by a configuration management system. Area Managers ensure that operating procedures are made readily available in the work area and that operators are trained to the requirements of the procedures and that conformance is mandatory. Operators are trained to report inadequate procedures, and/or the inability to follow procedures.

Nuclear safety control procedure requirements for workers in uranium processing areas are incorporated into the appropriate operating, maintenance and test procedures in place for uranium processing operations.

The safety program design requires the establishment and maintenance of documented procedures for environmental, health and safety limitations and requirements to govern the safety aspects of operations. Requirements for procedure

control and approval authorities are documented. Procedure review for updating frequencies are as follows:

Document	Review Frequency	Reviewing & Approving Functional Manager
Operating Procedures (OPs) {Note: Nuclear Safety Release/Requirement (NSR/R) limitations and requirements are incorporated into OPs}	When changed [1]	Area Manager and Affected EHS Discipline (Radiation, Criticality, Environmental, Industrial [4], or MC&A)
Operating Procedures (OPs)	Every 3 Years [3]	Area Manager and Affected EHS Discipline (Radiation, Criticality, Environmental, Industrial [4], or MC&A)
Common Procedures (CPs) and Work Instructions (WIs)	Every 2 Years [2]	Radiation & Criticality Safety, Environmental Protection, Industrial [4] , or MC&A
Nuclear Safety Instructions (NSIs)	Every 2 Years [2]	Radiation & Criticality Safety
Environmental Protection Instructions (EPIs)	Every 2 Years [2]	Environmental Protection

1) The safety awareness portions of these OPs are reviewed and updated by the appropriate environment, health, and safety (EHS) discipline when warranted based on process related facility change requests.
2) Every 2 years means a maximum interval of 26 months.
3) Every 3 years means a maximum interval of 39 months
4) EHS Discipline - Industrial means normal worker safety, chemical safety, and fire and explosion protection.

11.5.2 MANAGEMENT CONTROL PROCEDURES

Licensed material activities are conducted in accordance with management control programs described in administrative and general plant practices approved and issued by cognizant management at a level appropriate to the scope of the practice. These documented practices direct and control activities across the manufacturing functions, and assign functional responsibilities and requirements for these activities. These practices are reviewed for updating at least every two years (26 months).

11.6 AUDITS AND ASSESSMENTS

11.6.1 CRITICALITY, RADIATION, CHEMICAL AND FIRE SAFETY AUDITS

Representatives of the criticality safety function, the radiological safety function, and the chemical and fire safety function conduct formal, scheduled safety audits of fuel manufacturing and support areas in accordance with documented, approved practices. These audits are performed to determine that operations conform to criticality, radiation, and chemical and fire safety requirements.

Criticality and radiological audits are performed periodically, in accordance with documented, approved practices, such that all applicable process and support areas will be audited at least every two (2) years. These audits are performed under the direction of the manager of the criticality safety function and the manager of the radiation safety function. Chemical and fire safety audits are performed under the direction of the chemical and fire safety function manager. Personnel performing audits do not report to the production organization and have no direct responsibility for the function and area being audited.

Audit results are communicated in writing to the cognizant Area Manager and to the manager of the environment, health & safety function. Required corrective actions are documented and approved by the Area Manager, and tracked to completion by the environment, health & safety function.

Radiation protection personnel within the radiation safety function conduct weekly nuclear safety inspections of fuel manufacturing and support areas in accordance with documented procedures. Inspection findings are documented and sent to the affected Area Manager for resolution.

Records of the audit or inspection, instructions and procedures, persons conducting the audits or inspections, audit or inspection results, and corrective actions for identified violations of license conditions are maintained in accordance with procedural requirements for a minimum period of three years.

11.6.2 ENVIRONMENTAL PROTECTION AUDITS

An audit schedule of the environmental protection program is developed by the environmental protection function on an annual basis. Audits are conducted in accordance with documented practices to ensure that operational activities conform to documented environmental requirements.

Personnel under the direction of the manager of the environmental protection function perform the environmental protection audits. Personnel performing the audits do not report to the production organization and have no direct responsibility for the function and area being audited.

Audit findings are communicated to the cognizant Area Manager, who is responsible for nonconformance corrective action commitments in accordance with documented practices. The manager of the environmental protection function or delegate is responsible for resolution follow-up for identified nonconformance. Audit results in the form of corrective action items are reported to the GNF-A Facility Manager and staff for monitoring of closure status.

11.6.3 INDEPENDENT AUDITS

GNF-A commits to perform triennial independent audits of its safety program elements (radiation protection, criticality safety, chemical safety, fire and explosion protection, industrial safety and environmental protection). The audit team will consist of appropriately trained and experienced individuals who are not involved in the routine performance of the work or program being audited. The audit scope includes compliance to procedures, conformance to regulations and the overall adequacy of the safety program.

Audit results are reported in writing to GNF-A's Facility Manager, the Area Managers, the manager of the radiation safety function, and the manager of the criticality safety function, as appropriate. The findings of the audit are assigned to the appropriate safety function or Area Managers. The assigned responsible individual takes the necessary steps to investigate the finding and identify appropriate corrective actions to address and correct the finding.

The corrective actions resulting from the audit are entered into the management tracking system and reported and tracked to completion by the Facility Manager.

11.6.4 FIRE SAFETY

Fire protection audits and inspections include:

- Internal formal quarterly audits, supplemented by routine informal inspections.
- Independent auditors perform scheduled fire protection, prevention and inspections of the facility. Action plans are developed to address findings arising from such inspections.

These audits and inspections verify that ignition sources and combustibles are properly controlled.

11.6.5 WORKER CONCERNS

GNF-A commits to maintain a safety conscious work environment. All workers are encouraged to report potentially unsafe conditions to their supervisor, management or the safety organization. Reported concerns are promptly investigated, assessed and resolved.

11.7 INCIDENT INVESTIGATIONS

GNF-A commits to maintain a system to identify, track, investigate and implement corrective action for abnormal events (unusual incidents). The system includes the following requirements and features:

- The system operates in accordance with written procedures
- Abnormal events are documented, tracked and reported to the Area Managers, the safety functions and facility management
- Abnormal events associated with IROFS or their associated management measures are specifically identified
- Each event is considered in terms of regulatory reporting criteria
- Events are considered in terms of severity and compliance with regulations or license conditions.
- All condition reports require investigation, a determination of root or most probable cause and the identification of required corrective action
- More significant condition reports require a formal, systematic determination of root cause (typically using an independent, qualified team), definition of corrective actions and a higher level management review and approval of the investigation and corrective actions

- Monthly reports covering condition reports and their status are issued to the Facility Manager, Area Managers and the safety functional managers
- Events are graded for the purpose of an ongoing management evaluation of facility performance and used as one element in driving safety culture focus
- Records of the events and the documented evidence of closure are maintained for a minimum of three years
- Condition report information is used where appropriate when performing ISAs

11.8 RECORDS MANAGEMENT

Records appropriate for integrated safety analyses, IROFS, the application of management measures to IROFS, criticality and radiation safety activities, training/retraining, occupational exposure of personnel to radiation, releases of radioactive materials to the environment, and other pertinent safety activities are maintained in such a manner as to demonstrate compliance with license conditions and regulations.

Records of integrated safety analyses and the identification of IROFS are retained during the conduct of the activities analyzed and for six months following cessation of such activities to which they apply or for a minimum of three years.

Records of criticality safety analyses are maintained in sufficient detail and form to permit independent review and audit of the method of calculation and results. Such records are retained during the conduct of the activities and for six months following cessation of such activities to which they apply or for a minimum of three years.

Records associated with personnel radiation exposures are generated and retained in such a manner as to comply with the relevant requirements of 10 CFR 20. The following additional radiation protection records will be maintained for at least three years:

- Records of the safety review committee meetings
- Surveys of equipment for release to unrestricted areas
- Instrument calibrations
- Safety audits

- Personnel training and retraining
- Radiation work permits
- Surface contamination surveys
- Concentrations of airborne radioactive material in the facility
- Radiological safety analyses

Records associated with the environmental protection activities described in Chapter 10 are generated and retained in such a manner as to comply with the relevant requirements of 10 CFR 20 and this license.

11.9 OTHER QA ELEMENTS

GNF-A performs a broad spectrum of work that requires the application of QA measures. This includes work-requiring conformance to 10 CFR 50, Appendix B, 10 CFR 71, Subpart H as well as certain aspects of 10 CFR 70. As a result of these over arching quality requirements, GNF-A's management system is structured to provide a full scope of QA elements and apply them as appropriate.

With regard to 10 CFR 70, particularly the identification and maintenance of IROFS and the management measures (discussed in this Chapter) that assure the availability of the IROFS to perform their intended function when required, the following information outlines the classic QA Elements and summarizes the manner in which they are applied for the operations. The following assurance elements are applied to IROFS and the management measurements at GNF-A:

- Organization – GNF-A operates to a documented organizational structure in which responsibility and authority is clearly identified
- Program – GNF-A operates to written policies, procedures and instructions.
- Design Control – GNF-A policies and procedures outline a program to provide design control for IROFS including the management measures necessary to assure their successful operation (see CM program Section 11.2).
- Procurement Documentation Control – GNF-A policies and procedures require the definition of procurement specifications, review and approval of procurement to assure they are compatible with regulatory requirements

- Instructions, Procedures, and Drawings – GNF-A uses instructions, written procedures and drawings to document configuration, processes and methods for doing work
- Document Control – GNF-A implements document control as described here in Chapter (11.5).
- Control of Purchased Materials, Equipment, and Services – GNF-A procedures require that purchased materials, equipment or services be secured from appropriately qualified vendors and that as appropriate vendor certifications or in-house dedication of the items or work are provided
- Identification and Control of Materials, Parts, and Components
- Control of Special Processes – GNF-A procures materials from qualified vendors to documented specifications that include where necessary control of special processes. Internally the change control process, Production Tests, Engineering Evaluation Tests, Radiation Work Permit and Temporary Operating Procedure routines control special situations.
- Internal Inspections – GNF-A uses pre-operational audits for IROFS to verify that parts, configuration and operations are as intended.
- Test Control – GNF-A implements a functional test program for IROFS as defined in this Chapter.
- Control of Measuring and Test Equipment – GNF-A maintains measuring and test equipment in accordance with procedures.
- Handling, Storage, and Shipping Controls –GNF-A process for procuring materials include where appropriate handling and shipping controls to ensure the validity of the items received. In addition where shelf life is important controls are implemented to ensure these limits are implemented for the item.
- Inspection, Test, and Operating Status – Where the ISA and associated IROFS require this type of marking; items are so marked and maintained.
- Control of Nonconforming Materials, Parts, or Components - GNF-A maintains a non-conforming materials program.
- Corrective Action – GNF-A procedures for investigating the failure of IROFS require the definition of root cause and corrective action.
- Records – Where specific actions are required, GNF-A maintains records to demonstrate the action has been completed.
- Audits – GNF-A provides audits as defined in this Chapter.