
Safety Evaluation Report
for the Renewal of SNM-1097
Global Nuclear Fuel - Americas
Wilmington, North Carolina

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Division of Fuel Cycle Safety & Safeguards
Office of Nuclear Material Safety & Safeguards
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ABSTRACT

The report documents the U.S. Nuclear Regulatory Commission (NRC) staff review and safety and safeguards evaluation of the Global Nuclear Fuel – Americas, LLC (GNF-A) application for renewal of a license to possess and use special nuclear material (SNM) and byproduct material at their fuel fabrication facility located in Wilmington, North Carolina. The facility will continue to possess natural and enriched uranium up to a maximum of five weight percent uranium-235 for the manufacture of fuel assemblies for commercial nuclear power plants. The license was issued by the Atomic Energy Commission in January 1969, and was most recently renewed on June 27, 1997, for a ten-year term, expiring June 30, 2007. Because GNF-A submitted the license renewal application on April 2, 2007, more than 30 days in advance of the expiration date, it has continued to operate under the provisions of 10 CFR 70.38(a).

The objective of this review is to evaluate whether the continued operation of the facility prevents the potential adverse impacts to the worker and public health and safety, under both normal operating and accident conditions. The review also considers physical protection of SNM, material control and accounting of SNM, international safeguards, and the management organization, administrative programs, and financial qualifications provided to ensure the safe design and operation of the facility.

The NRC staff concludes, in this Safety Evaluation Report (SER), that the licensee's descriptions, specifications, and analyses provide an adequate basis for the safety and safeguards of facility operations, and that continued operation of the facility does not pose an undue risk to worker and public health and safety.

A notice of opportunity to request a hearing on the renewal application was published in the Federal Register on June 18, 2007 (72 FR 33539). No requests for hearing were received. A notice of availability of Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) was published in the Federal Register on May 19, 2009.

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EXECUTIVE SUMMARY

On April 2, 2007, GNF-A submitted to the U.S. Nuclear Regulatory Commission (NRC) an application requesting renewal of license SNM-1097, under 10 CFR Part 70, to possess and use SNM and byproduct material at GNF-A's fuel fabrication facility in Wilmington, North Carolina. GNF-A proposed that the GNF-A maintain continued authorization to possess and use a specified quantity of uranium-235 enriched to up to a maximum of 5 percent uranium-235. GNF-A requested a 40-year renewed license term. GNF-A submitted additional information related to the application on November 25, 2008 (ML083300489), and February 24, 2009 (ML090560191).

A notice of opportunity to request a hearing on the renewal application was published in the Federal Register on June 18, 2007 (72 FR 33539-33541). No requests for a hearing were received.

The NRC staff conducted its safety review in accordance with 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material;" 10 CFR Part 20, "Standards for Protection Against Radiation;" 10 CFR Part 73, Physical Protection of Plants and Materials;" 10 CFR Part 74, "Material Control and Accounting of Special Nuclear Material;" and other applicable regulations. The NRC staff used guidance in NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility" (NRC, 2002), to conduct the review. The staff's safeguards review involved reviews of GNF-A's Fundamental Nuclear Material Control Plan (FNMCP), and Physical Security Plan (PSP), which includes transportation security. The staff also reviewed GNF-A's Radiological Contingency and Emergency Plan.

GNF-A also submitted an Environmental Report, which was used to prepare, in a separate document, an Environmental Assessment (EA) and finding of not significant impact (FONSI) for the license renewal. The EA and FONSI were published in the Federal Register on May 19, 2009 (74 FR 23452-23453).

A summary of the NRC's review and findings in each of the review areas is provided below:

General Information

GNF-A provided an adequate description of the facility and processes so that the staff has an overall understanding of the relationships of the facility features and the function of each feature.

Financial qualifications were properly explained and outlined in the application. The description of the site included important information about regional hydrology, geology, meteorology, the nearby population, and potential effects of natural phenomena at the facility.

Organization and Administration

GNF-A adequately described the responsibilities and associated resources for the operation of the facility. The plans and commitments described in the application provide reasonable assurance that an acceptable organization, administrative policies, and sufficient competent resources have been established or committed for the safe operation of the facility.

Integrated Safety Analysis and Integrated Safety Analysis Summary

GNF-A adequately described the process for performing integrated safety analyses (ISA) for design and operation changes at the facility. The plans and commitments provide reasonable assurance that an acceptable process has been established and will be followed to maintain

GNF-A's compliance with the performance requirements of 10 CFR 70.61 and the ISA requirements of 10 CFR 70.62(b). GNF-A submitted an ISA Summary on June 12, 2003. The NRC staff reviewed this ISA Summary and several subsequent updates and approved them in a letter dated September 19, 2008 (ML082390852).

Radiation Protection

GNF-A provided sufficient information to evaluate the Radiation Protection Program. The application adequately describes: (a) the qualification requirements; (b) written radiation protection procedures; (c) the radiation work permit (RWP) program; (d) the program for ensuring that worker and public doses are as low as is reasonably achievable (ALARA); and (e) the necessary training for all personnel who have access to radiologically restricted areas. The radiation survey and monitoring program is adequate to protect workers and members of the public who may potentially be exposed to radiation.

Nuclear Criticality Safety

GNF-A provided adequate information to evaluate the Nuclear Criticality Safety (NCS) program. GNF-A committed to having an adequate group of qualified staff to develop, implement, and maintain the NCS program in accordance with the facility organization and administration and management measures. The program meets the regulatory requirements.

Chemical Process Safety

GNF-A adequately described and assessed accident consequences that could result from the handling, storing, or processing of licensed materials, and that could potentially have significant chemical consequences and effects. GNF-A performed hazard analyses that identified and evaluated those chemical process hazards and potential accidents, and established safety controls that meet the regulatory requirements.

Fire Safety

GNF-A committed to reasonable engineered and administrative controls to minimize the risk of fires and explosions. The items relied on for safety (IROFS) and defense-in-depth protection discussed in GNF-A's ISA Summary, along with safety basis assumptions and the planned programmatic commitments in the application, meet safety requirements and provide reasonable assurance that the facility is protected against fire hazards.

Emergency Management

GNF-A provided an adequate Radiological Contingency and Emergency Plan that meets the regulatory requirements. GNF-A commits to maintaining and executing the Radiological Contingency and Emergency Plan for responding to the radiological and chemical hazards that would result from a potential release of radioactive or chemically hazardous materials. The requirements of the Radiological Contingency and Emergency Plan are implemented through approved written procedures.

Environmental Protection

GNF-A committed to adequate environmental protection measures, including environmental and effluent monitoring and effluent controls to maintain public doses ALARA as part of the radiation protection program. GNF-A's proposed controls are adequate to protect the environment and the health and safety of the public, and comply with the regulatory requirements.

Decommissioning

GNF-A provided a Decommissioning Funding Plan demonstrating that adequate funding will be available for decommissioning and decontamination of the facility. GNF-A will update the site-specific cost estimate at least every three years, to reflect inflation and changes in site inventories and conditions that could affect the cost of decommissioning.

Management Measures

GNF-A provided information about management measures that will be applied to IROFS. The information describes: 1) configuration management; 2) maintenance; 3) training and qualifications; 4) procedures; 5) audits and assessments; 6) incident investigations; 7) records management; and 8) other QA elements. The proposed management measures are acceptable and meet the regulatory requirements of 10 CFR 70.62(d).

Material Control and Accountability

GNF-A provided the FNMCP for the facility. The FNMCP describes the programs to be used to control and account for the SNM at the facility. The program meets the applicable regulatory requirements in 10 CFR Part 74.

Physical Protection

GNF-A submitted an updated Physical Security Plan for the protection of SNM of low strategic significance used and possessed at the facility in Revision 9, dated April 6, 2009. NRC staff determined that the updated plan continues to be acceptable and meets the requirements in 10 CFR Part 73.

Exemptions and Special Authorizations

GNF-A requested a number of special authorizations and exemptions. These requests are in accordance with NRC regulations and are acceptable. They are discussed in the applicable sections of this SER.

ACRONYMS AND ABBREVIATIONS

ADU	Ammonium diuranate
AEA	Atomic Energy Act
ALARA	As low as is reasonably achievable
ANS	American Nuclear Society
ANSI	American National Standards Institute
AOA	Area of applicability
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
Bq	Becquerel
BWR	Boiling Water Reactor
CAA	Controlled access area
CAAS	Criticality accident alarm system
CAP	Corrective Action Program
CEDE	Committed Effective Dose Equivalent
CFR	Code of Federal Regulations
cm	centimeter
CM	Configuration management
CSA	Criticality safety analysis
DAC	Derived airborne concentration
DFFP	Decommissioning Funding Plan
dpm	disintegrations per minute
EA	Environmental Assessment
EH&S	Environmental Health and Safety
EP	Emergency Plan
EPA	U.S. Environmental Protection Agency
ERPG	Emergency Response Planning Guidelines
FNMCPC	Fundamental Nuclear Material Control Plan
FONSI	Finding of No Significant Impact
ft	feet
ft/s	feet per second
GNF-A	Global Nuclear Fuel - Americas
gpm	gallons per minute
HAZOP	Hazard and operability
HEPA	High efficiency particulate air
HF	Hydrogen fluoride
in	inch
IROFS	Items relied on for safety
ISA	Integrated safety analysis

kg	kilogram
km	kilometer
kPa	kiloPascals
kPa/s	kiloPascals per second
lb	pound
LTL	Lower tolerance limit
m	meter
m ³	cubic meter
MC&A	Material control and accounting
mg	milligram
mi	mile
mm	millimeter
mrem	millirem
mSv	milliSievert
m/s	meter per second
MT	metric ton
NCS	Nuclear criticality safety
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NRC	Nuclear Regulatory Commission
OSHA	U.S. Occupational Safety and Health Administration
PM	Preventive maintenance
psf	pounds per square foot
psf/s	pounds per square foot per second
psi	pounds per square inch
psia	pounds per square inch absolute
psig	pounds per square inch gauge
PSM	Process safety management
PSP	Physical security plan
PWR	Pressurized Water Reactor
QA	Quality assurance
QAPD	Quality Assurance Program Description
QMS	Quality Management System
RAI	Request for additional information
RASCAL	Radiological Assessment System for Consequence Analysis
rem	Roentgen equivalent man
RP	Radiation protection
RWP	Radiation Work Permit
SER	Safety Evaluation Report
SNM	Special Nuclear Material
SSC	Safety significant controls

Sv	Sievert
μg	microgram
UF_6	Uranium hexafluoride
UO_2F_2	Uranyl fluoride
USL	Upper subcritical limit
wt	weight

1.0 GENERAL INFORMATION

1.1 INSTITUTIONAL INFORMATION

The purpose of the NRC's review of institutional information is to determine whether the license renewal application (application) includes adequate information identifying GNF-A, site and facility characteristics, and the proposed activity.

1.1.1 REGULATORY REQUIREMENTS

The regulations in 10 CFR 70.22(a)(1) require each application for a license to contain the state where the corporation is incorporated; the location of the principal office; the names, addresses, and citizenship of the principal officers; and information concerning the control or ownership exercised over the corporation by any alien, foreign corporation, or foreign government.

1.1.2 REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria applicable to the NRC's review of the institutional information section of the application are contained in Section 1.2.4.3 of the "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," NUREG-1520 (NRC, 2002).

1.1.3 STAFF REVIEW AND ANALYSIS

In Section 1.2.1 of the application, GNF-A provided information on corporate ownership and organization. GNF-A is headquartered in Wilmington, North Carolina. GNF-A is a wholly-owned subsidiary of Global Nuclear Fuel Holding Co. L.L.C. General Electric Company holds a majority ownership interest in GNF-A.

The principal officer of GNF-A is Lisa M. Price, Chief Executive Officer and Facility Manager, Global Nuclear Fuel, LLC. Her address is PO Box 780, Mail Code J20, Wilmington, North Carolina 28402. Ms. Price is a United States citizen.

1.1.4 EVALUATION FINDINGS

The NRC staff has determined that GNF-A provided sufficient information concerning GNF-A's identity and ownership to adequately address the requirements of 10 CFR 70.22(a). GNF-A also adequately described information related to foreign ownership, control, or influence. The staff concludes that GNF-A has met the requirements of 70.22(a)(1).

1.2 AUTHORIZED ACTIVITIES

The purpose of the NRC's review of GNF-A's facility and process description is to determine whether the application meets the requirements of 10 CFR 70.22(a)(2), (3), and (4). Sections 1.1 and 1.2 of the application contain descriptions of the site and facility and activities. A more detailed description of the facility and its processes are contained in the ISA.

1.2.1 REGULATORY REQUIREMENTS

The regulations in 10 CFR 70.22(a)(2) require the application to contain a description of the activity for which the SNM will be used, the place at which the activity is performed, and the general plan for carrying out the activity.

The regulations in 10 CFR 70.22(a)(3) require the application to contain the period of time for which the license is requested.

The regulations in 10 CFR 70.22(a)(4) require the application to contain the name, amount, and specifications (including the chemical and physical form and isotopic content) of the SNM to be used.

In addition, the regulations in 10 CFR 70.65(b)(2) require each application to include a general description of the facility, with emphasis on those areas that could affect safety, including identification of the controlled area boundaries.

1.2.2 REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria applicable to the NRC's review of the facility and process description section of the application are contained in Section 1.1.4.3 of NUREG-1520 (NRC, 2002).

1.2.3. STAFF REVIEW AND ANALYSIS

In Sections 1.1 and 1.2 of the application GNF-A provided a description of the activity for which the SNM will be used, the place at which the activity will be performed, and the general plan for carrying out the activity. The product manufacturing operations authorized by the license consist of receiving low-enriched (less than 5% U-235) uranium hexafluoride, converting the uranium hexafluoride to uranium dioxide powder, and processing the uranium dioxide through pelletizing steps, fuel rod loading and sealing, fuel assembly, storage and product shipment.

In Section 1.2.3, GNF-A provides a description of the facility processes. This description includes the major chemical and mechanical processes used in the facility. GNF-A will use SNM in the production of fuel assemblies for commercial nuclear power plants. Byproduct material would be used in instrument calibration, and contamination may be present as a consequence of the historical feed of recycled uranium at other enrichment facilities. Enriched UF₆ supplied to the facility will meet current American Society for Testing and Materials (ASTM, 2006) ASTM C787, "*Standard Specification for Uranium Hexafluoride for Enrichment*", and periodic audits of suppliers will be performed to ensure that these conditions are met.

GNF-A also performs testing of a laser enrichment process. The laser enrichment test loop phase involves laboratory quantities of material to test design parameters. The small quantities

of enriched material contained within the test loop are reblended with tails, and recycled back into the test loop, for no net enrichment. The test loop was licensed by Amendment 45 to materials license SNM-1097 on May 12, 2008 (ML081070542). The loop is configured to ensure that it is for *experimental and demonstration purposes only*, as defined in 10 CFR 70.4.

Because the technology is classified up to Secret-Restricted Data, a Standard Practice Procedures Plan (SPPP) for the protection of classified material in accordance with 10 CFR Part 95 is required. The current SPPP is SP-01, Revision 10, and has been maintained in accordance with license safeguards condition SG-4.1. In order to protect classified information, a program cyber security plan is required. The current plan has been maintained in accordance with license safeguards condition SG-4.2.

NRC staff has determined that GNF-A provided sufficient descriptions of the activity for which the SNM will be used, the place at which the activity will be performed, and the general plan for carrying out the activity for the Commission to determine that the SNM is to be used for an activity licensed by the Commission pursuant to the Atomic Energy Act (AEA), as amended, and 10 CFR 70.23(a)(1).

In Sections 1.1.1 and 1.1.2 of the application, GNF-A provided a summary description of the GNF-A site and facility. GNF-A provided additional site information in the Environmental Report and the ISA. In the ISA Summary, GNF-A described the facility site, including nearby highways, railways, military installations, and bodies of water. GNF-A described nearby public facilities, historic and cultural landmarks, and land use. GNF-A described the site meteorology, including wind, precipitation, and severe weather. GNF-A described local surface water and ground water hydrology, including water quality and water use. GNF-A described regional and local geology. GNF-A described seismology, including geologic and tectonic conditions, seismic history, and seismicity in the area.

There are three “controlled areas” at the Wilmington site. The outer most is the owner-controlled area defined by the site boundaries and the north and south entry gates consistent with the controlled area described in 10 CFR 70.61(f) and 10 CFR 20.1003. The second is the Controlled Access Area (CAA) described in license renewal application section 1.1.2 that contains all the nuclear material and the nuclear manufacturing operations consistent with the restricted area defined in 10 CFR 20.1003. The third is the airborne controlled area (airborne radioactivity area) inside the fuel manufacturing building that contains the process equipment where uranium is processed.

The NRC staff has determined that GNF-A provided sufficient information concerning the site and facility.

GNF-A requested that SNM-1097 be renewed for a period of 40 years. NRC staff have determined that this period is in accordance with Commission instruction and is acceptable. In Section 1.2.2 of the application, GNF-A specified material possession limits and constraints, including the chemical and physical form of the material and its isotopic content. The quantities of transuranic elements and fission products from residual contamination as a consequence of the historical feed of recycled uranium at other facilities are expected to have no significant radiological impact.

1.2.4 EVALUATION FINDINGS

In accordance with 10 CFR 70.22(a)(2), GNF-A has adequately described the activity for which

the SNM is possessed and used, the place at which the activities are performed, and the general plan for carrying out the activity. In accordance with 70.23(a)(1), the NRC staff has determined that the SNM will be used in activities licensed by the Commission under Section 103 of the AEA.

The staff reviewed the site description for the GNF-A facility according to Section 1.3 of NUREG-1520 (NRC, 2002). GNF-A has adequately described and summarized general information pertaining to the site location, demographics, meteorology, hydrology, geology, and seismology of the site. The NRC staff verified that the site description is consistent with the information used as the basis for the Environmental Report, Emergency Plan, and ISA Summary; and that it demonstrates compliance with the regulatory requirements in 10 CFR 70.22(a)(2), and 70.65(b)(1).

In accordance with 10 CFR 70.22(a)(3), GNF-A adequately specified the length of time for which the license renewal is requested. GNF-A requested that the license be renewed for a period of 40 years. In 2006, the NRC gave notice that the maximum license term for 10 CFR Part 70 fuel cycle licensees who are required to submit ISA summaries for approval would be increased from a 10-year term to a 40-year term, at the next license renewal (71 FR 70441, December 4, 2006). This policy change was linked to the implementation of the requirements of Subpart H of 10 CFR Part 70 and consistency with the NRC's strategic goals for safety and effectiveness. Because of this policy change, the NRC allowed GNF-A to request up to a 40-year renewal term.

In accordance with 10 CFR 70.22(a)(4), GNF-A adequately described the name, amount, and specifications (including the chemical and physical form and isotopic content) of the SNM to be used.

2.0 ORGANIZATION AND ADMINISTRATION

The purpose of the review of GNF-A's organization and administration is to assure that GNF-A management and staff are qualified by reason of training and experience to use the material for the purpose requested in accordance with 10 CFR 70.22(a)(6) and 70.23(a)(2). This review ensures that the GNF-A management policies provide reasonable assurance that the licensee plans, implements, and controls site activities in a manner that ensures the safety of workers, the public, and the environment. The review also ensures that GNF-A has identified and provided adequate qualification descriptions for key management positions.

2.1 REGULATORY REQUIREMENTS

10 CFR 70.22(a)(6) requires that an application contain the technical qualifications, including training and experience of the licensee and members of its staff to engage in the proposed activities, in accordance with the regulations.

10 CFR 70.23(a)(2) states that an application will be approved if the Commission determines that the licensee is qualified by reason of training and experience to use the material for the purpose requested, in accordance with the regulations.

10 CFR 70.62 (d) requires an applicant or licensee to establish management measures to ensure compliance with the performance requirements of 10 CFR 70.61. NRC staff's evaluation of GNF-A's management measures is described in Section 11 of this SER.

2.2 REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria applicable to the NRC's review of the organization and administration section of the application are contained in Section 2.4.3 of NUREG-1520 (NRC, 2002).

2.3 STAFF REVIEW AND ANALYSIS

In Chapter 2 of the renewal application, GNF-A provides a description of the management organization structure, responsibilities, and authorities, including organizational operating units, positions and activities within organizational operating units, position accountability and requirements, and management of organization changes.

2.4 EVALUATION FINDINGS

GNF-A described its organization and management policies for providing adequate safety management for the safe operation of the GNF-A. The staff reviewed GNF-A's organization, management position summaries and qualifications, and management controls. These organizational and administrative elements describe clear responsibilities and associated resources for the safe operation of the facility. The staff reviewed this information and concludes that GNF-A has an acceptable organization, administrative policies, and sufficient competent resources to provide for the safe operation of the GNF-A, under both normal and abnormal conditions.

3.0 INTEGRATED SAFETY ANALYSIS AND INTEGRATED SAFETY ANALYSIS SUMMARY

The purpose of this review is to ensure that GNF-A commitments for the ISA and ISA Summary meet the regulatory requirements specified in 10 CFR 70.65.

3.1 REGULATORY REQUIREMENTS

The following regulatory requirements are applicable to the ISA and ISA Summary content:

1. 10 CFR 70.62 specifies the requirement to establish and maintain a safety program, including the performance of an ISA that demonstrates compliance with the performance requirements of 10 CFR 70.61;
2. 10 CFR 70.62(c) specifies requirements for conducting an ISA, including a demonstration that credible high-consequence and intermediate-consequence events meet the safety performance requirements of 10 CFR 70.61;
3. 10 CFR 70.65(b) specifies the contents of an ISA Summary.

3.2 REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria used during the NRC's review of GNF-A's ISA Summary and license application Chapter 3 are outlined in Sections 3.4.3.1 and 3.4.3.2 of NUREG-1520 (NRC, 2002).

3.3 STAFF REVIEW AND ANALYSIS

Chapter 3.0 of the application contains commitments to maintain the ISA for the site.

In accordance with 10 CFR 70.62(c)(3)(ii) and 70.65(b), GNF-A submitted a site-wide ISA Summary in which GNF-A provided the information required by 10 CFR 70.65(b). NRC staff reviewed this ISA summary and subsequent annual updates submitted in accordance with 70.72(d)(3) and approved them in a letter dated September 19, 2008 (ML082390852). In this approval, NRC staff concluded that the ISA Summary demonstrated the facility's compliance with the performance requirements of 10 CFR 70.61.

GNF-A commits to maintain process safety information in accordance with 10 CFR 70.62(b), and to use NRC-approved methodology for the identification of hazards, potential accident sequences, consequence and likelihood determinations, IROFS identification and evaluation, and determination of overall likelihood. GNF-A commits to review all plant design changes for impact to the ISA, and to management measures to maintain the availability and reliability of IROFS.

GNF-A committed to manage plant changes in accordance with configuration management commitments in Section 11.2 of the application. 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. Plant changes which result in ISA updates are reviewed and approved prior to implementation of any change.

3.4 EVALUATION FINDINGS

Staff has determined that GNF-A's commitments to maintain the ISA Summary and to use the configuration management process to evaluate plant design changes in accordance with 10 CFR 70.72 for effects on the ISA, and meets the requirements of 10 CFR 70.62.

4.0 RADIATION PROTECTION

The purpose of this review is to determine whether the licensee's Radiation Protection (RP) program is adequate to protect the radiological health and safety of workers and to comply with the associated regulatory requirements in 10 CFR Parts 19, 20, and 70.

4.1 REGULATORY REQUIREMENTS

4.1.1 RADIATION PROTECTION PROGRAM IMPLEMENTATION

Regulations applicable to the establishment of an RP program are presented in Part 20, Subpart B, "Radiation Protection Programs."

4.1.2 AS LOW AS IS REASONABLY ACHIEVABLE PROGRAM

Regulations applicable to the ALARA program are contained in 10 CFR 20.1101, "Radiation Protection Programs."

4.1.3 ORGANIZATION AND PERSONNEL QUALIFICATIONS

The regulation applicable to the organization and qualifications of the radiological protection staff are presented in 10 CFR 70.22, "Contents of Applications."

4.1.4 WRITTEN PROCEDURES

The regulation applicable to RP procedures and Radiation Work Permits (RWPs) are presented in 10 CFR 70.22, "Contents of applications."

4.1.5 TRAINING

The following regulations apply to the radiation safety training program:

- 10 CFR 19.12 "Instructions to Workers"
- 10 CFR 20.2110 "Form of Records"

4.1.6 VENTILATION AND RESPIRATORY PROTECTION PROGRAMS

Regulations applicable to the ventilation and respiratory protection programs are presented in Part 20, Subpart H, "Respiratory Protection and Controls to Restrict Internal Exposure in Restricted Areas."

4.1.7 RADIATION SURVEY AND MONITORING PROGRAMS

The following NRC regulations in Part 20 are applicable to radiation surveys and monitoring programs:

- Subpart C “Occupational Dose Limits”
- Subpart F “Surveys and Monitoring”
- Subpart L “Records”
- Subpart M “Reports”

4.1.8 ADDITIONAL PROGRAM REQUIREMENTS

The following Part 20 regulations are applicable to the additional program requirements:

- Subpart L “Records”
- Subpart M “Reports”
- Section 70.61 “Performance Requirements”
- Section 70.74 “Additional Reporting Requirements”

4.2 REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria for NRC’s review of the RP program are outlined in Sections 4.4.1.3; 4.4.2.3; 4.4.3.3; 4.4.4.3; 4.4.5.3; 4.4.6.3; 4.4.7.3; and 4.4.8.3 of NUREG-1520 (NRC, 2002).

4.3 STAFF REVIEW AND ANALYSIS

4.3.1 RADIATION PROTECTION PROGRAM IMPLEMENTATION

The GNF-A Facility Manager is responsible for the safety and all activities at the site. Chapter 2 of the GNF-A application provides an overview of the facilities Environmental Health and Safety (EHS) structure which includes the RP Function organization (RP Function). Both EHS and RP Function are administratively independent of production responsibilities but have authority to shutdown any process or facility deemed unsafe. The manager of the RP Function reports to the EHS manager who in turn reports directly to the Plant Manager.

The RP Function is responsible to establish a RP program, monitor and track exposure, provide input to training, conduct contamination control surveys, support ISA analyses, advise Area Managers on radiation safety, support emergency response planning, oversee the respiratory protection program and audit and assess the RP program. The licensee ensures that the RP program remains independent of the facility’s routine operations, maintains its objectivity, and focuses on implementing sound RP principles.

The RP Function maintains oversight of the facility's operations involving radioactive materials. It conducts quarterly audits and monthly safety committee meetings to assess the content and implementation of the radiation protection program, in accordance with 10 CFR 20.1101(c). In addition, the RP Function reviews information on atmospheric releases to ensure compliance with 10 CFR 20.1101(d).

The staff has reviewed the RP program implementation for compliance with the requirements in 10 CFR 20, Subpart B, "Radiation Protection Programs." The application demonstrates compliance with each of the acceptance criteria listed in NUREG 1520 (NRC, 2002), Section 4.4.1. These requirements include an outline of the RP structure and key personnel responsibilities, sufficient organizational support of the RP Function, independence of the RP Function, and scheduled audits of the RP program. The staff has reviewed the licensee's proposed implementation of the RP program and finds that it is sufficient to meet the requirements of the NRC regulations and is, therefore, acceptable.

4.3.2 ALARA PROGRAM

GNF-A's RP staff has a commitment to establish an effective radiation protection program which includes commitments to maintain employee exposures As Low as Reasonably Achievable ALARA. The ALARA program is implemented using written policies and procedures, to ensure that occupational radiation exposures are consistent with the requirements of 10 CFR 20.1101. Goals of the ALARA program are implemented through timely exposure monitoring, interaction of the RP staff with manufacturing personnel, and annual ALARA program assessments with senior management, as described in GNF-A application, section 2.4 (2007).

Area Managers are responsible for ensuring implementation of the ALARA program via proper use of procedures, equipment, and process designs. ALARA is incorporated into the recurring training program and is inherent in the Environmental Program. Monitoring and trending of exposure to the public and environment are conducted and presented annually to senior management to ensure doses remain ALARA.

The licensee's commitment to ALARA is demonstrated by their implementation of two separate safety committees which review plant operations for areas to reduce dose and improve safety. The functions of an ALARA Committee are conducted by the Wilmington Safety Review Committee. This committee meets three times a year and conducts an annual review of the RP program. The review examines exposure trends, effectiveness of equipment, and major changes in plant activities which may affect safety practices. The Safety Review Committee is augmented by a separate Radiation Safety Committee which meets monthly. The Radiation Safety Committee consists of managers from key manufacturing functions with activities affecting radiation safety. They monitor the status of projects, performance trends, and the radiation safety conditions of operations. A written report of each Radiation Safety Committee meeting is forwarded to cognizant Area Managers and the manager of the EHS function.

The staff has reviewed the ALARA program for compliance with the requirements in 10 CFR 20, Subpart B, "Radiation Protection Programs." The application demonstrates compliance with each of the acceptance criteria listed in the NUREG 1520 (NRC, 2002), Section 4.4.2. These ALARA requirements include a comprehensive program, policy and procedures, program goals, an ALARA Committee, a RP organization, and an audit program. The staff finds the implementation of an ALARA Program is sufficient to meet the requirements of the NRC regulations and is, therefore, acceptable.

4.3.3 ORGANIZATION AND PERSONNEL QUALIFICATIONS

The RP Function is overseen by the EHS manager. The RP Function staff interacts with Area Managers on matters of radiation safety. The RP Function manager has authority to shutdown potentially unsafe operations and has access to the Plant Manager through the EHS manager regarding all matters involving RP.

The licensee procedures require that they employ only suitably trained RP personnel at the facility. The RP Function consists of three primary groups: managers, the professional staff, and the technicians. The RP Function managers must hold a BS or BA degree in science or engineering and have two years of experience with oversight for radiation safety. Minimum qualifications for a senior member of the RP Function are a BS or BA degree in science or engineering with at least two years of nuclear industry experience in the assigned function or a professional certification in health physics. Radiation safety technicians must have a demonstrated understanding of radiation safety principles and concepts.

Training and qualification requirements must be completed prior to personnel assuming the full duties of safety-significant positions, and prior to working independently. Information for personnel requirements for the most relevant positions in the plant are contained in 2.2.1.6 of the GNF-A application.

The staff has reviewed the organization and minimum technical qualifications for compliance with the requirements in 10 CFR 70.22(a)6, "Contents of application" and 70.23(a)2, "Requirements for approval of application." The application demonstrates compliance with each of the acceptance criteria listed in NUREG-1520 (NRC, 2002), section 4.4.3. These requirements include suitably trained RP personnel, clear organizational relationships, qualified RP managers with access to upper management, defined responsibilities for the RP Function, and minimum training requirements. The staff finds the organization and personal qualification of the RP Function staff sufficient to meet the requirements of the NRC regulations and is, therefore, acceptable.

4.3.4 WRITTEN PROCEDURES

The licensee has implemented written procedures which incorporate ALARA principles throughout facility operations and specific RP procedures for operations which involve licensed materials. The RP Function is responsible for establishing and maintaining RP procedures. Area Managers are responsible to assure preparation of written, approved, and issued operating procedures which incorporate requirements established by the RP Function. Major modification to facility operations are also evaluated and receive recommendations from the Safety Review Committee. Area Managers also ensure their staff is aware of and trained on the appropriate procedures. As listed in section 11.5.1 of the application, operating procedures are reviewed and approved by the appropriate EHS Function manager, including the RP Function.

Written procedures are also implemented for non-routine actions under RWP. These RWPs are issued by supervisors with oversight from the RP Function when special radiation control requirements are necessary. The RWPs specify the necessary safety controls including clothing, reparatory protection, air sampling, and any other precautionary measures required. They are made available to each affected individual and a copy is maintained by the RP Function. They have specified expiration dates which are reviewed on a weekly basis.

The staff has reviewed the written procedures for compliance with 10 CFR 70.22(a)8, "Contents of Application" and 70.23(a)4, "Requirements for approval of application." The application demonstrates compliance with each of the acceptance criteria listed in NUREG-1520 (NRC, 2002), section 4.4.4. These requirements include radiation protection procedures which are written, reviewed, approved, distributed, and incorporate radiation work permits for non-routine circumstances. The staff finds the licensee's commitment to use written procedures sufficient to meet the requirements of the NRC regulations and is, therefore, acceptable.

4.3.5 TRAINING

The licensee's training program addresses requirements for employees to receive ongoing safety instruction and provide visitors with necessary safety procedures. Training requirements are established in accordance with administrative procedures in order to ensure they are reliable and consistent. Training is provided for each individual commensurate with their assigned duties and their radiation safety responsibilities. Nuclear Safety Training is required for operations staff, radiation protection technicians, contractor personnel, and visitors who receive unescorted access. The licensee has incorporated the provisions of 10 CFR 19.12 into the training program, as outlined in Section 11.4 of the application. The licensee includes basic information on radioactive materials, risks from low level radiation exposure in accordance with 10 CFR 19.12, radiation protection including ALARA principles, and nuclear criticality safety principles. Additional emphasis is placed on safety requirements in areas where human actions are important to safety.

Training program contents are reviewed as part of the management control program at least every two years by the manager of the criticality safety and radiation safety functions to ensure the contents are current and adequate. The effectiveness of the training is evaluated by an examination. Retraining is performed for personnel who require unescorted access to airborne radioactivity controlled area, at least every two years. Area Managers are responsible for ensuring effective and adequate training of personnel.

In addition to Nuclear Safety Training, the licensee conducts General Employee Training, Technical Training, Developmental Training, and On the Job Training. These programs all have the goal to train personnel for safe, reliable, and efficient operation of the facility. Records are maintained on each employee's qualifications, experience, training, and retraining.

The staff has reviewed the training program for compliance with 10 CFR 19.12, "Instructions to workers" and 20.2110, "Form of records." The application demonstrates compliance with each of the acceptance criteria listed in the NUREG-1520 (NRC, 2002), section 4.4.5. These requirements include implementation of training for employees and visitors commensurate with their potential exposure, ALARA principles, refresher training on a routine basis, and appropriate training material. The staff finds the licensee's training program sufficient to meet the requirements of the NRC regulations and is, therefore, acceptable.

4.3.6 VENTILATION AND RESPIRATORY PROTECTION PROGRAMS

The ventilation system has been designed to ensure airborne contamination is minimized. This includes the design to provide air flow from areas of lesser potential contamination to areas of higher potential contamination. The air flow rate is maintained in accordance with Table 4.1 of the application, and is checked monthly. Process areas with airborne concentrations greater than 10 derived air concentration (DAC) are shut down. This ensures individuals working an 8

hour shift would receive less than 80 DAC hours, equivalent to 4% of the occupational dose limit. This contributes to keeping internal doses ALARA.

To maintain low airborne concentrations, potentially contaminated air is exhausted through High-Efficiency Particulate Air (HEPA) filters which are at least 99.97% efficient for removal of 0.3 micron particles. Where necessary to prevent excessive wear on the filters, water scrubbers are provided to treat effluents in order to maintain filter effectiveness. Filters which exceed the manufacturer's ratings are removed from service. Room air in the uranium processing areas likely to exceed 0.1 DAC is filtered by HEPA filters and/or water scrubbers and may be recirculated.

Protection from airborne contamination is further reduced through the use of enclosures and localized ventilation such as filtered enclosures, hoods, and dust capturing exhaust ports. Air flow through hood openings is maintained at greater than 80 linear feet per minute to ensure sufficient air flow to prevent the escape of contamination. Additionally, differential pressure indicators are installed across exhaust system filters to ensure the pressure does not exceed four inches of water. These pressure indicators are monitored monthly. Periodic monitoring of the pressure across the filters prevents reduced effectiveness or failure through buildup of material.

Respirators are used when appropriate to reduce individual airborne exposure in accordance with 10 CFR Part 20, Subpart H. The program receives oversight from the RP Function which is responsible to maintain written procedures for the selection, fitting, issuance, maintenance, testing, training of personnel, monitoring, and record-keeping for individual respiratory protection equipment, in accordance with 10 CFR 20.1703(c)(4). Internal procedures provide the criteria for when the equipment must be used. The RP Function is responsible to review and update respiratory protection procedures, as necessary, whenever changes are made to the facility, process, or equipment. Oversight of the respiratory protection program by the RP Function is appropriate since they are aware of levels of airborne contamination throughout the facility. The respiratory protection requirements are incorporated into RWPs.

Employees are required to pass a medical exam and an annual fit test before being permitted to wear a respirator. Once approved, the employee is fit tested to achieve a minimum fit factor for both negative and positive pressure respirators. These minimum fit factors are consistent with fit factors listed in 10 CFR Part 20, Appendix A and Regulatory Guide 8.15, "Acceptable Programs for Respiratory Protection." Employees also receive respiratory training from a qualified instructor. Only equipment approved by the National Institute for Occupational Safety and Health (NIOSH) is utilized for respiratory protection.

The staff has reviewed the ventilation and respiratory protection program for compliance with 10 CFR Part 20 Subpart H, "Respiratory Protection and Controls to Restrict Internal Exposures in Restricted Areas." The application demonstrates compliance with each of the acceptance criteria listed in the NUREG-1520 (NRC, 2002), section 4.4.6. These requirements include appropriate ventilation systems, maintenance, flow velocity, respiratory protection program, written procedures for respiratory use, and records. The staff finds the licensee's ventilation and respiratory protection program sufficient to meet the requirements of the NRC regulations and is, therefore, acceptable.

4.3.7 RADIATION SURVEY AND MONITORING PROGRAM

Control of Surface Contamination Area access controls and personal protective equipment have been implemented to minimize contamination. GNF-A has identified controlled and non-controlled areas which are posted with instructions for survey and decontamination methods. Access points to the controlled areas have change rooms, step-off areas, and survey equipment provided. In the controlled areas, protective clothing must be worn as specified in procedures developed by the RP Function. The minimum clothing required for workers in controlled areas is shoe covers, coveralls, rubber gloves, and safety glasses.

Removable contamination surveys are conducted on a routine basis by the RP Function to ensure areas remains below safe radiation activity limits. A minimum contamination survey frequency has been established with predefined action limits for: Controlled Areas (Weekly \geq 5,000 dpm); Eating Areas (Weekly \geq 220 dpm), and Non-controlled Areas Monthly (Weekly \geq 220 dpm). Personal contamination surveys are conducted at access points to controlled areas. If contamination above background levels is identified, individuals are trained to attempt self-decontamination and then contact RP Function for assistance.

Personal dosimeters are used to monitor the deep-dose equivalent and shallow-dose equivalent from external sources of radiation. The dosimeters are processed by a National Voluntary Laboratory Accreditation Program (NVLAP) accredited vendors. Individuals who are required to wear dosimetry are determined by the RP Function based on the individual's work area, occupancy time, or other exposure information.

The primary method of determining Committed Effective Dose Equivalent (CEDE) is by measuring the concentration of radioactive material in the work area air. These calculated doses are augmented by bioassay and in-vitro lung scans. Air samples are continuously taken from each process area. The RP Function uses these air samples to determine the concentrations of uranium breathed by workers in accordance with Regulatory Guide 8.25 (NRC, 1992) and evaluates the effectiveness of personnel exposure controls. Air sampling results indicating greater than 2.5 DAC in a routine 8 hr sample are investigated. Operations and equipment are shut down, and immediate corrective action taken, at locations where an air sample exceeds 10 DAC without a specific known cause. Corrective actions are documented and implemented in proportion to the magnitude of the event. These limits on airborne exposure and corrective actions support the licensee's goals of keeping doses ALARA.

Bioassay monitoring with predefined action levels are implemented to ensure assigned doses based on air sampling are accurate. Individuals who work in areas with the potential for soluble airborne uranium intakes undergo biweekly urinalysis. Annual in-vivo lung counting measurements are established for individuals who have an assigned intake greater than 10 percent of the Annual Limit on Intake (ALI) based on air sampling measurements. Additional analysis is conducted on individuals involved in non-routine operations, perturbations or incidents, as specified by the RP Function.

Internal and external exposures are summed in accordance with the requirements of 10 CFR 20.1202. In addition, the licensee has established an administrative limit more restrictive than the regulatory requirements to ensure the annual occupational dose limits are not exceeded. Individuals who exceed the annual administrative exposure limit of 80% of the occupational dose limit are restricted from work activity involving radioactivity.

Sealed sources are stored in closed containers designed for plutonium. Leak tests are conducted which are capable of detecting the presence of 0.005-microcuries, or more, of alpha contamination on a smear test sample. Records of leak test results are maintained for review by the NRC staff. Damaged or broken sources are immediately withdrawn from use, and sent of to be decontaminated and repaired. The management of sealed sources by the RP Function is appropriate for identifying, recording and removing damaged sources from use.

The staff has reviewed the radiation surveys and monitoring programs for compliance with 10 CFR Part 20 Subpart F, "Surveys and Monitoring," and Subpart C, "Occupational Dose Limits." The application demonstrates compliance with each of the acceptance criteria listed in NUREG-1520 (NRC, 2002), section 4.4.7. These requirements include a program based on written procedures, personnel monitoring program, summation of external and internal doses, air sampling, contamination control, a corrective action program, calibrated survey equipment, source leak testing, an access control program, and reporting. The staff finds the licensee's radiation surveys and monitoring programs sufficient to meet the requirements of the NRC regulations and is, therefore, acceptable.

4.3.8 ADDITIONAL PROGRAM REQUIREMENTS

The licensee has established a program to maintain records of the RP program, radiation survey results, and the results of corrective action program referrals, RWPs, and planned special exposures. The licensee identifies, preserves, controls and destroys records in accordance with the guidelines, procedure, and practices set forth by GNF-A Section 11.8 (2007) in accordance with the regulations.

The licensee maintains an incident investigation program governed by written procedures to record, track, and investigate unusual events. The regulatory reporting requirements are evaluated for each event as part of this program. This program identifies occupational exposure to radiation exceeding the dose limits in Part 20, and results in reports to the NRC within the time specified in 10 CFR 20.2202 and 10 CFR 70.74. The licensee will refer to the facility's corrective action program, any unusual events and potential non-compliances that exceed or have the potential to exceed the dose limits in Part 20, Appendix B, or is required to be reported pursuant to 10 CFR 70.74.

The staff has reviewed the licensee's for compliance with 10 CFR Part 20 Subpart L, "Records," Subpart M, "Reports," 10 CFR 70.61, "Performance Requirements," and 10 CFR 70.74, "Additional Reporting Requirements." The application demonstrates compliance with each of the acceptance criteria listed in the NUREG-1520 (NRC, 2002), section 4.4.8. These requirements include a program to maintain RP records, evaluate and report significant events, and implement corrective actions. The staff finds the licensee's additional program commitments regarding records and reports sufficient to meet the requirements of the NRC regulations and is, therefore, acceptable.

4.4 EVALUATION FINDINGS

The licensee has established and will maintain an acceptable RP program that includes:

1. An effective documented program to ensure that occupational radiological exposures are ALARA;

2. An organization with adequate qualification requirements for the RP personnel;
3. Approved written RP procedures and RWPs for RP activities;
4. RP training for all personnel who have access to restricted areas;
5. A program to control airborne concentrations of radioactive material with engineering controls and respiratory protection;
6. A radiation survey and monitoring program that includes requirements for controlling radiological contamination within the facility and monitoring of external and internal radiation exposures; and
7. Other programs to maintain records, report to the NRC in accordance with Parts 20 and 70, and correct for upsets at the facility.

The licensee's RP program meets the requirements of Parts 19, 20, and 70 and is therefore acceptable.

5.0 NUCLEAR CRITICALITY SAFETY

5.1 NUCLEAR CRITICALITY SAFETY

The purpose of this review is to determine whether the applicant's NCS program is adequate to support safe operation of the facility, as required by 10 CFR Part 70. The information and commitments that are significant to this determination are described in Section 5.3. of NUREG-1520 (NRC, 2002).

The NCS programmatic review determines whether: (1) the applicant provided for the appropriate management of the NCS program; (2) the applicant identified, and committed to, the responsibilities and authorities of individuals for developing and implementing the NCS program; (3) the facility management measures described in 10 CFR 70.62 have been committed to and will support implementing and maintaining the NCS program; and (4) an adequate NCS program is described, which includes identifying and committing to the NCS methods, and NCS technical practices used to ensure the safe operation of the facility, as required by 10 CFR Part 70.

5.2 REGULATORY REQUIREMENTS

The review of GNF-A's NCS program should verify that the information the applicant provided meets the requirements of 10 CFR 70.22 and 70.65, which, respectively, specify the general and additional content of an application. In addition, the NCS review verifies compliance with the regulatory requirements in 10 CFR 70.24; 70.52; 70.61; 70.62; 70.64; 70.65; 70.72; and Appendix A to 10 CFR Part 70.

5.3 REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria for the NRC's review of the applicant's NCS program are outlined in Section 5.4 of NUREG-1502 (NRC, 2002). This includes the commitment to use NRC NCS Regulatory Guide 3.71, Revision 1, which endorsed the use of the American National Standards Institute/American Nuclear Society (ANSI/ANS) Series-8 NCS standards with certain modifications.

5.4 STAFF REVIEW AND ANALYSIS

5.4.1 ORGANIZATION AND ADMINISTRATION

The EHS function at GNF-A is independent of production responsibilities. The manager of the NCS function reports to the EHS manager. The NCS function has the authority to shutdown potentially unsafe operations, and must approve restart of any operation it has requested to be shutdown.

The minimum qualifications for an NCS function manager is a bachelor's degree in science or engineering, four years of experiences in assignments involving regulatory activities, and experience in the understanding, application, and direction of NCS programs.

The minimum qualifications for an NCS engineer are a bachelor's degree in science or engineering and experience in the assigned safety function. A senior NCS engineer must have at least three years experience in NCS. All NCS engineers have the authority and responsibility to conduct activities assigned to the NCS function, except for the independent technical reviews of NCS analyses which must be performed by a senior engineer.

The staff has reviewed GNF-A's organizational structure and finds that it is acceptable because the NCS function is independent from the production staff, NCS evaluations are performed by qualified reviewers, with independent review to ensure quality assurance, and GNF-A's administrative practices are consistent with the requirements in ANSI/ANS-8.19-2005, "Administrative Practices for Nuclear Criticality Safety." Additionally, the staff finds that the licensee has adequately addressed the acceptance criteria in NUREG-1520 (NRC, 2002), Section 5.4.3.2.

5.4.2 MANAGEMENT OF THE NCS PROGRAM

The NCS function at GNF-A is responsible for:

- Providing NCS support for nuclear operations
- Assessing normal and credible abnormal conditions
- Determining NCS limits for controlled parameters
- Performing neutronics calculations
- Writing criticality safety analyses
- Approving proposed changes in fissile material operations
- Specifying NCS control requirements and functionality
- Providing advice to Area Managers on NCS control measures, including review and approval of operating procedures
- Supporting emergency response planning and events
- Assessing the effectiveness of the NCS program through audits

The NCS manager is responsible for implementing the NCS program. GNF-A commits to a set of objectives for its NCS program which are consistent with the objectives listed in the SRP. These objectives include preventing an inadvertent criticality, meeting the NRC regulatory requirements relevant to NCS, performing NCS evaluations, and establishing NCS limits, controls, and IROFS.

The staff has reviewed the licensee's management of the NCS program and finds that it is acceptable because the licensee has developed, implemented, and commits to maintain an NCS program to meet the regulatory requirements of 10 CFR Part 70. Additionally, the staff finds that the licensee has adequately addressed the acceptance criteria in NUREG-1520 (NRC, 2002), Section 5.4.3.1.

5.4.3 NCS MANAGEMENT MEASURES

Employees at GNF-A must complete nuclear safety training, which includes NCS, to have unescorted access in the airborne radioactivity controlled area. Visitors to the airborne radioactive controlled area must receive nuclear safety training or must be escorted by a trained employee. Employees are retrained at least every two years. Other training is provided to employees based upon assigned duties, and may include General Employee Training, technical training, on-the-job training, and development training. A formalized NCS engineer training and qualification program will be developed and maintained by senior NCS staff.

GNF-A commits to conduct activities involving licensed material in accordance with properly issued and approved written procedures. Area managers must ensure that NCS requirements for workers are included in the appropriate procedures used for uranium operations, maintenance, and testing. New or changed operating and maintenance procedures require NCS review and approval as part of the configuration management program. When personnel encounter a condition not covered by procedure, they are trained to safely stop the operation and inform the NCS function. The operation cannot continue until NCS staff has evaluated the situation and provided recovery instructions.

GNF-A commits to have NCS staff perform quarterly audits of all fuel manufacturing and support areas. The purpose of these audits is to determine that operations conform to NCS requirements. NCS audits are conducted in accordance with approved procedures. Audit results are communicated in writing to the relevant area manager and to the manager of the EHS function. Necessary corrective actions are documented and approved by the area manager, and tracked to completion by the EHS function.

The radiation safety function is responsible for performing weekly inspections of fuel manufacturing and support areas, which includes verifying conformance to NCS requirements.

GNF-A will perform an independent audit of its NCS program every three years. This audit will be conducted by a team of appropriately trained and experienced individuals who are not normally involved with the NCS program. The scope of this audit includes compliance to procedures, conformance to regulations, and overall adequacy. Audit results, as appropriate, are reported in writing to the facility manager, area managers, and the manager of the NCS function. Corrective actions resulting from the audit are reported and tracked to completion by the facility manager.

GNF-A commits to maintain a configuration management program to ensure plant design changes do not adversely impact safety. A senior engineer in the NCS function will determine if changes which establish or change existing NCS parameters require NCS analysis. If an analysis is required, the change will not be placed into operation until the NCS analysis is complete.

The staff has reviewed the licensee commitments for NCS management measures and finds that they are acceptable because the licensee commits to provide training to personnel, conduct activities involving SNM using written and approved procedures, conduct NCS walkdowns, and perform NCS audits covering all aspects of the program on a regular schedule. GNF-A also commits to the double contingency principle as it relates to procedures. The staff finds that the licensee has adequately addressed the acceptance criteria in NUREG-1520 (NRC, 2002), Section 5.4.3.3.

5.4.4 NCS METHODOLOGIES AND TECHNICAL PRACTICES

GNF-A states that it achieves nuclear criticality safety by controlling one or more parameters of a system within established subcritical limits. The nuclear criticality safety bases for each system is established and documented in a criticality safety analysis (CSA). CSAs must contain sufficient detail and clarity to allow independent assessment of the results. CSAs are a controlled element of the ISA, and NCS controls designated as IROFS are identified in the CSAs. All assumptions relevant to NCS are justified, documented, and independently reviewed. A senior NCS engineer performs an independent technical review of each CSA to verify the adequacy of the analysis and proposed NCS controls.

5.4.5 NCS METHODOLOGIES

The CSAs specify the limits and controls necessary to ensure that all processes remain subcritical under normal and credible abnormal conditions. Limits on controlled parameters are established assuming optimum credible condition. This means that uncontrolled parameters are assumed to be in the worst-case condition, and that each controlled parameter is evaluated using credible accident conditions.

Methods currently used at GNF-A to demonstrate subcriticality of processes include hand calculations utilizing published experimental data, solid angle calculations, and Monte Carlo computer codes. When computer codes are used, the NCS analysis must demonstrate that the effective neutron multiplication factor (k_{eff}) for the system will not exceed the established upper subcritical limit (USL) for credible process upsets. The USL conservatively accounts for the bias, bias uncertainty, and a minimum margin of subcriticality (MMS), which are determined in the code validation process.

The licensee will also analyze the sensitivity of k_{eff} to key parameters by performing a set of parametric calculations in each CSA. The impact of varying these parameters is quantified and documented. This information helps in selecting adequate NCS controls for a system.

Computer code validation, including documentation, is consistent with the requirements of Section 4.3 of ANSI/ANS-8.1-1998. It considers parameters such as neutron energy spectra, degree of moderation, and geometric configuration of materials. The code validation process establishes the bias, bias uncertainty and MMS using well-characterized and adequately documented critical experiments. If a statistically significant trend exists between a selected parameter and the critical experiments, then the bias will be determined by regression analysis, otherwise the bias is constant. GNF-A will not use a positive bias. The bias uncertainty is estimated using a confidence interval of uniform width such that there is at least a 95 percent confidence that the calculated k_{eff} for a critical system will lie above the lower confidence limit.

Critical experiments used for validation are assessed for completeness and applicability to GNF-A processes, and come from multiple sources to minimize systematic errors. Experiments are selected to cover the range of parameters relevant to the normal and credible abnormal conditions for the modeled systems. The parameter range of selected critical experiments defines the area of applicability (AOA) for the code. The AOA may be extrapolated beyond the experimental parameter range using trends in the bias. The license application describes the general criteria to ensure that this extrapolation is done in a conservative manner.

GNF-A will apply a MMS of at least 0.03 for all criticality calculations, which has been its historical safety basis margin. This is justified by the use of critical experiments which closely match the applications at GNF-A, conservative methods to derive the bias and bias uncertainty, and a consistent conservative set of modeling assumptions defined by internal procedures.

NRC staff also reviewed portions of the validation reports for the proprietary computer codes (GEMER, GEKENO, and MCNP-05P) used by GNF-A for NCS analysis. These reports describe, in detail, the establishment of a USL for several AOA. The staff found that the AOA included the parameters relevant to current operations at GNF-A. Each report lists the benchmark experiments used in the validation and provides a code template for each set of experiments. Multiple statistical methods for determining the bias and bias uncertainty were described in the reports, including information about when each method may be used (e.g., when a trend in the data exists). These methods were identical or similar to those found in NRC guidance. The staff finds that code validation has been conducted in a manner consistent with

NRC expectations and licensee commitments.

GNF-A also verifies that each individual work station produces results equivalent to a development workstation prior to use of software for NCS calculations. The verification results for each workstation are documented. Verification consists of performing a small set of cases designed to test the various features in the code. Software changes are made in accordance with the configuration management program described in Chapter 11 of the license application. If a deviation is found during verification, the licensee will determine if a new validation needs to be performed.

5.4.6 NCS TECHNICAL PRACTICES

The licensee commits to the double contingency principle, requiring process designs to incorporate sufficient factors of safety such that at least two unlikely, independent, and concurrent changes in process conditions are required before a criticality accident is possible. Thus, for each process where a criticality accident is credible, at least two independent controls will be provided to defend one or more system parameters. The CSA will determine and identify all controlled parameters needed to ensure double contingency is met.

The four means of control, in order of preference, are passive engineered control, fail-safe active engineered control, augmented administrative control, and simple administrative control. An NCS control must be capable of preventing a criticality accident independent of the operation or failure of any other NCS control for credible initiating events. The relative effectiveness and reliability of controls are considered during the CSA process. The parameters which GNF-A may control for NCS are: (1) geometry; (2) mass; (3) moderation; (4) concentration or density; (5) neutron absorbers; (6) spacing; (7) material composition or heterogeneity; (8) reflection; (9) enrichment; and (10) process characteristics. Some of the requirements for specific controlled parameters are discussed in detail below; all requirements on the use of controlled parameters are specified in the license application.

Geometry: The application defines a safe geometry as 93% of the minimum critical cylinder diameter, 88% of the minimum critical slab thickness, or 76% of the minimum critical sphere volume. These limits are slightly larger than those identified in the SRP, however, they were previously approved for use at GNF-A so new justification is not needed.

Mass: The application defines a safe batch as 45% of the minimum critical mass when double batching is credible and 75% of the minimum critical mass when engineered controls prevent over batching.

Moderation: When moderation control is the primary means of preventing a criticality, a graded approach to the design control philosophy is used. At least two active engineered controls and one other control are required to prevent moderation of SNM for processes where moderator is intentionally and continuously added (e.g., superheated steam into a reactor). Processes where moderator is not continuously added, or not used at all, require a less stringent set of controls depending upon the safety margin. At a minimum, two independent controls prevent moderation of material in the system.

Concentration/Density: The application defines a safe concentration as less than or equal to one-half the minimum critical concentration or a hydrogen to ^{235}U ratio greater than 5200. When concentration controls are used, precautions are taken to protect against the accidental addition of a precipitating agent.

Neutron Absorbers: Neutron absorbers may be credited when they are part of a geometry control (fixed neutron absorber) or are in finished nuclear fuel bundles. The use of fixed neutron absorbers requires the composition of the absorber to be measured and documented prior to use and periodic verification of its integrity thereafter. Credit for neutron absorbers in fuel bundles requires that the presence of the absorber in completed fuel rods be verified by non-destructive testing and that rod placement in completed fuel bundles is documented in accordance with established quality control practices. Although GNF-A does not commit to ANSI/ANS-8.21, "Use of Fixed Neutron Absorbers in Nuclear Facilities Outside Reactors," its license commitments and administrative practices provide an equivalent level of safety.

Reflection: Most systems are analyzed at optimum reflection (e.g., 12-inches of water) for NCS purposes. In cases where less than optimal reflection is assumed, the analysis will account for all potential reflectors present under normal and credible abnormal conditions.

Enrichment: If enrichment control is not used, the maximum process enrichment of 5 wt% ²³⁵U is used in the analysis.

All processes are examined in the as-built condition to validate the safety design and to verify the installation.

The staff has reviewed the NCS technical practices and finds that they are acceptable because the licensee commits to the double contingency principle and defines the acceptability of controlled parameters used to define the criticality safety basis. Additionally, the staff finds that the licensee has adequately addressed the acceptance criteria in NUREG-1520 (NRC, 2002), Section 5.4.3.4.2.

5.4.7 CRITICALITY ACCIDENT ALARM SYSTEM

The licensee commits to maintain a criticality accident alarm system (CAAS) that meets the requirements of 10 CFR 70.24(a)(1) and ANSI/ANS-8.3-1997. The licensee also maintains internal records that demonstrate these requirements are met. The alarm is clearly audible in areas that must be evacuated. The CAAS is uniform throughout the facility and is supplied with emergency power. The CAAS is designed to remain operable during credible events such as those described in the ISA. If CAAS coverage is lost or credible event conditions exist where personnel remain in the building (e.g., severe weather), compensatory measures are initiated as part of the plant's emergency response plan. These compensatory measures may include halting the movement of SNM, limiting access to the area, or the use of temporary detection equipment. When CAAS coverage is lost, the affected operations are promptly rendered safe.

GNF-A requests to continue its exemption from the 10 CFR 70.24 CAAS requirements in areas where it has demonstrated that a criticality accident is not credible and there is not more than:

- A safe batch of finished reactor fuel rods; or
- The quantity of uranium authorized for delivery to a carrier when fully packaged for transport according to a valid NRC authorization for such packages without limit on the number of such packages, provided storage location preclude mechanical damage and flooding.

The staff finds that this exemption remains acceptable since it will not endanger life or property or the common defense and security.

The staff has reviewed the licensee's commitment to the CAAS requirements in 10 CFR 70.24 and finds that it is acceptable because the licensee maintains a CAAS that is capable of energizing a clearly audible alarm signal if accidental criticality occurs, and the licensee maintains emergency procedures for each area in which SNM is handled, used, or stored to ensure prompt personnel evacuation upon the sounding of the alarm. Additionally, the staff finds that the licensee has adequately addressed the acceptance criteria in NUREG-1520 (NRC, 2002), Section 5.4.3.4.3.

5.4.8 INTEGRATED SAFETY ANALYSIS

The SRP states that the NCS reviewer should determine that the applicant meets the acceptance requirements (SRP Section 3.4) for its ISA and ISA Summary as they pertain to NCS. On September 19, 2008, the NRC staff issued a letter approving GNF-A's ISA methodology and summary. GNF-A includes the approved ISA methodology in Chapter 3 of the license application. The NCS reviewer found that this is sufficient and that no further review was necessary.

5.5 EVALUATION FINDINGS

The staff reviewed the NCS program for GNF-A and has reasonable assurance that:

- (1) The licensee has a staff of managers, supervisors, engineers, process operators, and other support personnel who are qualified to develop, implement, and maintain the NCS program in accordance with the facility organization and administration, and management measures.
- (2) The licensee's conduct of operations is based on NCS methodologies and technical practices, which will ensure that the fissile material will be possessed, stored, and used safely according to the requirements in 10 CFR Part 70.
- (3) The licensee has developed, implemented, and will maintain a CAAS in accordance with the requirements in 10 CFR 70.24 and the facility emergency management program.
- (4) An exemption to the CAAS requirements in 10 CFR 70.24 for the quantities and forms of SNM specified in the license will not endanger public health or safety or the common defense and security.
- (5) The licensee has an NCS program which is in accordance with the subcriticality of operations and margin of subcriticality for safety requirements in 10 CFR 70.61(d) and baseline design criteria requirements in 10 CFR 70.64(a).

Based on the review, the NRC staff concludes that the GNF-A NCS program meets the requirements of 10 CFR Part 70 and provides reasonable assurance for the protection of public health and safety, including workers and the environment.

6.0 CHEMICAL PROCESS SAFETY

The primary purpose of the chemical process safety review is to determine that the licensee has designed a facility that will adequately protect workers, the public, and the environment against chemical hazards of licensed material and hazardous chemicals produced from licensed material. The licensee must also protect against facility conditions or operator actions that can affect the safety of licensed materials and thus present an increased radiological risk.

6.1 REGULATORY REQUIREMENTS

The regulatory basis for this review is found in 10 CFR 70.22 and 70.65. These sections describe the general and additional contents of the application that address chemical process safety. In addition, the chemical process safety review should provide reasonable assurance of compliance with 10 CFR 70.61, 70.62, and 70.64.

6.2 REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria for the NRC's review of chemical process safety are outlined in Section 6.4.3 of NUREG-1520 (NRC, 2002).

6.3 STAFF REVIEW AND ANALYSIS

The NRC's objective is to ensure safe operations involving licensed radioactive material and hazardous chemicals produced from licensed material, as defined in 10 CFR 70.4. The NRC recognizes that hazardous chemicals are also regulated by other Federal and State agencies. At the Federal level, the Occupational Safety and Health Administration (OSHA) has issued 29 CFR 1910.119, "Process Safety Management of Highly Hazardous Chemicals (PSM) Standard," and the Environmental Protection Agency (EPA) has published 40 CFR Part 68, "Risk Management Plan."

The NRC staff reviewed the application and the ISA Summary.

(a) Chemical Safety Program

10 CFR 70.62(a) requires a licensee to establish a safety program that will adequately protect the worker, public health and safety, and the environment from the chemical hazards of licensed material.

(b) Chemical Process Safety Information

10 CFR 70.62(b) requires a licensee to maintain process safety information to enable the performance and maintenance of an ISA.

(c) Team Conducting the Hazard Evaluation

10 CFR 70.62(c)(2) requires that an ISA be performed by a team with expertise in engineering and process operations. The ISA is performed by a team consisting of personnel with expertise in the safety disciplines being evaluated. The team members are familiar with the process,

engineering, and operations involved. The team is supported by a member knowledgeable in the process hazard analysis technique being used.

(d) Chemical Accident Sequences

10 CFR 70.65 requires a licensee to conduct an ISA to identify facility and external hazards and their potential for initiating accident sequences, their likelihood and consequences, and the IROFS.

(e) Chemical Accident Consequences

10 CFR 70.65(b)(7) requires that the proposed quantitative standards used to assess the consequences to an individual, from acute chemical exposure to licensed material or chemicals produced from licensed materials, which are on-site, or expected to be on-site, be described.

(f) Chemical Process Safety IROFS

10 CFR 70.61 requires that IROFS be applied to the extent needed to reduce the likelihood of occurrence of each high consequence, credible event, so that the event is highly unlikely or the consequences are less severe. And, that IROFS be applied to the extent needed to reduce the likelihood of occurrence of each intermediate consequence, credible event, so that the event is unlikely or the consequences are less severe.

(g) Chemical Process Management Measures

10 CFR 70.62(d) requires that management measures be established to ensure compliance with the performance requirements of 10 CFR 70.61.

(h) Coordination of Chemical Process Safety and Emergency Management

For hazardous chemicals, 10 CFR 70.22(i)(3)(xiii) requires that the Emergency Plan certify that the licensee has met its responsibilities under Emergency Planning and Community Right to Know Act of 1986, Title III. GNF-A's Radiological Contingency and Emergency Plan states that the facility complies with the EPA Superfund Amendment and Reauthorization Act, Title II regulations, also known as the "Emergency Planning and Community Right to Know Act."

6.4 EVALUATION FINDINGS

Based on the review of the application, the NRC staff concludes that GNF-A has adequately described and assessed chemical accident consequences and the effects that could result from the handling, storage, or processing of licensed materials. GNF-A has prepared a hazard analysis that identifies and evaluates those chemical process hazards and potential accidents, and established safety controls providing reasonable assurance of safe facility operation. To ensure that the performance requirements in 10 CFR Part 70 are met, GNF-A has stated that controls are available and able to perform their safety-related functions when needed.

The staff concludes that GNF-A's plan for managing chemical process safety meets the requirements of Part 70 and provides reasonable assurance that the public health and safety and environment will be protected.

7.0 FIRE SAFETY

The purpose of this review is to determine, with reasonable assurance, that GNF-A has (1) designed a facility that provides adequate protection against fires and explosions that could affect the safety of licensed materials and thus present an increased radiological risk; (2) considered the radiological consequences of fires; and (3) instituted suitable safety controls to protect workers, the public, and the environment.

7.1 REGULATORY REQUIREMENTS

The regulatory basis for the fire safety review includes the general and additional contents of the application, as required by 10 CFR 30.33, 10 CFR 40.32, 10 CFR 70.22, and 10 CFR 70.65. In addition, the fire safety review must provide reasonable assurance of compliance with 10 CFR 70.61 and 70.62.

7.2 REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria that the NRC uses for reviews of fire safety are outlined in Sections 7.4.3.1 through 7.4.3.5 of NUREG-1520 (NRC, 2002).

7.3 STAFF REVIEW AND ANALYSIS

The fire protection review was performed relative to the guidance provided in NUREG-1520 (NRC, 2002). The information to support this review was obtained from the "License Renewal Application for GNF-A," April 2, 2007, to the NRC; "GNF-A SNM-1097 License Renewal RAI Responses," November 25, 2008, to the NRC; and an onsite review at GNF-A on June 10, 2008.

7.3.1 BUILDING CONSTRUCTION AND FACILITY DESIGN

The facility and its original fire protection systems were designed and constructed to industrial standards that were in effect at the time of construction. The licensee commits to meeting the prevailing codes whenever facilities are expanded or modified. Facilities are generally noncombustible masonry or metal construction. Facility exit routes are posted throughout the facility and are unimpeded by physical security requirements. In addition, workers are trained in evacuation and periodic drills are conducted to verify the adequacy of egress. The electrical installation and wiring is in accordance with National Fire Protection Association (NFPA) 70, "National Electric Code."

7.3.2 PROCESS FIRE SAFETY

Hydrogen is used in the licensed process to provide a reducing atmosphere in the sintering furnaces. Although there is a risk associated with its use, safety systems are designed and

installed to effectively prevent an accident from occurring. Sintering furnaces comply with the edition of NFPA-86C, "Standard for Ovens and Furnaces," which was in effect at the time the furnaces were last upgraded in 1999. Flammable gas detectors are installed and maintained where required.

Flammable and combustible liquids are stored as required by NFPA-30, "Flammable and Combustible Liquid Code," and oxygen, acetylene, and propane gases are stored in the manner required by NFPA-55, "Standard for the Storage, Use, and Handling of Compressed Gases." Fire hazards associated with processing uranium oxides and combustible metals have been evaluated and conform to prevention and suppression requirements required by NFPA-801, "Standard for Fire Protection for Facilities Handling Radioactive Materials," (NFPA, 2003).

Plant boilers are constructed and operated in accordance with industry standards. They are separated from the buildings where the licensed process is located. Stationary combustion engines are appropriately designed, constructed, and operated.

7.3.3 FIRE PROTECTION AND EMERGENCY RESPONSE

The facility maintains a Fire Emergency Response Team, made up of employees trained in fire fighting techniques, first aid procedures, and emergency response. The team is organized, operated, trained, and equipped for incipient fire fighting capability; however they are not considered an industrial fire brigade. GNF-A maintains a Mutual Aid agreement with the Castle Haynes Volunteer Fire Department (CHVFD) for response to plant fires that escalate beyond the incipient level.

Fire alarm pull stations and audible fire alarms are installed throughout the facility. Automatic fire detectors are installed in areas with high combustible loading and/or infrequent occupancy, unless such areas are protected by automatic fire suppression systems. Portable fire extinguishers are installed throughout the facility in accordance with NFPA 10. Multipurpose fire extinguishers are provided generally for Class A/B/C fires. Specialized extinguishers are located in areas requiring protection from particular hazards, including water-exclusion areas.

The fire protection system includes an above-ground storage tank dedicated for fire suppression systems. The water is taken from the tank via a fire pump with automatic startup and manual stop. A jockey pump maintains sufficient pressure on the looped fire main at all times. A ground level fire protection reservoir also exists to aid in manual fire fighting. A back-up pump can provide ground level water to the fire main if needed. The facility is furnished with standpipes and hose connections except in moderator-exclusion zones. Portable extinguishers of the appropriate type and size are installed at proper locations. The suppression equipment was verified to be in satisfactory condition and unimpaired.

The fire pumps, sprinklers systems, and hydrants are operationally tested in accordance with testing frequencies specified by NFPA 25, "Inspection, Testing, and Maintenance of Water-based Fire Protection Systems." Hoses are hydrostatically tested and re-racked annually. Automatic sprinkler systems are designed and installed in accordance with industry standards.

7.3.4 FIRE SAFETY MANAGEMENT

The licensee commits to an adequate fire safety program, including satisfactory management measures including but not limited to: (1) a maintenance program to install, test, and maintain

IROFS to ensure that they are available and reliable; (2) fire safety awareness training for employees and contractors; and (3) an approved hot work permit and combustible controls program.

The licensee's independent auditors provide expertise and recommendations during their periodic assessments of the fire protection program. The periodic risk assessments audit the systems and program to current industry guidelines, and the auditor identifies any deficiencies in the current installation and maintenance that present a danger to safety, providing recommendations for resolving these deficiencies. In addition, internal quarterly audits and routine self-assessments are performed by the licensee.

7.3.5 FIRE HAZARDS ANALYSIS

The site Fire Hazard Analyses were performed for all plant areas and are part of the ISA process. They are maintained current by the Configuration Management process.

Pre-fire plans have been developed using current information regarding building construction, operations, points of attack, and personnel. The plans discuss available fire protection features and utilities for each process area. Information is available on combustible loadings and fire fighting strategy.

Fire Hazards Analyses and Pre-Fire Plans conform to the guidance provided in NFPA 801.

7.4 EVALUATION FINDINGS

The staff concluded that the licensee's capabilities meet the criteria in Chapter 7 of NUREG-1520 (NRC, 2002). The staff determined that the licensee's equipment, facilities, and procedures provide reasonable assurance that adequate fire protection will be provided and maintained for those IROFS to meet the safety performance requirements of 10 CFR Part 70.

8.0 EMERGENCY MANAGEMENT

8.1 REGULATORY REQUIREMENTS

GNF-A is required by 10 CFR 70.22(i)(1)(ii) to have an emergency plan. The plan must cover response to the radiological hazards of an accidental release of special nuclear material and to any associated chemical hazards directly incident thereto. 10 CFR 70.22(i)(3) contains the information requirements for the Emergency Plan.

8.2 REGULATORY ACCEPTANCE CRITERIA

NUREG-1520 (NRC, 2002) states that the Emergency Plan will be acceptable if it contains the following information:

- (i) *Facility description.* A brief description of the licensee's facility and area near the site.
- (ii) *Types of accidents.* An identification of each type of radioactive materials accident for which protective actions may be needed.
- (iii) *Classification of accidents.* A classification system for classifying accidents as alerts or site area emergencies.
- (iv) *Detection of accidents.* Identification of the means of detecting each type of accident in a timely manner.
- (v) *Mitigation of consequences.* A brief description of the means and equipment for mitigating the consequences of each type of accident, including those provided to protect workers onsite, and a description of the program for maintaining the equipment.
- (vi) *Assessment of releases.* A brief description of the methods and equipment to assess releases of radioactive materials.
- (vii) *Responsibilities.* A brief description of the responsibilities of licensee personnel should an accident occur, including identification of personnel responsible for promptly notifying offsite response organizations and the NRC; also responsibilities for developing, maintaining, and updating the plan.
- (viii) *Notification and coordination.* A commitment to and a brief description of the means to promptly notify offsite response organizations and request offsite assistance, including medical assistance for the treatment of contaminated injured onsite workers when appropriate. A control point must be established. The notification and coordination must be planned so that unavailability of some personnel, parts of the facility, and some equipment will not prevent the notification and coordination. The licensee shall also commit to notify the NRC operations center immediately after notification of the appropriate offsite response organizations and not later than one hour after the licensee declares an emergency.
- (ix) *Information to be communicated.* A brief description of the types of information on facility status, radioactive releases, and recommended protective actions, if necessary, to be given to offsite response organizations and to the NRC.

(x) *Training*. A brief description of the frequency, performance objectives and plans for the training that the licensee will provide workers on how to respond to an emergency including any special instructions and orientation tours the licensee would offer to fire, police, medical and other emergency personnel. The training shall familiarize personnel with site-specific emergency procedures. Also, the training shall thoroughly prepare site personnel for their responsibilities in the event of accident scenarios postulated as most probable for the specific site, including the use of team training for such scenarios.

(xi) *Safe shutdown*. A brief description of the means of restoring the facility to a safe condition after an accident.

(xii) *Exercises*. Provisions for conducting quarterly communications checks with offsite response organizations and biennial onsite exercises to test response to simulated emergencies. Quarterly communications checks with offsite response organizations must include the check and update of all necessary telephone numbers. The licensee shall invite offsite response organizations to participate in the biennial exercises. Participation of offsite response organizations in biennial exercises although recommended is not required. Exercises must use accident scenarios postulated as most probable for the specific site and the scenarios shall not be known to most exercise participants. The licensee shall critique each exercise using individuals not having direct implementation responsibility for the plan. Critiques of exercises must evaluate the appropriateness of the plan, emergency procedures, facilities, equipment, training of personnel, and overall effectiveness of the response. Deficiencies found by the critiques must be corrected.

(xiii) *Hazardous chemicals*. A certification that the applicant has met its responsibilities under the Emergency Planning and Community Right-to-Know Act of 1986, Title III, Pub. L. 99-499, if applicable to the applicant's activities at the proposed place of use of the special nuclear material.

8.3 STAFF REVIEW AND ANALYSIS

The staff has evaluated the Radiological Contingency and Emergency Plan (RC&EP). In accordance with 10 CFR 70.22(i), GNF-A commits to maintain and execute the RC&EP in response to the radiological hazards resulting from a release of radioactive material or hazardous chemicals incident to the processing of licensed material. The NRC staff reviewed the RC&EP with respect to 10 CFR 70.22(i) and the acceptance criteria in Section 8.4.3 of NUREG-1520 (NRC, 2002). The NRC staff determined that the RC&EP is adequate to demonstrate compliance with 10 CFR 70.22(i), in that:

- (1) the facility is properly configured to limit releases of radioactive materials in the event of an accident;
- (2) a capability exists for measuring and assessing the significance of accidental releases of radioactive materials;
- (3) appropriate emergency equipment and procedures are provided onsite to protect workers against radiation and other chemical hazards that might be encountered after an accident;
- (4) a system has been established to notify Federal, State, and local Government agencies and to recommend appropriate protective actions to protect members of the public; and
- (5) necessary recovery actions are established to return the facility to a safe condition after an accident.

The requirements of the RC&EP are implemented through approved written procedures. Changes that decrease the effectiveness of the emergency plan may not be made without prior NRC approval. The NRC will be notified of other changes that do not decrease the effectiveness

of the emergency plan within 6 months of making the changes. NRC fuel cycle inspection staff examines the emergency preparedness program as part of routine safety inspections.

GNF-A submitted Revision 9 to the RC&EP on April 18, 2008. NRC staff determined that the revision was correctly submitted under the provisions of 10 CFR 70.32(i). The staff finds this plan continues to be adequate to meet the requirements of 10 CFR 70.23(a)(11). Safety Condition S-3 contains the revision number and date of the current RC&EP, as follows:

S-3 The licensee shall maintain and execute the response measures in Revision 9 of the RC&EP, dated February 29, 2008, and submitted to NRC by letter dated April 18, 2008. This Plan may be further revised by the licensee consistent with 10 CR 70.32(i).

9.0 ENVIRONMENTAL PROTECTION

The purpose of the NRC's review of GNF-A's Environmental Protection Program is to determine whether GNF-A's proposed environmental protection measures are adequate to protect the environment, and the health and safety of the public, as required by 10 CFR Parts 20 and 70.

GNF-A's environmental report was part of its license renewal request, and was the basis for the EA and FONSI that the NRC staff previously prepared and issued in support of the proposed action.

9.1 REGULATORY REQUIREMENTS

To be considered acceptable, GNF-A must satisfy the following regulatory requirements regarding environmental protection:

1. Part 20 specifies the effluent control and treatment measures necessary to meet the dose limits and dose constraints for members of the public specified in Subparts B, D, and F; the survey requirements of Subpart F; the waste disposal requirements of Subpart K; the records requirements of Subpart L; and the reporting requirements of Subpart M.
2. 10 CFR 70.22(a)(7) states that the application shall contain a description of the equipment and facilities that will be used by GNF-A to protect health and minimize danger to life or property.
3. 10 CFR 70.22(a)(8) states that the application shall contain procedures to protect health and minimize danger to life or property.
4. 10 CFR 70.23(a) specifies in part that an application for the possession and use of SNM will be granted provided that, among other things, GNF-A's equipment and facilities are adequate to protect health and minimize danger to life or property, and that GNF-A's proposed procedures to protect health and minimize danger to life or property are adequate.
5. 10 CFR 70.59 outlines the radiological effluent monitoring reporting requirements for a Part 70 licensee.

9.2 REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria for the NRC's review of GNF-A's environmental protection program are outlined in Section 9.4.3.2 of NUREG-1520 (NRC, 2002).

9.3 STAFF REVIEW AND ANALYSIS

The NRC staff reviewed Chapter 10.0, "Environmental Protection," of the application. Chapter 10 describes the GNF-A Environmental Protection Program that assures that exposure of the public and the environment to hazardous materials, used in facility operations is kept

ALARA. The Environmental Protection Program includes effluent air controls, liquid waste treatment, solid waste disposal, environmental monitoring, semi-annual reporting of effluent data, off-site dose control, performance and documentation of analyses, and audits and compliance inspections.

The Environmental Protection Program includes commitments to perform representative stack sampling to determine the adequacy of air effluent controls and demonstrate compliance with applicable regulations. It includes liquid waste treatment facilities to implement ALARA and assure that 10 CFR 20 limits are met prior to discharge to the Cape Fear River; the effluent is continuously sampled and a composite of this sample is analyzed for gross alpha and beta activity and for isotopic uranium content. Solid waste disposal preparation facilities, with sufficient capacity and capability to enable processing, packaging, and transfer of solid wastes to licensed treatment or disposal to licensed treatment or disposal facilities, are provided and maintained in proper operating condition. No radioactive wastes are disposed of on site. Environmental monitoring of air, surface water, ground water, Cape Fear River water, sediment, soil, vegetation, and fish is performed in accordance with an established schedule. Environmental protection analysis is included in GNF-A's ISA process. GNF-A performs audits and compliance inspections of the Environmental Protection Program.

9.4 EVALUATION FINDINGS

GNF-A has developed a program to implement adequate environmental protection measures during operation, which include effluent controls to maintain public doses ALARA as part of the radiation protection program and environmental and effluent monitoring. The NRC staff concludes that GNF-A's program, as described in its application, is adequate to protect the environment and the health and safety of the public, and complies with regulatory requirements, imposed by the Commission, in Parts 20 and 70. The bases for these conclusions are the commitments contained in Chapter 10 of the application and discussed in Section 9.3 above.

The staff has prepared the EA in support of the proposed license renewal. Staff considered direct, indirect, and cumulative environmental impacts to 12 resource areas in their evaluation, including: land use; transportation; socioeconomics; air quality; water quality; geology and soils; ecology; noise; historic and cultural; scenic and visual; public and occupational health; and waste management. All of the environmental impacts were small-to-moderate. The license renewal request does not require altering the site footprint nor does it change the operating processes of the existing facility. The proposed action will not adversely affect federal or state-listed threatened or endangered species nor flora and fauna in the site vicinity.

Airborne effluents released through stacks and liquid effluents released in the North Cape Fear River are below and are anticipated to remain below regulatory limits in 10 CFR Part 20 for non-radiological and radiological contaminants. Public and occupational exposures are below the limit established in 10 CFR Part 20. GNF-A maintains acceptable waste management practices and procedures. The staff concluded that the proposed 40 year renewal of license SNM-1097 will not result in a significant impact to the environment.

NRC staff consulted with other agencies regarding the proposed action, including the National Oceanic and Atmospheric Administration (NOAA) Fisheries, the North Carolina State Historic Preservation Office, The Waccamaw Siouan Tribe, the North Carolina Cape Fear Regional Council of Governments, the North Carolina Department of Environment and Natural Resources, the North Carolina Department of Agriculture, the North Carolina Department of Cultural

Resources, the North Carolina Department of Transportation, the North Carolina Crime Control & Public Safety, Division of Emergency Management, Floodplain Management Program, New Hanover County Planning, and New Hanover County Environmental. The consultations ensured that the requirements of Section 7 of the Endangered Species Act and Section 106 of the National Historic Preservation Act were met and provided the designated state liaison agency the opportunity to comment on the proposed action.

The NRC staff concluded that the proposed renewal of license SNM-1097, involving the continued operation of the GNF-A site will not result in a significant impact to the environment. The NRC staff also concluded that the proposed action will not adversely affect federal- or state-listed threatened or endangered species. The staff also finds no significant impacts to regional historic and cultural resources. The facility already exists, and no substantial changes to the facility or operation are associated with the license renewal. Gaseous emissions and liquid effluents are within regulatory limits for non-radiological and radiological components. Public and occupational radiological dose exposures are below 10 CFR Part 20 regulatory limits.

10.0 DECOMMISSIONING FUNDING PLAN

The purpose of this review of GNF-A's Decommissioning Funding Plan (DFP) is to determine that funds will be available to decommission the facility safely and in accordance with 10 CFR 20.1401-1406 and 10 CFR 70.25, 70.22(a)(9), and 70.38.

10.1 REGULATORY REQUIREMENTS

The following NRC regulations require planning, financial assurance, and record-keeping for decommissioning, as well as procedures and activities to minimize waste and contamination:

10 CFR 20.1401-1406	"Radiological Criteria for License Termination" (Subpart E)
10 CFR 70.22(a)(9)	"Decommissioning Funding Plan"
10 CFR 70.25	"Financial Assurance and Recordkeeping for Decommissioning"
10 CFR 70.38	"Expiration and Termination of Licenses and Decommissioning of Sites and Separate Buildings or Outdoor Areas"

10.2 REGULATORY ACCEPTANCE CRITERIA

NUREG-1520 (NRC, 2002); NUREG-1757, "Consolidated NMSS Decommissioning Guidance," (NRC, 2003) defines relevant regulatory guidance and appropriate acceptance criteria for decommissioning and DFPs contained in applications.

10.3 STAFF REVIEW AND ANALYSIS

GNF-A provided an updated decommissioning plan and cost estimate on February 10, 2007 (ML070390174). In a letter dated May 8, 2007 (ML071570284), GE provided an updated GE parent company guarantee of funds for decommissioning: updated letter from the chief financial officer to demonstrate financial assurance. GNF-A provided additional information related to the cost estimate on August 10, 2007 (ML072220399). NRC staff reviewed the cost estimate and guarantee and determined that adequate financial resources will be available to decommission the GNF-A facility. This determination is documented in NRC letter dated October 10, 2007 (ML072420252). 10 CFR 70.25(e) requires licensees to update the cost estimates every three years and to submit the updates for NRC review. GNF-A has committed to review and update the cost estimate, as needed, on a triennial basis and submit the updated cost estimate to the NRC.

10.4 EVALUATION FINDINGS

The NRC staff evaluated GNF-A's DFP in accordance with NUREG-1757 (NRC, 2003), and determined that GNF-A's financial assurance for decommissioning continues to provide sufficient funding to ensure decommissioning and decontamination of the facility, and, therefore, provides reasonable assurance of protection for workers, the public, and the environment.

11.0 MANAGEMENT MEASURES

The safety program required by 10 CFR 70.62(a) must include management measures described in 70.62(d) and defined in 70.4.

The purpose of this review is to determine whether GNF-A's application for renewal provided sufficient information in Chapter 11 "Management Measures," to provide reasonable assurance that the management measures applied to Safety Significant Controls (SSCs) and/or IROFS, as documented in the ISA Summary, will ensure compliance with the performance requirements of 70.61. The management measures will ensure that engineered and administrative controls and control systems that are identified as IROFS are designed, implemented, and maintained, as necessary, to ensure they are available and reliable to perform their intended functions when needed to comply with the performance requirements of 10 CFR 70.61. This review also determines whether the measures are applied to the IROFS in a graded manner commensurate with the IROFS' importance to safety.

11.1 REGULATORY REQUIREMENTS

The requirements for fuel cycle facility management measures are specified in 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material."

1. 10 CFR 70.4 states that management measures include: (1) Configuration Management; (2) maintenance; (3) training and qualifications; (4) procedures; (5) audits and assessments; (6) incident investigations; (7) records management; and (8) other QA elements.
2. 10 CFR 70.62(a)(3) states that records must be kept for all IROFS failures; describes required data to be reported; and sets time requirements for updating the records.
3. 10 CFR 70.62(d) requires a licensee to establish management measures, for application to engineered and administrative controls and control systems that are identified as IROFS, pursuant to 10 CFR 70.61(e), to ensure they are available and reliable.
4. 10 CFR 70.72 requires a licensee to establish a Configuration Management program to evaluate, implement, and track changes to the facility; structures, systems and components; processes; and activities of personnel.

11.2 REGULATORY ACCEPTANCE CRITERIA

The guidance applicable to the NRC staff's review of the licensee's management measures program is contained in Chapter 11 of NUREG-1520 (NRC, 2002). The acceptance criteria applicable to this review are contained in Section 11.4.3 of NUREG-1520 (NRC, 2002).

11.3 STAFF REVIEW AND ANALYSIS

In Chapter 11, "Management Measures," of the renewal application 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 reliable to perform their function when needed. GNF-A applies Management Measures in a graded approach based on unmitigated risk as

described in Chapter 3 of the license application.

Details of the management measures are provided Section 1.6 of the ISA Summary Revision 11, 7/30/2008 (ML082130407), which was reviewed and approved by NRC staff on September 19, 2008 (ML082390852). In the November 25, 2008, RAI reply, GNF-A revised Chapter 11 of the license application to be consistent with the Management Measures described in the ISA Summary.

11.4 EVALUATION FINDINGS

The staff has verified that Chapter 11 of the renewal application provides sufficient information to satisfy the regulatory requirements of 10 CFR Part 70.62(d), and, on the basis of this information, the staff concludes that the application is complete and acceptable.

12.0 MATERIAL CONTROL AND ACCOUNTING AND INTERNATIONAL SAFEGUARDS

The NRC staff's review of, and findings regarding, GNF-A's material control and accountability (MC&A) program and international safeguards, is based in part on information that has been withheld from public disclosure under 10 CFR 2.390(d).

NRC staff reviewed the current license (Amendment No. 45) to determine the applicability of the current Safeguards Conditions.

The staff concluded that GNF-A provided an acceptable FNMCP for the facility that will meet the applicable Part 74 requirements. The FNMCP describes acceptable methods for achieving the performance objectives in 10 CFR 74.31(a) and the system capabilities of 10 CFR 74.31(c). As a result, the staff concluded that GNF-A meets the requirements in the area of MC&A to operate the facility under Part 74.

Safeguards Condition SG-1.2 discusses actions the licensee may undertake for fuel bundles and loose fuel rods received from the Wurgassen plant in Germany. Since the licensee continues to receive these items from the facility, this condition should remain in the license.

The staff requires the following two Safeguards conditions:

SG-1.1 The licensee shall follow Chapters 1.0 through 10.0 of its Fundamental Nuclear Material Control Plan dated December 16, 1987, which has been partially revised as indicated by Revision 44 of Page 1 (dated August 21, 2007, and titled "Revisions by Chapter") of said Plan. This Plan may be further revised in accordance with, and pursuant to, the provisions of either 10 CFR 70.32(c)(1)(iii) or 70.34.

SG-1.2 Notwithstanding the requirements of Sections 6.1 and 7.1 of the Plan identified in Condition SG-1.1, the licensee may (1) utilize a computer system independent of its Manufacturing Information and Control System (MICS) to track the SNM contained in fuel bundles and loose fuel rods received from the Wurgassen plant in Germany; and (2) have up to 90 days for completing shipper-receiver differences determinations and evaluations associated with the initial shipment of fuel assemblies from the Wurgassen plant, and up to six calendar months for subsequent shipments of loose rods. Receipt measurements and item controls associated with these fuel assemblies and rods shall be in accordance with the commitments contained in the licensee's letter (from Dr. R. J. Reda to Mr. R. C. Pierson) dated January 24, 1996.

GNF-A is subject to the provisions of 10 CFR Part 75, Safeguards on Nuclear Material – Implementation of US/IAEA Agreement. Staff recommends that Safeguards Conditions SG-3.1–SG-3.6 from the existing license be continued in the renewed license.

13.0 PHYSICAL PROTECTION AND PHYSICAL SECURITY

13.1 REGULATORY REQUIREMENTS

Each licensee who possesses or uses 10 kg or more of SNM of low strategic significance must submit a physical security plan describing how the licensee will comply with all the requirements of 10 CFR 73.67(c) - (g).

13.2 REGULATORY ACCEPTANCE CRITERIA

The licensee used Regulatory Guide 5.59 as guidance to write the PSP. The NRC reviewers used 10 CFR 73.67(f) "Fixed site requirements for SNM of low strategic significance" and NUREG-1615 (NRC, 1999) "Physical Protection Requirements for Categories I, II and III Material at Fuel Cycle Facilities" to review the PSP. NUREG-1615 (NRC, 1999) describes the requirements in 10 CFR 73.67.

13.3 STAFF REVIEW AND ANALYSIS

The NRC staff reviewed the GNF-A PSP, which is marked as sensitive information to be withheld under 10 CFR 2.390(d). Thus, the findings below are based in part on non-public information. As part of the review, the NRC also conducted a site visit.

The NRC staff visited the licensee's site for the purpose of observing the security operation relating to vehicle and personnel access control, Controlled Access Area intrusion detection measures, communication capabilities with local law enforcement, and vehicle and personnel search procedures.

The staff also compared the GNF-A PSP to the requirements in 10 CFR 73.67(f) and the requirements in the Category III (CAT III) Order issued to CAT III facilities on February 6, 2003. The CAT III Order mandated additional security measures which were identified at that time as "Interim Compensatory Measures" (ICMs).

13.4 EVALUATION FINDINGS

The PSP submitted by GNF-A contained all of the appropriate information to meet the requirements of 10 CFR 73.67(f) for a CAT III facility possessing 10 kg of SNM or more and is acceptable.

10 CFR 73.67(c)(2) states that each licensee who possesses or uses 10 kg or more of SNM of low strategic significance must, within 30 days after the plan submitted pursuant to paragraph (c)(1) is approved, or when specified by NRC in writing, implement the approved security plan. In accordance with 10 CFR 73.67(c)(2), the PSP is already in effect and has been in effect at the GNF-A's site for several years.

10 CFR 73.67(c)(1) states that each licensee who possesses or uses 10 kg or more of SNM of low strategic significance shall retain a copy of the effective security plan for three years after the

licensee possesses the SNM. Copies of the superseded material must be retained for three years after each change. 10 CFR 73.67(c)(1) also requires that records such as letters, drawings, and specifications, must include all pertinent information such as stamps, initials, and signatures. GNF-A has submitted sufficient information with the PSP to ensure that the requirements of 10 CFR 73.67(c)(1) have been met.

10 CFR 73.67(a)(1) states that each licensee who possesses or uses SNM of low strategic significance must establish and maintain a physical protection system that will: (1) minimize the possibilities for unauthorized removal of SNM consistent with the potential consequences of such actions; and (2) facilitate the location and recovery of missing SNM. Through the review of the PSP submitted by GNF-A and during a site visit by the NRC staff, it was determined that the security measures that GNF-A employs meet, or in many cases exceed, the requirements to provide reasonable assurance that 10 CFR 73.67(a)(1) is being met.

10 CFR 73.67(a)(2) requires that the physical protection system provide:

- (i) early detection and assessment of unauthorized access or activities by an external adversary within the controlled access area containing SNM;
- (ii) early detection of removal of SNM by an external adversary from a controlled access area;
- (iii) assure proper placement and transfer of custody of SNM; and
- (iv) respond to indications of an unauthorized removal of SNM and then notify the appropriate response forces of its removal, to facilitate its recovery.

Based on the PSP, which addresses security patrols, physical locking devices, fencing, and electronic measures, and during a site visit by the NRC staff, it was determined that the security measures that GNF-A employs meet, or in many cases exceed, the requirements to provide reasonable assurance that 10 CFR 73.67(a)(2) is being met.

10 CFR 73.67(f)(3) requires that the licensee assure that a watchman or offsite response force will respond to all unauthorized penetrations or activities. GNF-A has committed to an onsite security force that regulates access to the site in general and to specific buildings onsite. By means of patrols, access control, locking devices, and due to the size of the SNM housings, it would be difficult to remove SNM without detection.

Based on the review of the PSP and its implementation, the NRC staff concluded that the GNF-A PSP and security measures meet the applicable Part 73 requirements and recommends the following license condition:

SG-2.1 The licensee shall follow the physical protection plan entitled, "Physical Security Plan," Revision 9, dated April 1, 2009, submitted by letter dated April 6, 2009; and as it may be further revised in accordance with the provisions of 10 CFR 73.32(e).

14.0 SPECIAL AUTHORIZATIONS AND EXEMPTIONS

14.1 AUTHORIZATIONS

In the application, GNF-A requested a number of special authorizations.

14.1.1 AUTHORIZATION TO MAKE CHANGES TO LICENSE COMMITMENTS

In Section 1.3.1 of the application, GNF-A requested 10 special authorizations:

1. Authorizations to make changes to license commitments
2. Authorized guidelines for contamination-free articles
3. Authorized transfer of contamination-free liquids
4. Authorization to transfer test quantities of calcium fluoride
5. Authorization to transfer calcium fluoride to vendors for beneficial reuse
6. Authorization to dispose of industrial waste treatment products
7. Authorization to store sanitary sludge pending final disposal
8. Authorization for the use of materials at off-site locations
9. Authorization to use a dilution factor of 100 for airborne effluents
10. Authorization for workplace sampling adjustments

NRC staff confirmed that these authorizations have been in place in the previous license, as documented in the SER for the 1997 license renewal, and that they continue to be in accordance with the regulations and, therefore, acceptable.

14.2 EXEMPTIONS

In Section 1.3.1 of the application, GNF-A requested 4 exemptions:

14.2.1. EXEMPTION TO CRITICALITY MONITORING SYSTEM REQUIREMENTS

GNF-A requested authorization not to maintain the criticality accident monitoring system required by 10 CFR 70.24 when it is demonstrated that a credible criticality risk does not exist for each area in which there is not more than:

- A quantity of finished reactor fuel rods equal to or less than 45% of a minimum critical number under conditions in which double batching is credible, or equal to or less than 75% of a minimum critical number under conditions in which double batching is not credible, or
- The quantity of uranium authorized for delivery to a carrier when fully packaged as for transport according to a valid NRC authorization for such packages without limit on the number of such packages, provided storage locations preclude mechanical damage and flooding.

14.2.2 EXEMPTION TO POSTING REQUIREMENTS

GNF-A requested authorization to post areas within the Controlled Access Area in which radioactive materials are processed, used, or stored, with a sign stating "Every container in this area may contain radioactive material" in lieu of the labeling requirements of 10 CFR 20.1904.

14.2.3 EXEMPTION TO EXTREMITY DOSE DETERMINATION REQUIREMENTS

GNF-A requested authorization to use a skin thickness of 38 milligrams/cm² in the assessment of worker fingertip doses from uranium and for determining compliance to NRC extremity dose limits.

14.2.4 EXEMPTION FROM 10 CFR 20 TO USE ICRP 68

GNF-A requested an exemption from 10 CFR 20.1201 to use DAC and ALI values based on dose coefficients published in ICRP Publication No. 68, in lieu of the values in Appendix B of 10 CFR Part 20 in accordance with internal procedures.

14.3 STAFF EVALUATION

NRC staff reviewed these exemption requests and determined that the bases for NRC approvals, under 10 CFR 70.17, of the exemptions in previous license amendments were still valid and that the exemptions continue to be authorized by law and will not endanger the public health or safety or the common defense and security and are otherwise in the public interest. Staff recommends that the exemptions be continued in the renewed license.

15.0 REFERENCES

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NFPA-30, Flammable and Combustible Liquid Code, (Version in effect on date of initial licensing).

NFPA-55, Standard for the Storage, Use, and Handling of Compressed Gases, (Version in effect on date of initial licensing).

NFPA-801, Standard for Fire Protection for Facilities Handling Radioactive Materials, (NFPA, 2003).

NFPA 25, Inspection, Testing, and Maintenance of Water-based Fire Protection Systems, (Version in effect on date of initial licensing).

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16.0 SAFETY EVALUATION REPORT PREPARERS

The individuals listed below are the principal contributors to the preparation of this Safety Evaluation Report. The NRC staff directed the effort and contributed to the technical evaluations.

Mary Adams
Mathew Bartlett
Merritt Baker
James Downs
Blake Purnell
Tom Pham
Edward Johannemann