ML101550158

Safety Evaluation Report for the CO_2 License Amendment Application Richland Fuel Fabrication Facility Richland, Washington

Docket No. 70-1257
AREVA NP, Inc.

Manuscript Completed: July 2010

Division of Fuel Cycle Safety and Safeguards
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Enclosure 5

ABSTRACT

The report documents the U.S. Nuclear Regulatory Commission (NRC) staff's safety and safeguards evaluation of the AREVA NP, Inc. (AREVA) application to amend its license to possess and use special nuclear material (SNM) at its fuel fabrication facility (FFF) located in Richland, Washington. Specifically, AREVA is requesting a license amendment to authorize the installation and operation of a new process that will use supercritical carbon dioxide (CO_2) to extract uranium from waste material that contains a relatively low percentage of uranium. This new process will take place in the existing uranium dioxide building within the Richland FFF. AREVA's license was renewed on April 24, 2009, and will expire on April 24, 2049. AREVA submitted its license amendment request on June 12, 2008, in accordance with the requirements in Title 10 of the *Code of Federal Regulations* (CFR), Sections 70.34 and 70.72(d)(1).

The objective of this review is to evaluate the potential impacts from the proposed operations to the worker and public health and safety, under both normal operating and accident conditions. The NRC's review also considers physical protection of SNM; material control and accounting of SNM; and management organization, administrative programs, and financial qualifications provided to ensure the safe operation and eventual decommissioning of the facility.

The NRC staff concluded, in this Safety Evaluation Report, that AREVA's descriptions, specifications, and analyses for the proposed supercritical CO_2 extraction process 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 the worker or public health and safety.

A notice of opportunity to request a hearing on the renewal application was published in the *Federal Register* on January 16, 2009 (74 FR 3110-3114). No requests for a hearing were received. The NRC staff evaluated the AREVA's license amendment request and concluded that the request meets the regulatory criteria for a categorical exclusion, as described in 10 CFR 51.22(c)(11).

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EXECUTIVE SUMMARY

On June 12, 2008, AREVA submitted to the NRC a request to amend its special nuclear material (SNM) License No. SNM-1227, which it holds under 10 CFR Part 70. AREVA requested authorization to install and operate a new process that will use supercritical carbon dioxide (CO_2) to extract uranium from waste material that contains a relatively low percentage of uranium. A supercritical fluid is any substance at a temperature and pressure above its critical point. The critical point of a fluid is a unique temperature and pressure that, if exceeded, results in the fluid no longer exhibiting the characteristics of a liquid or a gas. In this physical state, the fluid can effuse through solids like a gas and dissolve materials like a liquid. In addition, close to the critical point, small changes in pressure or temperature result in large changes in density, allowing many properties of a supercritical fluid to be "fine-tuned." The proposed process will take place in AREVA's existing uranium dioxide (UO_2) building within its Richland, Washington facility. AREVA supplemented its application with additional submittals dated August 22, 2008; June 5, July 13, November 11, and December 4, 2009; February 4, 2010; e-mail and attachment from C.D. Manning dated April 16, 2010; April 28, 2010, and e-mail and attachment from C.D. Manning dated July 1, 2010. AREVA is requesting approval of the proposed license amendment request.

A notice of opportunity to request a hearing for the license amendment request was published in the *Federal Register* (FR) on January 16, 2009 (74 FR 3110-3114). No requests for a hearing were received.

The NRC staff conducted its safety and safeguards review in accordance with 10 CFR Part 20, "Standards for Protection Against Radiation;" 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material;" 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 NRC Technical Report Designation (NUREG)-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility" (NUREG-1520/NRC, 2002) and other applicable guidance documents to conduct its review. In cases, whereas AREVA's safety programs should be supplemented, the NRC staff identified license conditions to provide assurance of safe operation.

In its license amendment request, AREVA stated that the proposed process meets the regulatory criteria for a categorical exclusion (CATEX) pursuant to 10 CFR 51.22(c)(11). The NRC staff reviewed the information provided by AREVA and concluded that the proposed process is eligible for a CATEX because: 1) there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite, 2) there is no significant increase in individual or cumulative occupational radiation exposure, 3) there is no significant construction impact, and 4) there is no significant increase in the potential for or consequences from radiological accidents.

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

General Information

AREVA provided an adequate description of the proposed activities, the types of streams generated during daily operations, and the physical and chemical forms of the licensed material. The information provided by AREVA allowed the NRC staff to have an overall understanding of the proposed process and AREVA's general plan for carrying it out. AREVA's information is

considered acceptable and in compliance with the applicable requirements in 10 CFR 70.22 and 70.65.

Organization and Administration

AREVA adequately described its organization and management policies to support the proposed operations, including AREVA's plans to commission the startup and operations of the proposed activities. AREVA's information is considered acceptable and in compliance with the applicable requirements in 10 CFR 70.22, 70.23, and 70.62.

Integrated Safety Analysis and Integrated Safety Analysis Summary

AREVA adequately implemented its Integrated Safety Analysis (ISA) methodology for identifying high-consequence and intermediate-consequence events associated with the proposed process. AREVA also described the items relied on for safety (IROFS) to prevent or mitigate the consequences of such events. AREVA's ISA Summary and supporting information is acceptable and in compliance with the applicable requirements in 10 CFR 70.62, 70.64, and 70.65.

Radiation Protection

AREVA adequately described its implementation of a radiation protection (RP) program to ensure the health and safety of the workers at the facility, including those involved in the operations of the proposed process. AREVA's description of its RP program is acceptable and in compliance with the applicable requirements in 10 CFR Parts 19, 20, and 70.

Nuclear Criticality Safety

AREVA adequately described its implementation of a nuclear criticality safety (NCS) program to ensure the health and safety of the workers at the facility, including those involved in the operations of the proposed process. AREVA's description of its NCS program is found acceptable and in compliance with the applicable requirements in 10 CFR 70.22, 70.24, 70.52, 70.61, 70.62, 70.64, and 70.65.

Chemical Process Safety

AREVA adequately described its implementation of a chemical process safety program to ensure the health and safety of the workers at the facility, including those involved in the operations of the proposed process. AREVA's description of its chemical process safety program is found acceptable and in compliance with the applicable requirements in 10 CFR 70.22, 70.61, 70.62, 70.64, and 70.65.

Fire Safety

AREVA adequately described its implementation of a fire protection program to ensure the health and safety of the workers at the facility, including those involved in the operations of the proposed process. AREVA's description of its fire protection program is found acceptable and in compliance with the applicable requirements in 10 CFR 70.22, 70.61, 70.62, 70.64, and 70.65.

Emergency Management

AREVA adequately described its implementation of an EP to respond to emergencies associated with the proposed process. AREVA's site-wide emergency plan was previously approved by the NRC on May 1, 2007. AREVA's description of its EP plan in the context of the proposed process is found acceptable and in compliance with the applicable requirements in 10 CFR 70.22 and 70.64(a)(6).

Environmental Protection

AREVA adequately described its implementation of a program to protect the environment from the impacts associated with the proposed process. The description included information pertaining to waste minimization, effluent and environmental monitoring, etc. AREVA's information is considered acceptable and in compliance with the applicable requirements in 10 CFR Parts 20 and 70.

Decommissioning

AREVA adequately described the impacts of the proposed activities on AREVA's decommissioning funding plan for the Richland Fuel Fabrication Facility, and how AREVA will address these impacts. AREVA's information is considered acceptable and in compliance with the requirements in 10 CFR 70.22(a)(9) and 70.25(e).

Management Measures

AREVA adequately described its implementation of a management measures program to ensure that IROFS for the proposed process are available and reliable to perform their intended function when needed. AREVA's information is considered acceptable and in compliance with the requirements in 10 CFR 70.62, 70.64, and 70.72.

Material Control and Accountability

AREVA adequately described its material control and accounting program (MC&A) in the context of the proposed process, which includes implementation of a site-wide FNMCP. AREVA's site-wide FNMCP was previously approved by the NRC on November 5, 2009. AREVA's description of its MC&A program is found acceptable and in compliance with the applicable requirements in 10 CFR 70.22 and 10 CFR Part 74.

Physical Security and Physical Protection

AREVA has a program in place to provide physical security and protection at the facility. The proposed process does not create any critical target areas that could require any revisions to the existing PSP. AREVA's site-wide PSP was previously approved by the NRC on February 18, 2009. AREVA's PSP is found acceptable and in compliance with the applicable requirements in 10 CFR 73.67 for the purpose of the operations of the proposed process.

Exemptions and Special Authorizations

AREVA did not request any exemptions or special authorizations in its license amendment application to support the proposed supercritical CO_2 extraction process.

Environmental Review Pursuant to the National Environmental Policy Act

The environmental impacts associated with AREVA's use of the proposed process (see SER Section 15 below) fit within the environmental impacts previously assessed for the licensed activities. There is no significant increase in the amounts of any effluents that may be released offsite. There is no significant increase in individual or cumulative occupational radiation exposure. There is no construction impact; and there is no significant increase in the potential for, or consequences from, radiological accidents. AREVA's proposed process thus meets the applicable requirements for a CATEX in 10 CFR 51.22(c)(11). Accordingly, neither an environmental assessment nor environmental impact statement is required for this action.

LIST OF ACRONYMS AND ABBREVIATIONS

ADAMS	Agencywide Documents Access and Management System
ADU	Ammonium Diuranate
ALARA	As Low as is Reasonably Achievable
ANS	America Nuclear Society
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
CAA	Controlled Access Area
CAAS	Criticality Accident Alarm System
CATEX	Categorical Exclusion
CEI	Controlled Event Index
CFR	*Code of Federal Regulations*
CM	Configuration Management
CO_2	Carbon Dioxide
CTA	Critical Target Area
DFP	Decommissioning Funding Plan
DHS	Department of Homeland Security
EP	Emergency Management Plan
FFF	Fuel Fabrication Facility
FHA	Fire Hazards Analysis
FNMCP	Fundamental Nuclear Material Control Plan
FR	*Federal Register*
HAZOP	Hazards Operability
HEPA	High Efficiency Particulate Absorbing
HVAC	Heating, Ventilation, and Air Conditioning
IROFS	Items Relied On For Safety
ISA	Integrated Safety Analysis
LEU	Low-enriched Uranium
MC&A	Material Control and Accounting
NCS	Nuclear Criticality Safety
NEPA	National Environmental Policy Act
NRC	U.S. Nuclear Regulatory Commission
NUREG	NRC Technical Report Designation
PSP	Physical Security Plan
QA	Quality Assurance
RAI	Request for Additional Information
RCW	Regulatory Code of Washington
RP	Radiological Protection
SER	Safety Evaluation Report
SNM	Special Nuclear Material
TBP	Tributyl Phosphate
UN	Uranyl Nitrate
UO_2	Uranium Dioxide

1.0 GENERAL INFORMATION

1.1 FACILITY AND PROCESS DESCRIPTION

1.1.1 REGULATORY REQUIREMENTS

The regulatory basis for the review of AREVA's facility and process description is contained in 10 CFR 70.22, "Contents of Applications," and 10 CFR 70.65(b)(1), (2), and (3), "Additional Content of Applications.

1.1.2 REGULATORY ACCEPTANCE CRITERIA

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

1.1.3 STAFF REVIEW AND ANALYSIS

In its license amendment application, AREVA provided a description of the operations associated with the proposed process. AREVA's process would use supercritical carbon dioxide (CO_2) at a pressure of [redacted] to remove uranium from waste material that contains a relatively low percentage of uranium. The waste material is the result of AREVA's fuel manufacturing operations, which were evaluated by the NRC staff during the review of AREVA's license renewal application. The proposed process will be conducted at the existing uranium dioxide (UO_2) building within the AREVA site.

In its license amendment application, AREVA discussed different aspects of the proposed supercritical CO_2 extraction process, including: 1) process conditions; 2) major chemical and mechanical processes associated with the operations; 3) inventory of licensable materials that will be used, generated, or disposed of during the extraction operations; and 4) process vessels and equipment that will support the extraction operations. AREVA supplemented its process description with a flowchart of the proposed process. The flowchart illustrated the different process streams and included quantitative data on these streams. AREVA also described several design changes at a commercial-scale level that will improve industrial safety. These changes were based on operating experience gained by AREVA when the process was tested at a laboratory-scale.

The NRC staff reviewed the information in the license amendment application pertaining to the process description and concluded that AREVA has provided an acceptable description of the proposed operations including the different steps of the supercritical CO_2 extraction process. The NRC staff also reviewed the process description in the Integrated Safety Analysis (ISA) Summary and concluded that the information is consistent with the license amendment application.

1.1.4 EVALUATION FINDINGS

The NRC staff has reviewed the descriptions for AREVA's supercritical CO_2 extraction process in accordance with guidance from Section 1.1 of the Standard Review Plan. AREVA adequately described the supercritical CO_2 extraction process so that the staff has an overall understanding of the operations and the general plan for carrying out the proposed activities. AREVA has cross-referenced its process description with the more detailed descriptions elsewhere in its

license amendment application. The NRC staff concluded that AREVA has complied with the requirements of 10 CFR 70.22, 10 CFR 70.65(b)(1), (2), and (3), as applicable to this section.

1.2 INSTITUTIONAL INFORMATION

1.2.1 REGULATORY REQUIREMENTS

The regulatory basis for the review of AREVA's institutional information are contained in 10 CFR 70.22, "Contents of Applications," and 10 CFR 70.65(b)(1), (2), and (3), "Additional Content of Applications."

1.2.2 REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria applicable to the NRC's review of the institutional information section of the license application are contained in NUREG-1520 (NRC, 2002), Section 1.2.4.3.

1.2.3 STAFF REVIEW AND ANALYSIS

The NRC staff evaluated AREVA's institutional information during the review of AREVA's license renewal application. The review included the following areas: 1) corporate identity; 2) financial qualifications; 3) type, quantity, and form of licensed material; 4) authorized uses; and 5) special exemptions or special authorizations. In its license amendment application, AREVA does not provide any new or revised information pertaining to these areas that could modify the NRC staff's previous analysis and conclusion. Therefore, the NRC staff concluded that AREVA's institutional information, as described in the license renewal application, is also applicable to the proposed supercritical CO_2 extraction process and is, therefore, acceptable.

1.2.4 EVALUATION FINDINGS

The NRC staff has previously reviewed the institutional information for AREVA using guidance in Section 1.2 of the Standard Review Plan. The review was conducted in support of AREVA's license renewal application. AREVA has not provided any new or revised institutional information for the proposed supercritical CO_2 extraction process. As a result, the NRC staff has determined that AREVA has provided adequate institutional information and is in compliance with the applicable requirements in 10 CFR 70.22, and 70.65(b)(1), (2), and (3).

1.3 SITE DESCRIPTION

1.3.1 REGULATORY REQUIREMENTS

The regulatory basis for the review of AREVA's site description is contained in 10 CFR 70.22, "Contents of Applications."

1.3.2 REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria for the NRC's review of AREVA's site description section in the license amendment application are contained in Section 1.3.4 of NUREG-1520 (NRC, 2002).

1.3.3 STAFF REVIEW AND ANALYSIS

The NRC staff evaluated AREVA's site description during the review of AREVA's license renewal application. The review included the following areas: 1) site geography, 2) area demographics, 3) meteorology, 4) hydrology, and 5) geology. In its license amendment application, AREVA does not provide any new or revised information pertaining to these areas that could modify the NRC staff's previous analysis and conclusion. Therefore, the NRC staff concluded that AREVA's site description, as described in the license renewal application, is also applicable to the proposed supercritical CO_2 extraction process and is, therefore, acceptable.

1.3.4 EVALUATION FINDINGS

The NRC staff has previously reviewed the site description for AREVA using guidance in Section 1.3 of the Standard Review Plan. The review was conducted in support of AREVA's license renewal application. AREVA has not provided any new or revised institutional information for the proposed supercritical CO_2 extraction process. As a result, the NRC staff has determined that AREVA has provided adequate site description information, and is in compliance with the applicable requirements in 10 CFR 70.22.

1.4 REFERENCES

(NRC, 2002) U.S. Nuclear Regulatory Commission, NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," March 2002.

(AREVA, 2008a) "Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257)," June 12, 2008 (ADAMS Accession Number ML081700146).

(AREVA, 2008b) "Revised Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257)," Redacted Version, August 22, 2008 (ADAMS Accession Numbers ML082420070 and ML082420071).

(NRC, 2009a) January 28, 2009, Memorandum from R.L. Rodriguez to P. Habighorst, "Summary of Site Visit to AREVA NP, Inc. Richland, Washington Facility to Support Safety Review of CO_2 License Amendment Application," (ADAMS Accession Number ML090230589).

(NRC, 2009b) April 24, 2009, Safety Evaluation Report for the Renewal of License No. SNM-1227 for the AREVA NP, Inc. Fuel Fabrication Facility in Richland, Washington" (ADAMS Accession Number ML090760702).

2.0 ORGANIZATION AND ADMINISTRATION

2.1 REGULATORY REQUIREMENTS

The regulatory basis for the review of AREVA's organization and administration are contained in 10 CFR 70.22, "Content of Applications;" 10 CFR 70.23, "Requirements for the Approval of Applications;" and 10 CFR 70.62(d), "Safety Program and Integrated Safety Analysis."

2.2 REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria for 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

The NRC staff evaluated AREVA's organization and administration during the review of AREVA's license renewal application. The review included the following areas: 1) organization responsibility and authority, 2) technical qualifications of the individuals performing licensed activities, and 3) administration of safety programs. In its license amendment application, AREVA does not provide any new or revised information pertaining to these areas that could modify the NRC staff's previous analysis and conclusion. During the NRC's site visit in December 2008, AREVA explained the protocols for commissioning and startup of the proposed process. AREVA also described a specific qualification program for personnel that will work directly on the proposed process. Trained personnel will be re-qualified every two years and will also be re-trained if there are changes to any procedures or aspects of the proposed process. AREVA will implement its programs for fire safety, emergency management, and management measures consistent with their description in the AREVA's license renewal application. The NRC staff evaluated these programs for their applicability to the proposed process and their review is documented in Chapters 7, 8, and 11 of this Safety Evaluation Report (SER). Therefore, the NRC staff concluded that AREVA's organization and administration, as described in the license renewal application and supplemented during the December 2008 site visit, is applicable to the proposed supercritical CO_2 extraction process and is, therefore, acceptable.

2.4 EVALUATION FINDINGS

The NRC staff has previously reviewed the organization and administration for AREVA using guidance in Chapter 2 of the Standard Review Plan. The review was conducted in support of AREVA's license renewal application. AREVA has not provided any new or revised information pertaining to its organization and administration for the proposed supercritical CO_2 extraction process that could modify the NRC staff's previous analysis and conclusion. Therefore, the NRC staff has determined that AREVA has an acceptable organization; administrative policies; sufficient, competent resources to safely operate the proposed supercritical CO_2 extraction process; and is in compliance with the applicable requirements in 10 CFR 70.22, 70.23, and 70.62(d).

2.5 REFERENCES

(NRC, 2002) U.S. Nuclear Regulatory Commission, NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," March 2002.

(AREVA, 2008a) "Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257)," June 12, 2008 (ADAMS Accession Number ML081700146).

(AREVA, 2008b) "Revised Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257)," Redacted Version, August 22, 2008 (ADAMS Accession Numbers ML082420070 and ML082420071).

(NRC, 2009a) January 28, 2009, Memorandum from R.L. Rodriguez to P. Habighorst, "Summary of Site Visit to AREVA NP, Inc. Richland, Washington Facility to Support Safety Review of CO_2 License Amendment Application," (ADAMS Accession Number ML090230589).

(NRC, 2009b) April 24, 2009, Safety Evaluation Report for the Renewal of License No. SNM-1227 for the AREVA NP, Inc. Fuel Fabrication Facility in Richland, Washington," (ADAMS Accession Number ML090760702).

3.0 INTEGRATED SAFETY ANALYSIS AND INTEGRATED SAFETY ANALYSIS SUMMARY

3.1 REGULATORY REQUIREMENTS

The regulatory basis for the review of AREVA's ISA and ISA Summary are contained in 10 CFR 70.62, "Safety Program and Integrated Safety Analysis;" 10 CFR 70.64, "Requirements for new Facilities or new Processes at Existing Facilities;" and 10 CFR 70.65, "Additional Content of Applications."

3.2 REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria for the NRC's review of the applicant's ISA and ISA Summary are outlined in Sections 3.4.3.1 and 3.4.3.2 of NUREG-1520 (NRC, 2002).

3.3 STAFF REVIEW AND ANALYSIS

During the NRC staff's review of the original site-wide ISA Summary, the NRC staff found the ISA Summary to be in compliance with the requirements for content and methodology; and a detailed technical evaluation report was prepared in support of this review. The site-wide ISA Summary was approved by the NRC staff on October 25, 2007. The license amendment application for the CO_2 extraction process included a supplement to the ISA Summary chapter for the UO_2 building, where the proposed process will be installed.

The NRC staff reviewed the ISA Summary for the proposed process and concluded that it meets the requirements in 10 CFR 70.62 and 70.65 with respect to its content and demonstrates that all credible high-consequence and intermediate-consequence events meet the safety performance requirements of 10 CFR 70.61.

BASELINE DESIGN CRITERIA

A discussion of Baseline Design Criteria was included in Chapter 9 of the license amendment application. The staff's review of each criterion is discussed below:

Quality Standards and Records

Using the guidance in NUREG-1520 (NRC, 2002), the NRC staff reviewed existing commitments in AREVA's license for design control, procurement, procedures, drawings, document control, inspection, testing, and control of measuring and test equipment and finds these commitments to be adequate for meeting the requirements of 10 CFR 70.64(a)(1).

Natural Phenomena Hazards

The NRC staff reviewed the information provided in Section 7.1.1 of the site-wide ISA Summary and finds that it addresses historical storms, earthquakes, tornados, flood, volcanoes, and hurricanes and is adequate for meeting the requirements of 10 CFR 70.64(a)(2).

Fire Protection

The NRC staff reviewed existing commitments in AREVA's license for fire protection, including the existing programs for monitoring combustible loading. The NRC staff notes that AREVA did not request any changes to its fire safety program to support the supercritical CO_2 extraction

process. The NRC staff reviewed Section 7.2.3 of the site-wide ISA Summary and concludes that the commitments and analyses were found adequate for meeting the requirements of 10 CFR 70.64(a)(3) for the purpose of the proposed process. Further discussion concerning AREVA's fire protection program can be found in Chapter 7 of this SER.

Environmental and Dynamic Effects

The NRC staff reviewed the information provided in Section 9.2 of the license amendment application and finds that it provides direction to the site-wide ISA Summary which addresses environmental and other external effects. Section 7.1.2 of the existing site-wide ISA Summary contains a detailed evaluation of building design criteria of the area where the proposed process is installed, as well as historical and postulated events. Section 8.4 of the license amendment application clarifies that gaseous releases pass through HEPA filters prior to being exhausted, and liquid releases are captured and recovered within the UO_2 Building. The NRC staff finds the information provided in the license amendment application and the ISA Summary to be adequate for meeting the requirements of 10 CFR 70.64(a)(4).

Chemical Protection

Using the guidance in NUREG-1520 (NRC, 2002), the NRC staff reviewed AREVA's commitments for protection against the hazards from chemicals in the proposed process. A detailed description of hazardous chemicals related to the new process, their quantities and concentrations is provided in Section 8.2 of the amendment request. Additional information on the consequences of accidents affecting the listed chemicals, as well as the items relied on for safety (IROFS) and indices of overall likelihood are contained in the supplemental ISA scenarios provided with the amendment request. The NRC staff finds the program commitments in the license amendment application, plus the additional discussion provided in the ISA Summary, to be adequate for meeting the requirements of 10 CFR 70.64(a)(5).

Emergency Capability

Using the guidance in NUREG-1520 (NRC, 2002), the NRC staff reviewed the commitments in Section 9.6 of the license amendment application, as well as prior commitments in the site Radiological Contingency and Emergency Plan. Emergency scenarios and responses are contained in Section 7.2.3.2 of the site-wide ISA Summary. The NRC staff finds the information provided in these documents to be adequate for meeting the requirements of 10 CFR 70.64(a)(6).

Utility Services

Using the guidance in NUREG-1520 (NRC, 2002), the NRC staff reviewed the license amendment application—as well as commitments made during the site visit—and verified that there are no scenarios that exceed the 10 CFR 70.61 performance requirements that are not addressed in the site-wide ISA Summary. The NRC staff finds the commitments adequate for meeting the requirements of 10 CFR 70.64(a)(7).

Inspection, Testing, and Maintenance

The amendment request commits fully to the information in Chapter 8 of the site-wide ISA Summary. The NRC staff examined the descriptions of preventive and corrective maintenance and functional testing programs associated with IROFS, as well as other management

measures, and finds the information provided to be adequate for meeting the requirements of 10 CFR 70.64(a)(8).

Criticality Control

A detailed discussion of this review area is included in Chapter 5 of this SER. The NRC staff determined that the risk of nuclear criticality was not credible in many cases due to the application of passive controls. In other cases, the risk of nuclear criticality was ensured to be highly unlikely due to the application of independent reliable controls. The NRC staff finds the commitments adequate for meeting the requirements of 10 CFR 70.64(a)(9).

Instrumentation and Controls

The license amendment application commits fully to the information in Chapter 8 of the site-wide ISA Summary. Instruments are specified, installed, and tested in accordance with site engineering standards; and entered into the site Instrument Repetitive Maintenance system, as well as the corrective action program, in the event of a failure. Instruments are subject to functional testing and additional management measures commensurate with risk. The NRC staff examined the descriptions of programs and concluded that they are adequate for meeting the requirements of 10 CFR 70.64(a)(10).

3.4 EVALUATION FINDINGS

The NRC staff concluded that AREVA's safety program, if established and maintained pursuant to the requirements in 10 CFR 70.62, 70.64, and 70.65, is adequate to provide reasonable assurance that IROFS will be available and reliable to perform their intended safety function(s) when needed, and in the context of the performance requirements of 10 CFR 70.61.

Many hazards and potential accidents can result in unintended exposure of persons to radiation, radioactive materials, or toxic chemicals incident during the processing of licensed materials. The NRC staff finds that AREVA has performed an ISA to identify and evaluate those hazards and potential accidents, as required by the regulations. The NRC staff reviewed the ISA Summary and other information pertaining to the supercritical CO_2 extraction process, and finds that it provides reasonable assurance that AREVA has identified IROFS and established engineered and administrative controls to ensure compliance with the performance requirements of 10 CFR 70.61. Specifically, the NRC staff finds that the ISA results, as documented in the ISA Summary for the proposed process, provided reasonable assurance that the IROFS, the management measures, and AREVA's programmatic commitments will, if properly implemented, make all credible intermediate-consequence accidents "unlikely," and all credible high-consequence accidents "highly unlikely."

3.5 REFERENCES

(NRC, 2002) U.S. Nuclear Regulatory Commission, NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," March 2002.

(NRC, 2007) October 25, 2007, letter from the U.S. NRC to R.E. Link, "Approval of Integrated Safety Analysis Summary (TAC L31856)," (ADAMS Accession Number ML072290197).

(AREVA, 2008a) "Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257)," June 12, 2008 (ADAMS Accession Number ML081700146).

(AREVA, 2008b) "Revised Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257)," Redacted Version, August 22, 2008 (ADAMS Accession Numbers ML082420070 and ML082420071).

(NRC, 2009a) January 28, 2009, Memorandum from R.L. Rodriguez to P. Habighorst, "Summary of Site Visit to AREVA NP, Inc. Richland, Washington Facility to Support Safety Review of CO_2 License Amendment Application," (ADAMS Accession Number ML090230589).

4.0 RADIATION PROTECTION

4.1 REGULATORY REQUIREMENTS

4.1.1 RADIATION PROTECTION PROGRAM IMPLEMENTATION

Regulations applicable to the establishment of a *radiation protection* (RP) program are presented in 10 CFR Part 20, Subpart B, “Radiation Protection Programs.”

4.1.2 AS LOW AS IS REASONABLY ACHIEVABLE PROGRAM

Regulations applicable to the As Low as is Reasonably Achievable (ALARA) program are presented 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 RP 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 are presented in 10 CFR 70.22, “Contents of Applications.”

4.1.5 TRAINING

The following regulations apply to the Radiation Safety Training Program:

1. 10 CFR 19.12 “Instructions to workers”

2. 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 10 CFR 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 10 CFR Part 20 are applicable to radiation surveys and monitoring programs:

1. Subpart C “Occupational Dose Limits”

2. Subpart F “Surveys and Monitoring”

3. Subpart L “Records”

4. Subpart M “Reports”

4.1.8 ADDITIONAL PROGRAM REQUIREMENTS

The following regulations are applicable to the additional program requirements:

1. Section 70.61 ”Performance requirements”

2. 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

The NRC staff evaluated AREVA’s RP program during the review of AREVA’s license renewal application. The review included the following areas: 1) RP program implementation, 2) organization and personnel qualifications, 3) written procedures, 4) training, 5) ventilation and respiratory protection program, 6) radiation survey and monitoring program, and 7) additional program requirements. AREVA has requested an amendment to its special nuclear material (SNM) license to extract UO_2 from waste ash using supercritical CO_2. Although this operation is new to AREVA, laboratory and scale-up testing during development provided some operating experience.

The radiological hazards for the supercritical CO_2 extraction process are limited to exposure to low-enriched uranium, which is comparable to current licensed operations. The facility’s RP program will be extended to the CO_2 operations. The current RP program includes qualified staff, training, personal protective equipment, surveys, bioassay, etc., which will be used to maintain doses to the worker ALARA. The facility will be operated in accordance with written RP procedures for normal operations and temporary radiation job permits will be issued for non-routine activities. The commitment to apply the RP program and procedures for the existing facility to the new CO_2 extraction process provides reasonable assurance of compliance with the RP program requirements in 10 CFR Part 20.

Direct radiation is not a hazard for this facility due to the limited enrichment and the low quantity of licensed material in the proposed operations. However, internal exposure is possible if a leak or vessel failure results in a sudden, high-pressure release of hazardous process materials. Such a release could cause occupational inhalation of aerosols containing soluble uranium. AREVA’s ISA Summary identifies three basic types of high- pressure releases: 1) a release at the extractor vessel, 2) a piping failure, and 3) a column failure. Exposures from these types of releases were analyzed in the ISA Summary. They were determined to be “highly unlikely” based on the construction and maintenance of the pressure systems in accordance with applicable codes and standards. The pressure systems are constructed of stainless steel and ductile materials which resist corrosion and would develop small leaks prior to failure. Since AREVA is relying on construction and maintenance of the pressure vessel systems in accordance with industry codes and standards to demonstrate regulatory compliance, a safety condition S-6 is incorporated into the license which states:

S-6 Pressure vessels used in the supercritical CO_2 extraction process that have an outside diameter of more than six inches shall be constructed, certified, and maintained in accordance with the American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section VIII, Division 1, without exception.

The NRC staff also reviewed the potential for exposure through injection of process materials resulting from leaks in the pressurized system. These injections exposures were evaluated by AREVA and determined to be non-credible. The limited quantity of material, the pressure system design, and maintenance provide reasonable assurance that doses associated with the proposed supercritical CO_2 extraction process will be maintained ALARA.

Additional features have been designed into the CO_2 system to reduce the potential and consequences of a high-pressure release. Pressure relief valves have been incorporated into the system to discharge gaseous and aerosol releases through the building exhaust and dual High Efficiency Particulate Absorbing filtration. Containment hoods and glove boxes are used with ash handling to minimize airborne exposure. Process enclosures have been designed to maintain a negative pressure during system breaches. Pressure sensors have been installed in the ducting to activate sufficient exhaust capacity to absorb and filter the largest postulated system breach. In addition, shut-off valves are designed to localize any system breach. The enclosures, ventilation, and airborne filtration provide additional safety features which will mitigate the internal exposure due to a release from the uranium recovery system.

4.4 EVALUATION FINDINGS

AREVA has applied a three-tiered approach to provide RP for the supercritical CO_2 extraction process which includes: 1) implementation of the facility-wide RP program on the proposed process; 2) design and maintenance of the pressure vessel system in accordance with industry codes and standards; and 3) incorporation of safety features such as sensors, ventilation, and isolation barriers. These characteristics mitigate the hazards of operating a high-pressure system and provide reasonable assurance of compliance with the regulatory requirements in 10 CFR 19, 20, and 70.

4.5 REFERENCES

(NRC, 2002) U.S. Nuclear Regulatory Commission, NUREG-1520, “Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility,” March 2002.

(AREVA, 2008a) “Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257),” June 12, 2008 (ADAMS Accession Number ML081700146).

(AREVA, 2008b) “Revised Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257),” Redacted Version, August 22, 2008 (ADAMS Accession Numbers ML082420070 and ML082420071).

(AREVA, 2009a) June 5, 2009, from R.E. Link to the NRC, “Response to Request For Additional Information Regarding the Review of the AREVA NP Inc., Fuel Fabrication Facility Supercritical CO_2 License Amendment Application; License No. SNM-1227 (Docket No. 70-1257/ TAC L32689),” (ADAMS Accession Number ML091600100).

(AREVA, 2009b) July 13, 2009, letter from R.E. Link to the U.S. NRC, “Amended Response to Request For Additional Information Regarding the Review of the AREVA NP Inc., Fuel Fabrication Facility Supercritical CO_2 License Amendment Application; License No. SNM-1227 (Docket No. 70-1257/TAC L32689),” (ADAMS Accession Number ML091960345).

5.0 NUCLEAR CRITICALITY SAFETY

5.1 REGULATORY REQUIREMENTS

The review of AREVA's nuclear criticality safety (NCS) program verified that the information AREVA 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.

5.2 REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria for the NRC's review of AREVA's NCS program are outlined in Section 5.4 of NUREG-1520 (NRC, 2002). This includes the commitment to use NRC Regulatory Guide 3.71, Revision 1, which endorses the use of the American National Standards Institute/American Nuclear Society, Series-8 NCS standards, with some exceptions.

5.3 STAFF REVIEW AND ANALYSIS

The primary purpose of this review is to ensure that the proposed CO_2 process meet the requirements of 10 CFR 70.24, 70.61, and 70.64 as they relate to NCS. In addition to reviewing the license amendment application, the NRC staff also reviewed the current license, the approved ISA methodology, and other AREVA documents to verify that existing AREVA commitments were followed and are sufficient to ensure the safety of the process. Information which is significant to this determination is described in this section. The NRC staff did not review existing processes which will receive the product and waste streams from the new process.

5.3.1 LICENSE COMMITMENTS

AREVA has not requested a change to its safety program commitments as part of this license amendment application. The safety programs will be applied to the new process consistent with existing license commitments.

In the license renewal application, AREVA committed to follow the double contingency principle as part of its NCS program. Thus, where practicable, process designs shall incorporate sufficient factors of safety during normal and credible abnormal conditions to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality accident is possible.

Using the guidance in NUREG-1520 (NRC, 2002), the NRC staff has reviewed AREVA's existing commitments in light of the application for a new process and finds that they continue to be acceptable for the proposed process. Specifically, the commitment to the double contingency principle is sufficient to meet the requirement in 10 CFR 70.64(a)(9).

5.3.2 ISA SUMMARY

The purpose of the ISA Summary review is to verify that AREVA complied with the requirements of 10 CFR 70.65(b) as it relates to NCS. The ISA Summary requirements—important for NCS that are reviewed in this section—are 10 CFR 70.65(b)(3), (4), (6), and (8). Review of criticality accident alarm system (CAAS) information (10 CFR 70.65(b)(4)) is discussed in Section 5.3.4.

Review of management measures (10 CFR 70.65(b)(4)) is discussed in Section 5.3.3. Review of other ISA Summary requirements is discussed in Section 5.3.1.

1. Process Description

The process will extract uranium enriched up to 5.0 wt% ^{235}U from incinerator ash using supercritical CO_2 as the process solvent. [redacted] are used in the process to convert the uranium oxide contained in the ash into uranyl nitrate. The uranyl nitrate (UN) solution is then transferred to storage tanks where it will be fed into existing facility processes.

The ash is generated as part of the existing waste handling operations and is stored onsite. Both the product and waste streams from the new process will be transferred to existing facility operations. These existing operations were not reviewed as part of this license amendment application because they were reviewed in the license renewal SER; they did not substantially change as a result of this new process.

The NRC staff has reviewed the process description in the ISA Summary using NUREG-1520 (NRC, 2002) and finds it acceptable. Specifically, AREVA provided sufficient information in the ISA Summary to determine where criticality hazards exist and how operations might impact NCS.

2. Performance Requirements

AREVA must provide information to demonstrate that criticality accidents will be at least "highly unlikely" in accordance with 10 CFR 70.61(b) and that that the process will be subcritical under normal and credible abnormal conditions in accordance with 10 CFR 70.61(d). The NRC staff only considered those controls designated as IROFS when it reviewed the ISA Summary for compliance with these requirements.

AREVA uses an index method to evaluate risk and compliance with the performance requirements of 10 CFR 70.61. On October 25, 2007, the NRC staff approved AREVA's initial ISA Summary with the understanding that a Controlled Event Index (CEI) of -4 would be limited to a small number of high-consequence events. All other high consequences were expected to have a CEI ≤ -5. For this review, the NRC staff verified that all criticality accident sequences listed in the ISA Summary had a CEI ≤ -5.

Ash buckets are favorable geometry containers and are administratively limited to no more than 45 percent of a critical mass. The combined uranium content of staged buckets in a process batch is limited to 15.8 kg (IROFS 6910), equivalent to about 18 kg of UO_2. The plant computer system will not allow a label to be printed for an over-batched container. The license amendment application included a nuclear criticality safety (NCS) analysis which demonstrated that the staging conveyer will be subcritical under credible abnormal conditions.

The ash preparation equipment will not be a favorable geometry. Pipe and roof integrity is identified as an IROFS to prevent external sources of water from entering the process equipment. No IROFS were identified which would ensure that the feed material is dry before it enters the process; instead, AREVA identifies two mass controls (IROFS 6910 and 6911) to prevent a criticality accident. IROFS 6910 is described above. IROFS 6911 prevents the addition of ash into the preparation equipment if more than 7 kg of material is held up in the system.

IROFS 6910 and 6911 were determined to be independently capable of preventing a criticality accident. Associated with IROFS 6910 is a management measure to clean out the preparation equipment after each process batch. This management measure ensures that less than a critical mass will be inside the preparation equipment, even if IROFS 6911 fails. If IROFS 6910 fails, IROFS 6911 does not ensure that less than a critical mass of material will be put into the process. However, the in-feed scale associated with IROFS 6911 will ensure that the contents (ash, uranium, water, etc.) of each bucket do not exceed 18 kg. Thus, IROFS 6911 will ensure that the worst case credible combination of UO_2 and water is subcritical.

Several types of process upsets were identified that could cause incomplete extraction of uranium from the ash. This could lead to a criticality if the spent ash is transferred to the 55-gallon waste drum. Two independent assays are identified as IROFS which will prevent this transfer from occurring if the uranium content of the spent ash is too high.

The process columns, piping, and other equipment are favorable geometry IROFS based on conservative assumptions about the material in the process. AREVA also considered spills, leaks, processing of the wrong fissile material (e.g., pellets), and transfer of fissile material to the wrong place (e.g., chemical supply tanks) to be credible initiating events. For each of these events, appropriate IROFS were identified to prevent a criticality accident from occurring.

The NRC staff also reviewed the summaries of NCS evaluations and calculations provided with the license amendment application and in response to NRC's request for additional information (RAI). The summaries indicated that AREVA used conservative assumptions, relative to the normal and credible abnormal process conditions, in the NCS evaluations and calculations.

Using the guidance in NUREG-1520 (NRC, 2002), the NRC staff has reviewed the information provided in the ISA Summary and supporting NCS documents to demonstrate compliance with the performance requirements of 10 CFR 70.61 and finds it is acceptable. Specifically, the NRC staff has reasonable assurance that: 1) each portion of the process has been evaluated for NCS, 2) criticality accidents will be at least highly unlikely, and 3) the process will be adequately subcritical under normal and credible abnormal conditions.

3. Defense-in-Depth

The process has been designed with very conservative assumptions for NCS. The ash is expected to be dry and have low concentrations of uranium. The extraction process itself does not produce high uranium concentrations. Most of the favorable geometry process vessels have dimensions which are significantly smaller than what is necessary for a criticality to occur. Where practical, AREVA identified fixed, favorable geometry equipment as the primary means of preventing a criticality accident. In addition, AREVA did not credit the separation columns packing for any volume displacement.

The NRC staff has reviewed the information provided in the license amendment application and ISA Summary as it relates to the defense-in-depth practices required by 10 CFR 70.64(b).

Using the guidance in NUREG-1520 (NRC, 2002), the NRC staff reviewed this information and finds it acceptable. Specifically, the NRC staff has reasonable assurance that AREVA has designed the process with a preference for engineered controls and will operate it in a manner which limits the challenges to NCS IROFS.

4. IROFS and Sole IROFS

The ISA Summary submitted with the license amendment application indicated that several passive engineered controls used to demonstrate that criticality accidents were not credible or highly unlikely were not designated as IROFS. In its letter dated June 5, 2009, AREVA stated that it considered these controls to be "design features" and not IROFS. AREVA defined a design feature as a passive engineered control that cannot credibly fail except due to a loss of configuration control. It further considered the loss of configuration control applied to these design features to be at least "highly unlikely."

The NRC staff noted that the use of design features was not described in the AREVA's approved ISA methodology on October 25, 2007, or in the associated NRC Technical Evaluation Report. The reliance on "design features" to demonstrate the safety of the process, without designating them as IROFS, conflicts with AREVA's definitions for "credible" and "highly unlikely."

The NRC staff also noted that some "design features" were equivalent to IROFS identified for existing processes. On May 6, 2009, the NRC staff questioned why AREVA was taking a different approach to identifying controls.

In response to these concerns, AREVA agreed to designate process design features and other controls as IROFS via letters dated November 11, 2009, and February 4, 2010. In addition, inappropriate configuration modification is identified as a credible accident initiator. AREVA uses a generic IROFS designation for some design features relied on to prevent a criticality accident. This generic IROFS includes structures, systems, and components such as favorable geometry equipment, floors, dikes, and piping. Other design features, such as an air break, were designated as specific IROFS. This response adequately addresses the concern regarding the use of design features to meet the performance requirements without calling them IROFS.

AREVA does not identify any sole IROFS for this license amendment application.

Using the guidance in NUREG-1520 (NRC, 2002), the NRC staff has reviewed the descriptive list of NCS IROFS in the ISA Summary and finds it acceptable. For each credible criticality accident sequence identified in the ISA Summary, the list included the IROFS needed to render the sequence "highly unlikely." The descriptions were sufficient to understand how the IROFS would prevent a criticality from occurring.

5.3.3 MANAGEMENT MEASURES

By letter dated November 11, 2009, AREVA identified configuration control as an IROFS for certain accident sequences. The NRC staff noted that configuration control is a management measure applied to IROFS to ensure their availability and reliability. The NRC staff determined that configuration control cannot be designated as an IROFS, since the risk index for the IROFS already factors in the applied management measures. In response to this issue, AREVA removed configuration control from its list of IROFS and identified other controls as IROFS to demonstrate compliance with the performance requirements. There were no changes to the management measure program that would affect criticality safety. Appropriate management measures were listed in the ISA Summary for each IROFS.

Using the guidance in NUREG-1520 (NRC, 2002), the NRC staff reviewed AREVA's descriptions of management measures to be applied to the new process and finds that they are acceptable.

5.3.4 CRITICALITY ACCIDENT ALARM SYSTEM

The licensee has not requested any changes to its commitments regarding the CAAS. This process is being installed in a location which already required CAAS coverage; therefore, a review of information in the ISA Summary regarding CAAS placement was not performed since it is not expected to change significantly. The NRC staff has reasonable assurance that AREVA will continue to maintain a CAAS that meets the requirements of 10 CFR 70.24 and include information about the CAAS in the ISA Summary to comply with 10 CFR 70.65(b)(4).

5.4 EVALUATION FINDINGS

Based on this review, the NRC staff has reasonable assurance that AREVA has conducted an ISA for the proposed uranium extraction process that adequately:

1. Identified all credible criticality accidents.

2. Identified controls to prevent each credible criticality accident to meet the performance requirements and provide defense-in-depth.

3. Designated as IROFS those controls relied on to meet the performance requirements, as required by 10 CFR 70.61(e).

4. Identified management measures which will be applied to IROFS to ensure they will be available and reliable to perform their function when needed, as required by 10 CFR 70.62(d).

Therefore, the NRC staff has reasonable assurance that the performance requirements of 10 CFR 70.61, as they relate to NCS, will be met. In addition, the staff has reasonable assurance that AREVA will continue to maintain a CAAS in compliance with the requirements of 10 CFR 70.24 and adhere to the double contingency principle as required in 10 CFR 70.64(a)(9). The staff concurs that AREVA's conduct of operations for the proposed process will ensure that fissile material will be possessed, stored, and used safely according to the requirements in 10 CFR Part 70. Based on this review, the staff concluded that the licensee's 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.

5.5 REFERENCES

(NRC, 2002) U.S. Nuclear Regulatory Commission, NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," March 2002.

(NRC, 2007) October 25, 2007, letter from the U.S. NRC to R.E. Link, "Approval of Integrated Safety Analysis Summary (TAC L31856)," (ADAMS Accession Number ML072290197).

(AREVA, 2008a) "Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257)," June 12, 2008 (ADAMS Accession Number ML081700146).

(AREVA, 2008b) "Revised Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257)," Redacted Version, August 22, 2008 (ADAMS Accession Numbers ML082420070 and ML082420071).

(NRC, 2009a) January 28, 2009, Memorandum from R.L. Rodriguez to P. Habighorst, "Summary of Site Visit to AREVA NP, Inc. Richland, Washington Facility to Support Safety Review of CO_2 License Amendment Application," (ADAMS Accession Number ML090230589).

(AREVA, 2009b) June 5, 2009, from R.E. Link to the NRC, "Response to Request For Additional Information Regarding the Review of the AREVA NP Inc., Fuel Fabrication Facility Supercritical CO_2 License Amendment Application; License No. SNM-1227 (Docket No. 70-1257/ TAC L32689)," (ADAMS Accession Number ML091600100).

(AREVA, 2009c) July 13, 2009, letter from R.E. Link to the NRC, "Amended Response to Request For Additional Information Regarding the Review of the AREVA NP Inc., Fuel Fabrication Facility Supercritical CO_2 License Amendment Application; License No. SNM-1227 (Docket No. 70-1257/TAC L32689)," (ADAMS Accession Number ML091960345).

(AREVA, 2009d) November 11, 2009, letter from R.E. Link to the NRC, "Revised Responses to NRC Requests for Additional Information (RAIs) on the AREVA NP Inc. Supercritical CO_2 System License Amendment (TAC L32689)," (ADAMS Accession Number ML093210178).

(AREVA, 2009e) December 4, 2009, letter from R.E. Link to NRC, "Clarifications to AREVA's Responses to NRC's Request for Additional Information (RAI) Related to the AREVA NP Inc., Supercritical CO_2 System License Amendment (TAC L32689)," (ADAMS Accession Number ML093420082).

(AREVA, 2009f) December 14, 2009, e-mail from Calvin Manning to Rafael Rodriguez and Blake Purnell, Subject: "Re: Bkg. Information Re: December 4, 2009, Submittal," (ADAMS Accession Number ML101040903).

(AREVA, 2010a) February 4, 2010, letter from R.E. Link to the NRC, "Responses to NRC's Request for Additional Information Related to the AREVA NP Inc. Supercritical CO_2 System License Amendment (TAC L32689)," (ADAMS Accession Number ML100430771).

6.0 CHEMICAL SAFETY

6.1 REGULATORY REQUIREMENTS

The regulatory bases for this review are the general and additional contents of an application that address chemical-process safety, as required by 10 CFR 70.22, and 70.65. In addition, the chemical process safety review is intended to provide a determination of compliance with the performance requirements, safety program and ISA, and requirements for new processes (including baseline design criteria), as required by 10 CFR 70.61, 70.62, and 70.64.

6.2 REGULATORY ACCEPTANCE CRITERIA

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

6.3 STAFF REVIEW AND ANALYSIS

The NRC staff reviewed the licensee's amendment application and its ISA Summary submitted by AREVA and considered the following areas:

1. Chemical Process Description,

2. Chemical Accident Sequences,

3. Chemical Accident Consequences,

4. Items Relied on for Safety (IROFS), and

5. Process Safety Management

The NRC staff evaluated AREVA's ISA documents and responses to requests for additional information (RAIs) during an onsite visit in December 2008 in order to have a better understanding of the processes and safety requirements. The NRC staff also supplemented its evaluation by reviewing additional, publicly available information, as needed. These sources are referenced in Section 6.5 of this SER. The evaluation is summarized in the following sections.

6.3.1 CHEMICAL PROCESS DESCRIPTION

6.3.1.1 EXISTING PROCESSES AT THE FACILITY

The primary operation of the facility is the manufacture of nuclear fuel assemblies for use in commercial light water reactors. The license renewal application provided an adequate description of the primary manufacturing activities. They are supported by a large number of production support activities—including, but not limited to—materials storage, waste processing, analytical/physical testing, and facilities/equipment maintenance. Further information on the existing processes and facilities are found in the license renewal application and the associated SER. As stated in the license renewal SER, the NRC staff found the existing processes and facilities provided reasonable assurance of adequate safety for NRC-regulated aspects of chemical safety.

6.3.1.2 PROPOSED PROCESS: SUPERCRITICAL CARBON DIOXIDE EXTRACTION SYSTEM

AREVA proposes to install a supercritical CO_2 extraction process in an existing room of the UO_2 building at the facility, as described in Sections 5-7 of the license amendment application. The proposed process would be used to recover low-enriched uranium (LEU) from solid uranium-bearing materials, such as incinerator ash, and recycle it to the fuel fabrication process, thus recovering LEU and reducing or eliminating low level radioactive waste. All process vessels and piping would be manufactured from stainless steels or equivalent (e.g., 316L SS) to minimize corrosion and contamination of the recovered uranium.

The CO_2 process for ashes and solids constitutes a semi-batch process. The license amendment application discussed the specifics of the proposed process. In its letter dated July 13, 2009, and e-mail dated March 18, 2010, AREVA stated that all pressure vessels with an outside diameter of six inches or larger would conform to the American Society of Mechanical Engineers (ASME) Code, Section VIII, Division 1.

AREVA also included a process flow sheet, along with a mass balance. The process flow sheet was consistent with supercritical extraction principles and approaches available in the open literature reviewed by NRC staff [(Clifford et. al., 2001) and (World Nuclear News, 2008)]. The NRC staff performed several checks on the accuracy and consistency of the mass balance table. Such checks were found to be in agreement within 5-10% of AREVA's data, depending on batch times assumed. Such differences are typical for a new process design scaled up from experiments, and are considered acceptable.

The NRC staff concluded that AREVA has provided an adequate description of the proposed process in its license amendment application.

6.3.1.3 LOCATION OF THE PROPOSED PROCESS - UO_2 BUILDING

AREVA plans to install the proposed process in the UO_2 building. The staff reviewed the existing processes and building during the review of the license renewal application (NRC 2009b). The remainder of the building discussion focuses on the area planned for the supercritical CO_2 extraction process.

AREVA describes the planned location of the proposed process in Section 4 of the license amendment application. The supercritical CO_2 extraction process equipment will be installed and operated in [redacted] of the UO_2 building. Detailed process flow sheets and equipment plans provided by the licensee are consistent with the proposed location, and indicate that the majority of the equipment and all of the high pressure ([redacted]) will be located in a hood enclosure with exhaust via the building's existing Heating Ventilation and Air Conditioning (HVAC) system. The latter includes high efficiency particulate absorbing (HEPA) filters prior to discharge. All high-pressure lines would also be located within hood or duct enclosures connected to the building's existing HVAC system.

The NRC staff visited the facility in December 2008 and inspected the planned location of the supercritical CO_2 extraction process and equipment. AREVA identified likely locations for the proposed process equipment and lines, including CO_2 sensors. Specific locations for the sensors would be identified by the vendor. The sensors would utilize the CAAS power supply, which exists in the area. Standard, benign utility lines (water, air, nitrogen) were found in the area—no fuel or chemical supply lines were present. The proposed location is isolated by walls

and doors, and is self-contained. There are no apparent accident scenarios involving interactions with existing facility hazards that would trigger Part 70.61 requirements.

The NRC staff has determined that AREVA has provided an adequate description of the proposed location for the supercritical CO_2 extraction process.

6.3.1.4 USE OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS BOILER AND PRESSURE VESSEL CODE

AREVA is using the current version (2007, issued in 2008) of the American Society of Mechanical Engineers (ASME) Code, Section VIII, Division 1, "Rules for the Construction of Pressure Vessels," without exception. Section VIII is the standard portion of the ASME Code for unfired pressure vessels.

AREVA indicated the following in a conference call with the NRC staff on June 18, 2009:

- All high-pressure vessels will be new.
- All high-pressure piping and tubing will be new.
- All fittings and nozzles will be new.
- The design intentionally minimizes the number of welds in the system.
- The extractor vessels will be machined from monolithic pieces of stainless steel.
- AREVA will conduct routine visual inspections of the extractor vessel internal surfaces and lids for signs of additional corrosion and wear. The inspection will be proceduralized. The inspection may have limited accessibility and visibility of the extractor vessels because of their locations in the ventilation enclosure. Accessibility will not be fully determined until the equipment is installed.
- A certified inspector from the State of Washington will conduct inspections to ensure conformance with the ASME Code.

The State of Washington has jurisdiction over pressure vessels at AREVA, via the Department of Labor and Industries, Division of Specialty Compliance Services, Boiler/Unfired Pressure Vessel Section. The "State of Washington Boilers and Unfired Pressure Vessel Laws" are found in Chapter 70.79 Regulatory Code of Washington and Chapter 296-104 Washington Administrative Code. These endorse and codify ASME Code requirements. Other requirements include:

- A Washington State installation permit is needed.
- There must be internal visual inspections.
- There must be a pressure/hydrostatic test to 1.5 times the maximum working pressure.
- The history of the vessels, including alterations and repairs, must be documented.
- Any repairs must meet ASME Code requirements for the intended service.
- An operational test in the intended service and application must be conducted prior to full operation.
- Additional Non-Destructive Examination may be required by the State or the inspector, based upon operational experience.
- There will be biannual inspections by the State.

The NRC staff contacted the State inspectors on July 21, 2009, to discuss AREVA's proposed process and to discuss the applicable State requirements. The State inspectors stated that they

have been contacted by AREVA regarding pressure vessels for use in a high-pressure system using CO_2. The State inspectors also confirmed the use of the ASME Code and requirements listed above.

Use of the ASME Code is a reasonable, and generally accepted, good engineering practice to improve equipment reliability and minimize the effects of off-normal events and potential accidents. The cited sections appear suitable for addressing the supercritical CO_2 extraction process requirements. The NRC staff concluded this is an acceptable approach.

6.3.1.5 POTENTIAL CORROSION AND EROSION

The supercritical CO_2 extraction process fluids are capable of causing general and localized (specific) corrosion. The license amendment application states that the process vessels and piping/tubing will be fabricated from Type 316L stainless steel. This is stated to be a ductile material with properties that enhance confinement of the high-pressure materials by yielding rather than fracturing.

The NRC staff reviewed one manufacturing form which showed austenitic stainless steels were being used; it also indicated no additional corrosion allowance was included. The NRC staff review found that austenitic stainless steels, such as Type 316L, are frequently used in commercial applications of super critical CO_2 applications to reduce potential corrosion from these chemicals to acceptable levels. AREVA also plans to periodically inspect for potential degradation of the system's materials of construction, which will be incorporated into procedures. The ASME Code is used for design, fabrication, installation, operation, and periodic inspection and maintenance of the supercritical CO_2 extraction pressure vessels and equipment. As noted in Section 6.3.1.4, the supercritical CO_2 extraction process system will be periodically inspected by the State of Washington. AREVA has identified these inspections as IROFS in its letter dated July 13, 2009. Overall, the NRC staff concluded that potential corrosion/erosion concerns are adequately addressed by the use of stainless steels, the application of the ASME Code, and periodic inspections.

6.3.1.6 PRESSURE RELIEF DEVICES

The ASME Code requires pressure relief of pressure vessels. The license amendment application and design documentation included pressure relief devices, and several rupture disks and valves are indicated on the process diagrams. Several of these have been identified with safety functions (see Section 6.3.4).

6.3.1.7 VENTILATION SYSTEMS

Specific information on the HVAC system for each building was included in each process' ISA Summary, in the renewal application. Chapter 18 of the ISA Summary contains information on the plant-wide ventilation system. The ventilation system includes primary filters, ducting for the HEPA filters (upstream and downstream), pre-filters, and the final HEPA banks. The HVAC system was found to be acceptable for the existing processes.

Additional features are present in the location planned for the proposed process. All process vessels and piping/tubing will be located within hoods or ducts connected to the HVAC system in the UO_2 building. A loss of the HVAC will trigger an alarm in the process room. The room will also contain CO_2 detectors and alarms in operator areas. The HVAC loss and CO_2 alarm systems activate on loss of standard electrical power. Both systems are identified as IROFS. Operators will be trained via procedures to evacuate upon activation of either alarm.

The NRC staff has found that the existing ventilation system and extra features in the CO_2 process room are adequate to provide reasonable assurance of adequate safety for protection against potential releases of hazardous chemicals and radiochemicals from the supercritical CO_2 extraction process.

6.3.1.8 PROCESS DESCRIPTION CONCLUSION

Overall, the NRC staff finds that AREVA has provided process descriptions that are sufficiently detailed to allow an understanding of the chemical process hazards and approaches taken by the licensee to address these hazards.

6.3.2 CHEMICAL ACCIDENT SEQUENCE

The license amendment application included information on the chemicals used and their interactions. Specific sequences were included and summarized per the ISA methodology. A summary follows.

6.3.2.1 CHEMICAL SCREENING AND CLASSIFICATION

AREVA identified the chemicals of concern based on one or more characteristics of the chemical or the quantity in storage/use at the facility. For the proposed process, these chemicals are [redacted]

AREVA provided a table of chemicals including quantities and location in Chapter 3 of the ISA Summary. In Chapter 7 of the ISA Summary, AREVA further identified hazardous chemicals (including those with low-consequence accidents) derived from licensed material. For this proposed process, nitrogen dioxide is the principal stable chemical derived from reactions of nitric acid and uranium compounds. Red oil, an organic-nitrate compound formed from reactions of TBP in nitric acid media (the formation is exacerbated by the presence of uranium), is unstable and discussed under chemical interactions in the next section.

AREVA provided a comprehensive list of chemical concentrations and consequence categories for the inhalation pathway in Appendix A in Chapter 8 of the ISA Summary. This list is based upon publicly available information from the American Industrial Hygienist Association, the Department of Energy, and the NRC.

The NRC staff has reviewed the list of chemicals and interactions and concluded that AREVA has appropriately identified chemicals of concerns.

6.3.2.2 HAZARDOUS CHEMICALS AND CHEMICAL INTERACTIONS

Overall facility chemical hazards are discussed in the NRC staff's SER of the license renewal application. This chapter focuses only on the chemicals specific to the supercritical CO_2 extraction process and their hazards and interactions.

TBP/nitric acid reactions are often called red oil reactions. AREVA explained that red oil reactions would occur at a low rate due to the near ambient temperatures of the supercritical CO_2 extraction process, purification of the process solvents and the TBP prior to recycle, and the semi-continuous venting of the process (e.g., when the extractors are cycled). This removes red oil reactants and intermediates, and reduces the potential for red oil events.

Consequently, AREVA concluded that no controls are needed. The NRC staff compared the process conditions with those identified as necessary for significant red oil formation and concerns and concluded that AREVA had appropriately addressed potential red oil reactions.

AREVA stated that nitrogen oxides would be removed from the process during solvent TBP purification and the venting of the process, thus preventing accumulation. Venting would be accomplished via the existing HVAC system/stack, which includes HEPA filters. Nitrogen dioxide formation would be comparable to the existing ADU recovery process and, thus, small. The NRC staff found the explanation and approach provided by AREVA to be acceptable.

AREVA stated that the effects from acid/base neutralization and dilution would be small due to the relatively small quantities involved, high-surface/volume ratios of the equipment, and process temperature control. The NRC staff's review noted that adherence to the ASME Code and the presence of relief devices would mitigate any unanticipated enthalpy and related pressure increases.

In conclusion, the NRC staff has determined that AREVA has adequately described chemical hazards and potentially hazardous chemical interactions.

6.3.2.3 SUMMARY OF CHEMICAL ACCIDENT SEQUENCES

The ISA Summary accident sequences addressed both intermediate- and high-consequence events in the proposed supercritical CO_2 extraction process. Consequences due to radiochemical exposures, chemical exposures, and mechanical injuries were also considered.

The NRC staff's review of the process and hazards involved did not identify any chemical accident categories or sequences overlooked by AREVA. The NRC staff concluded that AREVA has identified appropriate chemical accident sequences based on its use of an approved process hazards analysis method to identify those sequences and the results of the above staff review.

6.3.3 CHEMICAL ACCIDENT CONSEQUENCES FROM THE SUPERCRITICAL EXTRACTION PROCESS

6.3.3.1 METHODOLOGIES FOR ASSESSING CHEMICAL ACCIDENT CONSEQUENCES

In section 6.3.2 of the license renewal application, AREVA committed to the methods used in the ISA to estimate chemical quantitative consequences. The NRC staff previously concluded that AREVA had identified and used appropriate methods and valid assumptions in estimating the consequences from identified chemical accident sequences.

6.3.3.2 Summary of Results for Chemical Accident Consequences

Potential Consequences to a Member of the Public

AREVA stated that there are no consequences of concern to members of the public from potential events involving the supercritical CO_2 extraction process. The NRC staff reviewed AREVA's supporting calculations during its site visit. The NRC staff conducted independent confirmatory calculations that indicated the quantities of NRC regulated chemicals were too small and the distances to the controlled area boundary too large for there to be any consequences of concern to members of the public. Therefore, the NRC staff agrees with the AREVA assessment.

Potential Consequences from Small Leaks, Failures, and Releases

AREVA stated that there would be no consequences of concern to the workers should small leaks from the process piping and equipment occur during operation. AREVA explained that all high-pressure piping and vessels would be within hoods and ducting connected to the building's HVAC system, whose integrity would not be challenged by the fluid release(s). The NRC staff found that, while the ductwork and HVAC are not identified as IROFS, AREVA has identified two administrative control IROFS based upon alarms and evacuation (discussed in Sections 6.3.1.3 and 6.3.1.7) that address the issue. The NRC staff concluded that while potential, unmitigated consequences to workers might be slightly higher than estimated by AREVA, the presence of the ductwork and the IROFS will reduce potential consequences to workers below the intermediate level and, thus, address the safety concern.

Potential Consequences from Large Leaks, Failures, and Releases

The evaluation by AREVA concluded that high consequences could occur to the workers if these types of events occurred. AREVA identified IROFS to prevent or mitigate these types of events. The NRC staff's review agreed that potential consequences from these types of events could be high and that IROFS could provide appropriate prevention or mitigation. The NRC staff's review of the IROFS is discussed in Section 6.3.4.

Potential Consequences from Scenarios Involving the Extractors

The evaluation by AREVA concluded that high consequences could occur to the workers if certain scenarios occurred with the extractors. AREVA identified IROFS to prevent or mitigate these events. The staff's review agreed that potential consequences from these types of events could be high and that IROFS could provide appropriate prevention or mitigation. The NRC staff's review of the IROFS is discussed in Section 6.3.4.

Potential Consequences from HVAC Failures

AREVA did not identify any direct consequences from HVAC failures. However, AREVA noted that a loss of HVAC capability could increase the consequences of other events (e.g., small leaks from the process) and, thus, could have indirect consequences. Consequently, AREVA included two administrative control IROFS based upon alarms. The administrative controls required personnel to evacuate the area if the HVAC system ceased to function (indicated by an alarm) or if excessive CO_2 was detected (indicated by a separate alarm). The alarms would use the same power source as the CAAS. The staff's review found the approach provided reasonable assurance of safety.

Potential Consequences from Human Factors

Operator actions with the potential for intermediate or high consequences primarily occur during the loading and unloading of the extractor vessels, and have been considered. The NRC staff also evaluated potential impacts from deliveries to the process room using heavy equipment. AREVA provided information showing that two of the three types of forklifts used in the process area cannot enter the room (i.e., too large to fit through the doorways into the process area). The third type of forklift is small and could enter the room (although this would not normally be planned). AREVA reviewed the room layout and noted that the forklift would have to make numerous turns before it could impact the hood areas containing the supercritical CO_2 extraction

process. AREVA concluded it was highly unlikely that this type of forklift could make multiple turns and achieve sufficient speed to both penetrate the hood areas and breach the high-pressure boundary. The staff reviewed the information provided by AREVA, the amendment application, and information from the site visit, and similarly concluded that it would be highly unlikely for the small forklift to breach both the hood and the supercritical CO_2 extraction process high-pressure boundary. Other potential human factors would be addressed by process safety management at the facility (Section 6.3.5).

6.3.4 ITEMS RELIED ON FOR SAFETY

6.3.4.1 CHEMICAL PROCESS IROFS

Potential Consequences to a Member of the Public

AREVA stated that no chemical process IROFS are required because no consequences of concern occur. As analyzed previously in Section 6.3.3.2, the NRC staff review agrees that there are no consequences of concern to members of the public from the proposed chemical processes.

Potential Consequences from Small Leaks, Failures, and Releases, and HVAC Failures

AREVA identified alarms for detecting CO_2 outside of the ductwork and alarms on HVAC failure as part of administrative IROFS. Activation of either alarm would result in worker evacuation of the area per procedures and training. Defense-in-depth is provided by application of the ASME Code, Section VIII, Division 1. The NRC staff concluded that these IROFS and the use of the ASME Code provide adequate assurance of safety.

Potential Consequences from Large Leaks, Failures, and Releases

AREVA identified all major pressure vessels of the supercritical CO_2 extraction process as IROFS and subject to the full provisions of the ASME Code, Section VIII, Division 1 for those pressure vessels with an outside diameter greater than six inches. Pressure relief devices on the high-pressure system ([redacted]) were also designated as IROFS. AREVA also identified vessel inspections by an ASME-certified inspector as an administrative control IROFS. As analyzed further in Section 6.3.4.2, the NRC staff found that as-built pressure vessels have failure rates in the unlikely-not unlikely range. However, the application of ASME Code requirements, relief devices, and inspections reduce failure rates into the highly unlikely range. Consequently, the NRC staff concluded that the approach provides reasonable assurances of safety.

Potential Consequences from Scenarios Involving the Extractors

The evaluation by AREVA concluded that high consequences could occur to the workers if certain scenarios occurred with the extractors. AREVA identified engineered and administrative control IROFS to prevent these events, with the majority of the reliability achieved via high reliability, engineered controls. The NRC staff review agreed that potential consequences from these types of events could be high. The NRC staff found that the identified IROFS of engineered design features, interlock/control systems, and operator pressure measurement (internal extractor pressure) would have the appropriate reliabilities and functionalities, and would provide for appropriate prevention of high-consequence scenarios.

6.3.4.2 RELIABILITY OF PRESSURE VESSELS AND PIPING

The NRC staff reviewed pressure vessel reliability in more detail because of its importance in addressing potential catastrophic failures and large leaks of supercritical CO_2 extraction process materials that would result in high consequences to the workers.

Potential catastrophic failures of the pressure vessels have been identified by AREVA as high-consequence events for the workers. Thus, a key design feature is the reliability of the pressure vessels and relief systems for the prevention of catastrophic failures.

Pressure vessels generally have a failure rate of circa 10^{-4}/yr for disruptive events/failures and circa 10^{-3}/yr for non-disruptive events/failures (In general, disruptive events constitute catastrophic failures that lead to the rapid release of a large fraction of the pressurized fluid, while non-disruptive events constitute conditions [e.g., cracking] that could lead to a major release but are caught by inspection before failure occurs.). Application of the applicable ASME Code generally reduces these failure rates by one or two orders of magnitude to the 10^{-5}/yr to 10^{-6}/yr range, thus rendering the high-consequence, catastrophic events highly unlikely. Inspections of the vessels after fabrication, after installation, and periodically during operations are crucial to achieving and maintaining this high reliability by detecting and correcting flaws and corrosion/erosion effects before they propagate and lead to disruptive failures. In addition, the ASME Code requires that relief devices would vent excess fluids (in this case, via blow-down tanks and the HVAC/HEPA exhaust) before rupture could occur.

The NRC staff reviewed several studies performed by different organizations to get additional insights regarding the reliability of pressure vessels and piping that conform to the ASME Code. These organizations include: 1) Pacific Northwest Laboratories, 2) National Aeronautic and Space Administration, and 3) United Kingdom Health and Safety Executive. Based on the information from these sources, the NRC staff concluded that adherence to the ASME Code, including relief devices and periodic inspections, is an acceptable method to satisfy the regulatory requirements of 10 CFR Part 70. Consequently, the NRC staff finds that AREVA's approach to apply the ASME Code, Section VIII, Division 1, with the appropriate inspection protocols and relief devices, is an acceptable means to meet the "highly unlikely" criteria of 10 CFR 70.61.

6.3.4.3 MANAGEMENT MEASURES

AREVA has identified management measures to ensure the availability and reliability of chemical safety IROFS in both Chapter 11 of the license renewal application and Chapter 8 of the ISA Summary. The management measures program, as described in the license renewal application, will be implemented for those IROFS identified for the supercritical CO_2 extraction process.

6.3.4.4 SUMMARY OF THE IROFS REVIEW

AREVA's ISA Summary described the accident sequences and the specific IROFS that are applied to prevent or mitigate the consequences of those accident sequences. The identified IROFS provide protection to prevent or mitigate consequences from potential events involving NRC regulated materials in and associated with the proposed process. Based on reviews of the license amendment application, the NRC staff's onsite visit, review of RAI responses and additional information from AREVA, and publicly available information, the NRC staff concluded that AREVA has identified an appropriate set of IROFS to address chemical and process safety of the proposed process.

AREVA provided information for chemical process IROFS identified for the facility. AREVA's approach uses design approaches typically used in radiochemical facilities, such as the ASME, National Electrical Codes, and National Fire Protection Association codes. Furthermore, AREVA's design of the chemical process systems includes numerous, additional controls and uncredited defenses, in addition to the IROFS, for maintaining safe conditions during operation.

6.3.5 PROCESS SAFETY MANAGEMENT

6.3.5.1 PROCESS HAZARD ANALYSIS

AREVA has performed a Process Hazards Analysis, which will be reviewed and updated every 5 years. The NRC staff reviewed the results of the AREVA hazards operability (HAZOP) analysis as discussed in the ISA Summary. This method is identified as an acceptable method in NUREG-1513 (NRC, 2001). The HAZOP considered a variety of internal process, facility, and external hazards that could breach the process and release licensed material and hazardous chemicals produced from licensed materials, and hazardous chemicals that might affect the safety of licensed materials. The results of AREVA's ISA are presented in the ISA Summary, which contains information concerning the accident sequences identified as a result of the HAZOP, the unmitigated risk of each accident sequence, and the IROFS applied to prevent or mitigate the accident sequence. The NRC staff also reviewed selected high-consequence and intermediate-consequence accident scenarios to confirm that chemical events that could exceed the performance requirements of 10 CFR 70.61 were addressed.

6.3.5.2 CONTRACTORS

In response to an inquiry by the NRC staff, AREVA confirmed that contractor personnel are required to complete both general site training and job-specific training prior to beginning work at the Richland Fuel Fabrication Facility (FFF).

6.3.5.3 PRE-STARTUP SAFETY REVIEW

In response to an inquiry by the NRC staff, AREVA confirmed that pre-startup safety reviews are performed in accordance with internal procedures, including reviews specified by the Engineering Change Notice procedure for new processes.

6.3.5.4 MECHANICAL INTEGRITY

AREVA has identified the high-pressure vessels in the proposed process, the relief devices, and some associated equipment as IROFS (see Section 6.3.4). Consequently, the design, fabrication, installation, operation, maintenance, inspection, and replacement of these components are important attributes for their capability to perform their safety functions. Management measures are applied, as applicable, to maintain mechanical integrity and ensure that they are replaced with like-kind components.

6.3.5.5 MAINTENANCE

AREVA has a mature, functioning maintenance program in place, which includes preventive and recurring (calibration) maintenance on safety-related mechanical components and instruments. Formal programs are in place for scheduling and documentation. Maintenance functions are performed in accordance with approved procedures.

6.3.5.6 Training

In Chapter 11 of the license renewal application, and the license amendment application, AREVA commits to general health and safety training—and training specific to the supercritical CO_2 extraction process.

6.3.5.7 PROCEDURES

AREVA commits to the use of written procedures for licensed activities.

6.3.5.8 AUDITS AND ASSESSMENTS

In Chapter 11 of the license renewal application, and the license amendment application, AREVA commits to maintaining an audit and investigation program to assess activities important to safety or environmental protection.

6.3.5.9 MANAGEMENT OF CHANGE

In Chapter 11 of the license renewal application, and the license amendment application, AREVA commits to controlling the facility safety basis with a management of change program.

6.3.5.10 EMERGENCY PLANNING

In chapter 8 of the license renewal application, and the license amendment application, AREVA commits to maintaining a current emergency plan. The license amendment application further states that no changes are expected due to the presence of the proposed process.

6.3.5.11 INCIDENT INVESTIGATION AND CORRECTIVE ACTIONS

In chapter 11 of the license renewal application, and the license amendment application, AREVA commits to implementing and maintaining an incident and corrective action program.

Based on the above, the NRC staff concluded that AREVA's chemical process safety program provides reasonable assurance of adequate protection against chemical risks produced from licensed material, facility conditions which affect the safety of licensed material and hazardous chemicals produced from licensed material, and meets the requirements of 10 CFR 70.64(a)(5).

6.4 EVALUATION FINDINGS

The NRC staff evaluated the license amendment application using the criteria in the NUREG-1520 (NRC, 2002). Based on the review of the license amendment application, responses to RAIs, a site visit, the ASME Code, and other relevant documents, the NRC staff has concluded that AREVA has described and assessed accident consequences that can result from the handling, storage, or processing of licensed materials in the supercritical CO_2 extraction process areas that can potentially have significant chemical consequences and effects. AREVA 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, AREVA has stated that controls are maintained, available, and reliable to perform their safety-related functions when needed. The staff has reviewed these safety controls and AREVA's plan for managing chemical process safety and finds them acceptable. The NRC staff concluded that AREVA's plan for managing chemical-process safety and their controls meets the

requirements of Part 70, and provides reasonable assurance that public health and safety, and the environment, will be protected.

6.5 REFERENCES

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7.0 FIRE SAFETY

7.1 REGULATORY REQUIREMENTS

The regulatory basis for the fire safety review includes the general and additional contents of the license application, as required by 10 CFR 70.22 and 10 CFR 70.65. In addition, the fire safety program must provide reasonable assurance of compliance with the requirements in 10 CFR 70.61, 70.62, and 70.64.

7.2 REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria for the NRC's review of AREVA's fire safety program are outlined in Sections 7.4.3.1 through 7.4.3.5 of NUREG-1520 (NRC, 2002).

7.3 STAFF REVIEW AND ANALYSIS

7.3.1 FIRE SAFETY MANAGEMENT MEASURES

Fire safety management measures are described by AREVA in the license renewal application for License No. SNM-1227. These measures include a description of the fire safety organization; fire prevention program; inspection, testing, and maintenance of fire protection systems; emergency response organization, and pre-fire plan. The NRC staff's review of the fire safety management measures is contained in Section 7.3.1 of the license renewal SER.

7.3.2 FIRE HAZARDS ANALYSIS

A fire hazards analysis (FHA) is performed for those facilities that contain special nuclear material in sufficient quantities and in a form that, if released in a fire, could result in at least an intermediate consequence event or accident sequence, as defined in 10 CFR 70.61. For the supercritical CO_2 extraction process, such a sequence has not been identified; and an FHA incorporating this process was not prepared by AREVA.

7.3.3 FACILITY DESIGN

The supercritical CO_2 extraction system will be installed and operated in the existing UO_2 building. This building, like other AREVA site buildings, has been designed and built to the applicable national state and local building, electrical, and fire codes as required by the City of Richland Fire Marshall and Building Department at the time of their construction. In the building design, emphasis has been placed on minimizing combustible materials in the construction of facilities, provision and maintenance of effective intra-building fire barriers, and segregating non-radiological and radiological operations to the extent feasible. The NRC staff's review of the AREVA facility design is provided in Section 7.3.3 of the license renewal SER.

7.3.4 PROCESS FIRE SAFETY

AREVA's ISA evaluates the fire risks associated with: 1) combustibles and flammable process chemicals; 2) exothermic reactions of uranium oxides; 3) high- temperature and/or high-pressure equipment; and 4) laboratory operations, including specialty laboratory equipment, hoods and chemicals.

There are no potential accident sequences due to fire identified by AREVA. The only significant chemical used in this process which has the potential to produce a fire-initiated release is TBP,

which is a Class III - B combustible liquid and must be preheated for combustion to occur. TBP will be supplied from a small tank and will only comprise about 10% of the solution with supercritical CO_2. The TBP will be protected from preheating due to nearby combustibles by combustible loading controls and surveillances. In addition, the contents of the TBP feed tank are not sufficient to produce a chemical release that can exceed the 10 CFR 70.61 threshold values, even if heated by all potential combustibles. The UO_2 building is fully equipped with fire extinguishers, alarm pull boxes, and heat detectors.

Based on the above, the NRC staff concluded that the license amendment application is consistent with the guidance in Section 7.4.3.4 of NUREG-1520 (NRC, 2002). Therefore, the NRC staff concluded that the facility meets the requirements of 10 CFR 70.22, 70.61, 70.62, 70.64, and 70.65 as they pertain to process fire safety.

7.3.5 FIRE PROTECTION AND EMERGENCY RESPONSE

Fire suppression needs beyond incipient fire fighting is supplied by the Richland Fire Department. The NRC staff's evaluation of AREVA's emergency response capabilities are provided in Section 7.3.5 of the license renewal SER.

7.3.6 BASELINE DESIGN CRITERIA

The regulations in 10 CFR 70.64 (a)(3) require that the design provide for adequate protection against fire and explosions. The room where the supercritical CO_2 extraction system is installed will remain subject to existing plant-wide monitoring programs to maintain low combustible loading. For additional fire protection, the UO_2 building is fully equipped with fire extinguishers, alarm pull boxes, and heat detectors. A key aspect of the site fire protection program is the fire emergency response service provided by the City of Richland. Based on the code compliant construction of the building housing the system, and the maintenance of an adequate fire protection program and equipment in accordance with the appropriate fire codes and standards, the NRC staff has determined the supercritical CO_2 extraction process to be in conformance with the baseline design criteria with regard to fire safety.

7.4 EVALUATION FINDINGS

The NRC staff determined that the proposed supercritical CO_2 extraction process is designed and is to be operated consistent with the guidance in Chapter 7 of NUREG 1520 (NRC, 2002). Therefore, the NRC staff has concluded, with reasonable assurance, that the proposed process meets the requirements of 10 CFR 70.22, 70.61, 70.62, 70.64 and 70.65 as they pertain to the fire safety aspects of the facility.

7.5 REFERENCES

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8.0 EMERGENCY MANAGEMENT

8.1 REGULATORY REQUIREMENTS

The regulatory basis for the emergency management review is set forth in 10 CFR 70.22(i)(1)(ii), 10 CFR 70.22(i)(3), and 10 CFR 70.64(a)(6).

8.2 REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria for the NRC's review of the emergency management plan (EP) are outlined in Section 8.4.3 of NUREG-1520 (NRC, 2002).

8.3 STAFF REVIEW AND ANALYSIS

The NRC staff evaluated AREVA's EP during the review of AREVA's license renewal application. The review included the following areas: 1) facility description, 2) onsite and offsite emergency facilities, 3) types of accidents, 4) classification of accidents, 5) detection of accidents, 6) mitigation of consequences, 7) assessment of releases, 8) roles and responsibilities, 9) notification and coordination, 10) information to be communicated to offsite response organizations, 11) training, 12) safe shutdown, and 13) exercises and drills. In the license amendment application, AREVA stated that they plan to use the NRC-approved EP for the proposed CO_2 process, without any significant revisions to the subject plan.

In response to the NRC's RAI regarding the inclusion of the new process within the description of the existing UO_2 building, AREVA clarified on June 5, 2009, that Section 1.2 of the EP would be reviewed and updated as appropriate within a few months of the startup of the supercritical CO_2 uranium recovery process. Since the material is descriptive in nature, such changes do not affect the effectiveness of the EP.

In the SER for the license renewal application, the NRC staff concluded that AREVA's safety program, if established and maintained pursuant to 10 CFR 70.62, 70.64, and 70.65, is adequate to provide reasonable assurance that IROFS will be available and reliable to perform their intended safety function(s) when needed, and in the context of the performance requirements of 10 CFR 70.61. For the purpose of the proposed process, the NRC staff found that AREVA has performed an adequate ISA to identify and evaluate those hazards and potential accidents associated with the proposed process. The NRC staff reviewed the ISA Summary and other information and found that it provides reasonable assurance that AREVA identified adequate IROFS and established engineered and administrative controls to ensure compliance with the performance requirements of 10 CFR 70.61. Specifically, the NRC staff found that the ISA results, as documented in the ISA Summary for the proposed process, provided reasonable assurance that the IROFS, the management measures, and AREVA's programmatic commitments will make all credible, intermediate-consequence accidents unlikely and all credible high-consequence accidents highly unlikely.

In the license amendment application, AREVA concluded that the existing emergency capabilities—as discussed in the current ISA Summary and as promulgated in the EP, Document E08-01-1.0—are deemed sufficient to meet the requirements in 10 CFR 70.64(a)(6). As a result, AREVA stated that the existing EP is adequate to support the proposed operations, and no changes were necessary to meet the regulations in 10 CFR 70.61. The NRC staff reviewed the license amendment application, as well as the ISA Summary for the proposed CO_2 process and the existing version of the emergency plan. Based on these references, the NRC staff concluded that the consequences for the postulated events for the proposed process are

bounded by the events analyzed in the ISA Summary provided in AREVA's license renewal application in the context of emergency planning. Therefore, the NRC staff concluded that the current version of AREVA's EP provides reasonable assurance that AREVA has adequate protocols and measures to respond, manage, and recover from emergency events associated with the proposed CO_2 process.

8.4 EVALUATION FINDINGS

The NRC staff concluded that the proposed process, as described in the license amendment application, and AREVA's EP provide adequate protection to the health and safety of the workers, the public, and that they meet the applicable regulatory requirements in 10 CFR 70.22(i)(1)(ii), 10 CFR 70.22(i)(3), and 10 CFR 70.64(a)(6).

8.5 REFERENCES

(NRC, 1992) U.S. Nuclear Regulatory Commission, Regulatory Guide 3.67, "Standard Format and Content for Emergency Plans for Fuel Cycle and Materials Facilities," January 1992.

(NRC, 2002) U.S. Nuclear Regulatory Commission, NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," March 2002.

(AREVA, 2006) September 20, 2006, letter from R.E. Link to the U.S. NRC, "AREVA NP Inc. Emergency Preparedness - Part I - E08-01-1.0 Emergency Plan - Version 3.0 and Part III - E08-03-1.0 Emergency Plan Implementing Procedures - Version 2.0," (ADAMS Accession Number ML062860396).

(NRC, 2007) May 14, 2007, letter from the U.S. NRC to R.E. Link, "Approval of AREVA NP Inc.'s Submittal of the Revised Emergency Plan for the Richland Facility (TAC L32598)," (ADAMS Accession Number ML071310261).

(AREVA, 2008) "Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257)," June 12, 2008 (ADAMS Accession Number ML081700146).

(AREVA, 2008) August 22, 2008 letter from R.E. Link to the U.S. NRC, "Revised Application for Amendment to License No. SNM-1227; Installation of Supercritical CO2 Uranium Recovery Process (Docket No. 70-1257)," (ADAMS Accession Number ML082420073).

(AREVA, 2009) June 5, 2009 letter from R.E. Link to the U.S. NRC, "Response to Request for Additional Information Regarding the Review of the AREVA NP Inc., Fuel Fabrication Facility Supercritical CO2 License Amendment Application; License No. SNM-1227 (Docket No. 70-1257/TAC L32689)," (ADAMS Accession Number ML091600100).

9.0 ENVIRONMENTAL PROTECTION

9.1 REGULATORY REQUIREMENTS

To be considered acceptable, AREVA must satisfy the following regulatory requirements regarding environmental protection:

1. 10 CFR 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 AREVA to protect health and minimize danger to life or property (such as handling devices, working areas, shields, measuring and monitoring instruments, devices for the disposal of radioactive effluents and wastes, and storage facilities, etc.).

3. 10 CFR 70.22(a)(8) states that the application shall contain procedures to protect health and minimize danger to life or property (such as procedures for personnel monitoring and waste disposal, etc.).

4. 10 CFR 70.23(a) specifies, in part, that an application for the possession and use of special nuclear material (SNM) will be granted, provided that—among other things—the applicant's equipment and facilities are adequate to protect health and minimize danger to life or property; and that the applicant's proposed procedures to protect health and minimize danger to life or property are adequate.

5. 10 CFR 70.59 sets forth 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 AREVA's environmental protection program are outlined in Section 9.4.3.2 of NUREG-1520 (NRC, 2002).

9.3 STAFF REVIEW AND ANALYSIS

9.3.1 EFFLUENT AND ENVIRONMENTAL CONTROLS AND MONITORING

The supercritical CO_2 extraction process will be operated by AREVA managers and staff who are qualified and trained in accordance with the qualification and training program approved by the NRC in the license renewal application. The NRC staff determined that such qualification and training program is adequate to provide qualified plant personnel associated with environmental protection and is, therefore, acceptable.

9.3.2 EFFLUENT CONTROLS AND WASTE MINIMIZATION

The NRC staff's environmental review of the radiation protection program focuses on AREVA's methods to maintain public doses resulting from operations effluents ALARA, in accordance with 10 CFR 20.1101. The NRC's review also evaluated AREVA's waste minimization practices.

AREVA's proposed program for effluent controls and waste minimization was reviewed using the guidance in Section 9.4.3 of NUREG-1520 (NRC, 2002). The NRC findings are explained below:

1. Radiological (ALARA) Goals for Effluent Control

   The NRC staff reviewed AREVA's established ALARA goals for effluent control during the review of the license renewal application. The supercritical CO_2 extraction process is subject to these ALARA goals established for AREVA's license.

2. Effluent Controls To Maintain Public Doses ALARA

   Supercritical CO_2 extraction process air emissions under normal processing conditions will contain no significant concentration of hazardous materials and will be removed through the UO_2 building HVAC exhaust system. Gaseous and/or aerosol releases of significantly concentrated hazardous materials to the environment is prevented by a system of pressure relief valves designed to safely discharge through the building exhaust system. Such a release is therefore subject to two stages of High Efficiency Particulate Absorbing (HEPA) filtration before it exits the building. Any liquid releases, such as uranyl nitrate and tributyl phosphate, will remain contained within the UO_2 building and manually recovered.

   The NRC staff reviewed the effluent control system for the supercritical CO_2 extraction process and determined that there is reasonable assurance that the HVAC exhaust and HEPA filtration systems will be effective in controlling gaseous and aerosol releases and are acceptable. The NRC staff also reviewed the liquid spill containment plan and determined that there is reasonable assurance that it will adequately contain liquid releases.

3. ALARA Reviews and Reports to Management

   Operation of the supercritical CO_2 extraction process will be included in the annual review of the radiation protection program, including the ALARA effluent control program. This annual ALARA review was reviewed and approved by the NRC staff as part of the license renewal application review. The NRC staff has determined that this approved program is adequate to detect any upward trends in release concentrations, environmental monitoring data, and radionuclide usage from operation of the supercritical CO_2 extraction process to determine whether operational changes to the process are needed to achieve the ALARA effluent goals; and to evaluate the design for system installations or modifications. The NRC staff has determined that the ALARA review commitment is acceptable.

4. Waste Minimization

The amount of solid radioactive waste generated from the supercritical CO_2 extraction process will be slightly less than the alternate processing methods that AREVA could use.

The inert material in the ash will remain unchanged, but cartridge filters will not be part of the process and the amount of solid filter-aid will be reduced. The solid waste from this process will be similar in composition to the other solid waste that is generated from uranium recovery operations currently used at the AREVA site. The overall volume of waste will be slightly reduced from the other recovery processes currently licensed at the Richland FFF due to increased efficiency and using fewer process filters that require disposal.

The NRC staff previously reviewed AREVA's waste minimization program in the license renewal application. The NRC staff determined that this license amendment application is consistent with AREVA's waste minimization efforts and existing license commitments and is, therefore, acceptable.

9.3.3 EFFLUENT AND ENVIRONMENTAL MONITORING

The airborne and liquid effluents from the supercritical CO_2 extraction process will be monitored in accordance with the plant-wide effluent monitoring programs described in the license renewal application, and specifically applied to the UO_2 building. The NRC staff reviewed these effluent monitoring programs and determined that they will continue to be adequate to maintain the expected concentrations of radioactive materials in airborne and liquid effluents ALARA and are acceptable.

AREVA identifies and monitors all liquid and airborne effluent discharge locations and identifies monitoring locations. The supercritical CO_2 process effluents will discharge through existing discharge points in the UO_2 building. The monitoring locations are unchanged from the NRC-approved monitoring locations in AREVA's license. The NRC staff reviewed the effluent monitoring locations and determined that they are acceptable.

AREVA continuously samples airborne effluents from all routine and non-routine operations and from anticipated events associated with the plant, including effluents from areas that are not used for processing SNM, such as laboratories, experimental areas, storage areas, and fuel element assembly areas. The supercritical CO_2 extraction process airborne effluents will exhaust through the existing HVAC system for the UO_2 building, via two-stage HEPA filtration, and will be continuously sampled at the process stacks in accordance with the existing license conditions. The NRC staff reviewed AREVA's requirement to continuously sample the UO_2 building effluent and determined that it provides reasonable assurance that the sampling program will continue to be acceptable for the supercritical CO_2 extraction process.

The sample collection and analysis methods and frequencies are appropriate for the effluent medium and the radionuclide(s) being sampled. Sampling methods ensure that AREVA obtains representative samples using appropriate sampling equipment and sample collection and storage procedures. AREVA will use the sampling and analysis methods and frequencies specified in the license for the supercritical CO_2 extraction process. Since the process will not use any radiological or chemical materials that are not currently in use at the Richland plant, the NRC staff has determined that there is reasonable assurance that the current sample collection

and analysis methods are adequate to monitor effluents from the supercritical CO_2 extraction process and are acceptable.

Existing license commitments include maintaining procedures with action levels to assure regulatory compliance. AREVA is committing to use them to support the supercritical CO_2 process. The NRC staff reviewed these commitments in the license renewal application and concluded that they are adequate to assure environmental protection during the operations of the proposed process.

AREVA will apply laboratory quality control procedures to the licensed activities at the UO_2 building, including the supercritical CO_2 process effluent samples, in accordance with the AREVA license. The NRC staff has evaluated these procedures and determined that they provide reasonable assurance that they are adequate to validate analytical results.

In the license renewal application, AREVA completely and accurately describes all applicable Federal and State standards for discharges and any permits issued by Federal, State, or local governments for gaseous and liquid effluents. AREVA described all applicable Federal and State standards for discharges and permits issued by Federal, State, and local governments for gaseous and liquid effluents in the license renewal application. These standards and permits are not changed for the supercritical CO_2 extraction process and are acceptable.

The process does not involve any discharge of process effluents into any ponds, lagoons or water bodies. All tanks, including those for chemical storage and process vessels associated with the proposed process, are located above ground, precluding any releases to groundwater or surface water bodies. Since the proposed process will take place inside the UO_2 building, it also helps to preclude any releases from going directly into the soil.

AREVA controls and maintains releases to sewer systems to meet the requirements of 10 CFR 20.2003, “Disposal by Release into Sanitary Sewerage.”

AREVA described the expected releases to sanitary sewerage in the license renewal application. Sewer liquid effluent will remain subject to existing NRC and City of Richland radiological and chemical release limits. The NRC staff has determined that AREVA’s controls on discharges to sanitary sewerage will continue to be acceptable during operation of the supercritical CO_2 extraction process.

Reporting procedures comply with the requirements of 10 CFR 70.59 and the guidance in Regulatory Guide 4.16. AREVA provides reports that include the concentrations of principal radionuclides released to unrestricted areas in liquid and gaseous effluents and the minimum detectable concentration for the analysis and the error for each data point. AREVA provides a semiannual effluent report in accordance with 10 CFR 70.59 and its license. The NRC staff has determined that this reporting procedure continues to be acceptable during operation of the supercritical CO_2 extraction process.

AREVA’s procedures and facilities for solid and liquid waste handling, storage, and monitoring result in safe storage and timely disposition of the material. The solid waste from the supercritical CO_2 extraction process will be similar in composition to the other solid waste that is generated from uranium recovery operations currently used at the AREVA site. The overall volume of waste will be slightly reduced from the other recovery processes currently licensed at the Richland site due to increased efficiency and using fewer process filters that require

disposal. The NRC staff has reviewed AREVA's solid waste handling procedures as described in the license renewal application and determined that they will be adequate for solid wastes generated by the proposed process and are acceptable.

9.3.4 ENVIRONMENTAL MONITORING

AREVA will continue to perform environmental monitoring in accordance with the conditions in its license. The NRC staff has determined that the supercritical CO_2 extraction process does not use and will not emit any radiological or chemical constituents that are not already included in AREVA's environmental monitoring program. Therefore the existing environmental monitoring program is acceptable.

9.3.5 INTEGRATED SAFETY ANALYSIS SUMMARY

AREVA provided an ISA Summary with the license amendment application for the supercritical CO_2 extraction process and determined that there are no high or intermediate consequence accident scenarios for which IROFS are required. The CO_2 gaseous outputs that are exhausted from the stack have also been reviewed and do not result in any high or intermediate consequences as defined in 10 CFR 70.61. The NRC staff reviewed the ISA Summary submitted with the supercritical CO_2 license amendment application and agrees that there are no high or intermediate environmental consequences from the process. Therefore, no additional ISA Summary information is necessary for the environmental review.

9.3.6 ENVIRONMENTAL PROTECTION MANAGEMENT MEASURES

Because the ISA performed for the supercritical CO_2 extraction process concluded that there were no high or intermediate environmental consequence accidents, no environmental protection IROFS are needed and no management measures are required to assure their availability and reliability.

9.4 EVALUATION FINDINGS

AREVA has committed to adequate environmental protection measures including: 1) environmental and effluent monitoring; and 2) effluent controls to maintain public doses ALARA as part of the radiation protection program. The NRC staff concluded, with reasonable assurance, that AREVA's conformance to the application and license conditions is adequate to protect the environment and the health and safety of the public and to comply with the regulatory requirements imposed by the Commission in 10 CFR Parts 20 and 70. The bases for these conclusions are stated in each of the above acceptance criteria.

9.5 REFERENCES

(NRC, 2002) U.S. Nuclear Regulatory Commission, NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," March 2002.

(NRC, 2003) Environmental Review Guidance for Licensing Actions Associated with NMSS Programs (NUREG-1748), August 2003.

(AREVA, 2008a) "Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257)," June 12, 2008 (ADAMS Accession Number ML081700146).

(AREVA, 2008b) "Revised Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257)," Redacted Version, August 22, 2008 (ADAMS Accession Numbers ML082420070 and ML082420071).

(NRC, 2009a) January 28, 2009, Memorandum from R. Rodriguez to P. Habighorst, "Summary of Site Visit to AREVA NP, Inc. Richland, Washington Facility to Support Safety Review of CO_2 License Amendment Application," (ADAMS Accession Number ML090230589).

(NRC, 2009b) April 24, 2009, Safety Evaluation Report for the Renewal of License No. SNM-1227 for the AREVA NP, Inc. Fuel Fabrication Facility in Richland, Washington," (ADAMS Accession Number ML090760702).

10.0 DECOMMISSIONING

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 70.22(a)(9) "Decommissioning Funding Plan (DFP)"

10 CFR 70.25 "Financial Assurance and Recordkeeping for Decommissioning"

10.2 REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria for the NRC's review of AREVA's DFP can be found in NUREG-1757, Vol. 3, "Consolidated Decommissioning Guidance," (NRC, 2003).

10.3 STAFF REVIEW AND ANALYSIS

The NRC staff evaluated AREVA's decommissioning financial assurance during the review of AREVA's license renewal application. During the NRC's site visit in December 2008, AREVA explained the impacts of the proposed supercritical CO_2 extraction process on the estimated decommissioning costs. AREVA clarified that the estimated decommissioning costs, as described in the current DFP, will increase. AREVA will revise the estimated decommissioning cost to reflect additional items associated with the proposed process, such as additional volume of equipment to be disposed of, labor costs, etc. Pursuant to 10 CFR 70.25(e), AREVA is required to update its estimated decommissioning costs at intervals not to exceed every three years. AREVA will revise the DFP to include the proposed supercritical CO_2 extraction process. These revisions will be included in the next update of AREVA's DFP scheduled for December 2011. The NRC will evaluate AREVA's DFP periodically, including any changes to the estimated decommissioning costs caused by the proposed process, to determine if adequate financial assurance has been provided. Therefore, the NRC staff concluded that AREVA currently has reasonable decommissioning financial assurance and will demonstrate that sufficient funds will be available to support the eventual decommissioning of the Richland FFF, including any impacts resulting from the proposed supercritical CO_2 extraction process.

10.4 EVALUATION FINDINGS

The NRC staff has previously reviewed the decommissioning financial assurance for AREVA using guidance in Chapter 10 of the Standard Review Plan. The review was conducted in support of AREVA's license renewal application. AREVA has adequately described what will be the impact of the proposed process on its DFP, and how they will address these impacts. The NRC staff has determined that AREVA has reasonable decommissioning financial assurance and will demonstrate that adequate funds will be allocated to address additional costs for associated with the proposed supercritical CO_2 extraction process. Therefore, the NRC staff concluded that AREVA is in compliance with the applicable requirements in 10 CFR 70.22(a)(9) and 70.25(e).

10.5 REFERENCES

(NRC, 2002) U.S. Nuclear Regulatory Commission, NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," March 2002.

(NRC, 2003) U.S. Nuclear Regulatory Commission (NRC), NUREG-1757, Volume 3, "Consolidated Decommissioning Guidance-Financial Assurance, Recordkeeping, and Timeliness," September 2003.

(AREVA, 2008a) "Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257)," June 12, 2008 (ADAMS Accession Number ML081700146).

(AREVA, 2008b) "Revised Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257)," Redacted Version, August 22, 2008 (ADAMS Accession Numbers ML082420070 and ML082420071).

(NRC, 2009a) January 28, 2009, Memorandum from R.L. Rodriguez to P. Habighorst, "Summary of Site Visit to AREVA NP, Inc. Richland, Washington Facility to Support Safety Review of CO_2 License Amendment Application," (ADAMS Accession Number ML090230589).

(NRC, 2009b) April 24, 2009, Safety Evaluation Report for the Renewal of License No. SNM-1227 for the AREVA NP, Inc. Fuel Fabrication Facility in Richland, Washington," (ADAMS Accession Number ML090760702).

11.0 MANAGEMENT MEASURES

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 (CM), 2) maintenance, 3) training and qualifications, 4) procedures, 5) audits and assessment, 6) incident investigations, 7) records management, and 8) other quality assurance (QA) elements.

2. 10 CFR 70.62(a)(3) states that records must be kept for all items relied on for safety (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. For new facilities or new processes at existing facilities, 10 CFR 70.64(a)(1) states that the design must be developed and implemented in accordance with management measures to provide adequate assurance that the IROFS will be available and reliable to perform their function when needed.

5. 10 CFR 70.72 requires a licensee to establish a CM program to evaluate, implement, and track changes to the facility, structures, systems and components, processes, and of personnel activities.

11.2 REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria for the NRC's review of AREVA's management measures program is contained in Section 11.4.3 of NUREG-1520 (NRC, 2002).

11.3 STAFF REVIEW AND ANALYSIS

The NRC staff reviewed Section 9.1, Quality Standards and Records, of the license amendment for the installation of supercritical CO_2 uranium recovery process. The license amendment application states that AREVA's current quality assurance program, as discussed in Section 8.8 of the current ISA Summary, applies to the CO_2 uranium recovery process. AREVA also states that no near-term changes to the quality assurance program are required for the installation and operation of the proposed supercritical CO_2 extraction system.

During the NRC's site visit on December 2008, AREVA clarified that specific elements of the proposed process (i.e., IROFS, training, procedures, etc.) will be managed and tracked using the existing program. AREVA will develop specific procedures and training for personnel working with this proposed process. Some aspects of the management measures program, such as staff training, are discussed in Section 2.3 of this SER.

The NRC staff previously reviewed the existing quality assurance program as part of the license renewal application. The review included the following areas: 1) CM, 2) maintenance,

3) training and qualifications, 4) procedures, 5) audits and assessments, 6) incident investigations, 7) records management, and 8) other quality assurance elements. In the SER for the license renewal, the NRC concluded that AREVA's management measures complied with applicable NRC regulations and was acceptable. Based on the above, the NRC staff concluded that AREVA's management measures, as described in Chapter 11 of the license renewal application, is also applicable to the proposed supercritical CO_2 extraction process and is, therefore, acceptable.

11.4 EVALUATION FINDINGS

The NRC staff has previously reviewed management measures for AREVA using guidance in Chapter 11 of the Standard Review Plan. This review was conducted in support of AREVA's license renewal application. AREVA has not provided any new or revised information pertaining to its management measures for the proposed supercritical CO_2 extraction process that could modify the NRC staff's previous analysis and conclusion. Therefore, the NRC staff has determined that AREVA has an acceptable management measures to safely operate the proposed supercritical CO_2 extraction process, and is in compliance with the applicable requirements in 10 CFR 70.4, 70.62(d), 70.64(a)(1) and 70.72.

11.5 REFERENCES

(NRC, 2002) U.S. Nuclear Regulatory Commission, NUREG-1520, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," March 2002.

(AREVA, 2008a) "Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257)," June 12, 2008 (ADAMS Accession Number ML081700146).

(AREVA, 2008b) "Revised Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257)," Redacted Version, August 22, 2008 (ADAMS Accession Numbers ML082420070 and ML082420071).

(NRC, 2009a) January 28, 2009, Memorandum from R.L. Rodriguez to P. Habighorst, "Summary of Site Visit to AREVA NP, Inc. Richland, Washington Facility to Support Safety Review of CO_2 License Amendment Application," (ADAMS Accession Number ML090230589).

(NRC, 2009b) April 24, 2009, Safety Evaluation Report for the Renewal of License No. SNM-1227 for the AREVA NP, Inc. Fuel Fabrication Facility in Richland, Washington," (ADAMS Accession Number ML090760702).

(AREVA, 2009c) June 5, 2009 letter from R.E. Link to the U.S. NRC, "Response to Request for Additional Information Regarding the Review of the AREVA NP Inc., Fuel Fabrication Facility Supercritical CO2 License Amendment Application; License No. SNM-1227 (Docket No. 70-1257/TAC L32689)," (ADAMS Accession Number ML091600100).

12.0 MATERIAL CONTROL AND ACCOUNTING

12.1 REGULATORY REQUIREMENTS

To be considered acceptable, AREVA must satisfy the regulatory requirements regarding material control and accounting (MC&A), pursuant to 10 CFR 70.22, "Content of Applications," and 10 CFR Part 74, "Material Control and Accounting of Special Nuclear Material."

12.2 REGULATORY ACCEPTANCE CRITERIA

The Fundamental Nuclear Material Control Plan (FNMCP) is acceptable if it describes methods for achieving the performance objectives of paragraphs (1) through (3) of 10 CFR 74.31(a), and the system capabilities of paragraphs (1) through (8) of 10 CFR 74.31(c). In addition, NUREG-1065, Revision 2, "Acceptable Standard Format and Content for the Fundamental Nuclear Material Control Plan Required for Low-Enriched Uranium Facilities," provides guidelines for implementing an effective MC&A program at fuel cycle facilities.

12.3 STAFF REVIEW AND ANALYSIS

In the license amendment application, AREVA stated that no revisions or enhancements to the FNMCP would be required to support the proposed process. AREVA also stated that the onsite inventory of uranium-bearing ash material is expected to be reduced as a result of the proposed process. On November 5, 2009, the NRC approved Version 4.0 of AREVA's FNMCP for its Richland FFF. Version 4.0 of the Plan included specific activities and practices in the facility's MC&A program to address the supercritical CO_2 extraction process.

The NRC reviewed the information in the license amendment application and Version 4.0 of AREVA's FNMCP. The NRC staff concluded that the current version of AREVA's FNMCP is acceptable to meet the applicable requirements in the area of MC&A to operate its supercritical CO_2 extraction process. Furthermore, the NRC staff notes that any changes to the FNMCP associated with the proposed process would be evaluated and, if required, approved by the NRC staff before they can be implemented by AREVA.

12.4 EVALUATION FINDINGS

The NRC staff concluded that Version 4.0 of AREVA's FNMCP is acceptable for meeting the applicable requirements in 10 CFR 70.22 and 10 CFR Part 74 in the context of the supercritical CO_2 extraction process. Version 4.0 of AREVA's FNMCP describes acceptable methods for achieving the performance objectives in 10 CFR 74.31(a) and the system capabilities in 10 CFR 74.31(c).

12.5 REFERENCES

(NRC, 1995) U.S. Nuclear Regulatory Commission, NUREG-1065, Revision 2, "Acceptable Standard Format and Content for the Fundamental Nuclear Material Control Plan Required for Low-Enriched Uranium Facilities," December 1995.

(AREVA, 2008a) "Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257)," June 12, 2008 (ADAMS Accession Number ML081700146).

(AREVA, 2008b) "Revised Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257)," Redacted Version, August 22, 2008 (ADAMS Accession Numbers ML082420070 and ML082420071).

(AREVA, 2009a) November 5, 2009, letter from U.S. NRC to Dan L. Noss, "Approval of AREVA NP, Inc.'s Fundamental Nuclear Material Control Plan-E07-01-001, Revision 4.0 (TAC L32832)," (ADAMS Accession Number ML093060491).

13.0 PHYSICAL PROTECTION AND PHYSICAL SECURITY

13.1 REGULATORY REQUIREMENTS

Each licensee who possesses or uses 10 kg or more of special nuclear material (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) through (g).

13.2 REGULATORY ACCEPTANCE CRITERIA

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

13.3 STAFF REVIEW AND ANALYSIS

The NRC staff reviewed AREVA's license amendment request and Revision 5.0 of AREVA's PSP, which was approved by letter dated February 18, 2009. Specifically, the NRC staff reviewed the types of chemicals to be used in the proposed process, the location where they would be stored, the protective measures required for these types of materials and processes, and the amount of SNM generated by the proposed process. The NRC staff also evaluated whether the proposed activity would adversely affect the current PSP in such a manner that would reduce its safeguards effectiveness. The proposed process will take place at the existing UO_2 building inside the Richland FFF. This building is well within the approved controlled access area (CAA) boundary and provides adequate protection for the materials to be used in the proposed process, as required by 10 CFR 73.67 and consistent with the "Risk-Based Performance Standards Guidance-Chemical Facility Anti-Terrorism Standards" by the U.S. Department of Homeland Security (DHS).

During the December 2008 site visit, the NRC staff evaluated AREVA's chemical dispersion calculations to determine if any of the materials used would create a Critical Target Area (CTA) within the Richland FFF. The NRC staff conducted brief, comparative calculations that confirmed AREVA's conclusions. There are no events in the supercritical CO_2 extraction process that could have adverse health or safety consequences to offsite receptors. Based on the information from AREVA, insights from the site visit, and dispersion analyses, the NRC staff concluded that the proposed process does not create any CTA concerns. The addition of the proposed process does not require modifications to the existing CAA perimeter or internal security controls because the proposed process will be installed and operated at an existing process building. Therefore, the NRC staff concluded that AREVA's current PSP and associated protective measures and controls are adequate to ensure the safe and secure operation of the proposed process and the entire Richland FFF.

13.4 EVALUATION FINDINGS

The NRC staff reviewed AREVA's current PSP and the information provided in the license amendment application and concluded that the proposed process does not create any security concerns at the Richland FFF. AREVA's PSP provides adequate physical protection measures to support the proposed supercritical CO_2 extraction process and meets the applicable requirements in 10 CFR 73.67 and is, therefore, acceptable.

13.5 REFERENCES

(NRC, 1983) U.S. Nuclear Regulatory Commission, Regulatory Guide 5.59, "Standard Format and Content for a Licensee Physical Security Plan for the Protection of Special Nuclear Material of Moderate or Low Strategic Significance," February 1983.

(NRC, 1999) U.S. Nuclear Regulatory Commission, NUREG-1615, "Physical Protection Requirements for Categories I, II and III Material at Fuel Cycle Facilities," March, 1999 (ADAMS Accession Number ML023160218).

(AREVA, 2008a) "Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257)," June 12, 2008 (ADAMS Accession Number ML081700146).

(AREVA, 2008b) "Revised Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257)," Redacted Version, August 22, 2008 (ADAMS Accession Numbers ML082420070 and ML082420071).

(NRC, 2009a) January 28, 2009, Memorandum from R.L. Rodriguez to P. Habighorst, "Summary of Site Visit to AREVA NP, Inc. Richland, Washington Facility to Support Safety Review of CO_2 License Amendment Application," (ADAMS Accession Number ML090230589).

(NRC, 2009) February 18, 2009, letter from the U.S. NRC to T. Tate, "Approval of Revision 5.0 of the Physical Security Plan for AREVA NP, Inc., Richland, Washington, Fuel Fabrication Facility; License No. SNM-1227 (Docket No. 70-1257/TAC L32697)," (ADAMS Accession Number ML090420474).

(DHS, 2009) U.S. Department of Homeland Security, "Risk-Based Performance Standards Guidance: Chemical Facility and Anti-Terrorism Standards," May 2009.

14.0 EXEMPTIONS AND SPECIAL AUTHORIZATIONS

14.1 SPECIAL AUTHORIZATIONS

AREVA did not request any special authorizations in support of the proposed supercritical CO_2 extraction process.

14.2 EXEMPTIONS

AREVA did not request any special exemptions in support of the proposed supercritical CO_2 extraction process.

14.3 REFERENCES

(AREVA, 2008a) "Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257)," June 12, 2008 (ADAMS Accession Number ML081700146).

(AREVA, 2008b) "Revised Application for Amendment to License No. SNM-1227; Installation of Supercritical CO_2 Uranium Recovery Process (Docket No. 70-1257)," Redacted Version, August 22, 2008 (ADAMS Accession Numbers ML082420070 and ML082420071).

15.0 ENVIRONMENTAL REVIEW PURSUANT TO THE NATIONAL ENVIRONMENTAL POLICY ACT

15.1 REGULATORY REQUIREMENTS

The regulatory basis for a Categorical Exclusion (CATEX) under the National Environmental Policy Act (NEPA) is outlined in 10 CFR 51.22, "Criterion for Categorical Exclusion: Identification of Licensing and Regulatory Actions Eligible for Categorical Exclusion or otherwise not Requiring Environmental Review."

15.2 REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria for the NRC's environmental review under NEPA and CATEX determinations are contained in NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs," (NRC, 2003) and in Chapter 9 of NUREG-1520 (NRC, 2002).

15.3 STAFF REVIEW AND ANALYSIS

The NRC staff has determined that the license amendment application results in a change in process operations and equipment from already licensed activities. The regulations in 10 CFR 51.22(c)(11) allows for a CATEX for such changes, provided that:

1. There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite;

2. There is no significant increase in individual or cumulative occupational radiation exposure;

3. There is no significant construction impact; and

4. There is no significant increase in the potential for or consequences from radiological accidents.

In the revised license amendment application dated August 22, 2008, AREVA addressed each of these four criteria.

1. The supercritical CO_2 extraction process does not add any new chemicals to process streams. CO_2, uranium liquids and compounds, tributyl phosphate, and nitric acid are already used in uranium recovery and waste treatment processes at the Richland fire hazards analysis. The amount of these chemicals in liquid and gaseous effluents, except for CO_2, will be comparable or, in some cases, decreased relative to using existing processes to recover uranium from ash materials. The amount of CO_2 used in the process is minimized via recycling into the process, and CO_2 releases will be low relative to other current plant usage/releases. AREVA provided a proprietary quantitative estimate of the CO_2 effluents from the supercritical CO_2 extraction process and maintenance and compared it to the total CO_2 discharged from the Richland FFF during calendar year 2007. As described in Chapter 9 of this SER, the NRC staff evaluated the expected gaseous, liquid, and solid effluents and AREVA's proposed controls and monitoring and determined that they are adequate to demonstrate

continued compliance with the public dose limits in 10 CFR 20 Subpart D and do not constitute a significant change in the types or a significant increase in the amounts of any effluents that may be released offsite.

2. The direct dose radiation exposure will be essentially the same as using existing processing methods for uranium recovery from ash material. Internal exposure is expected to decrease due to better containment and equipment designs. The amount of solid radioactive waste generated from this process will be slightly less than the alternate processing methods that AREVA could use. The inert material in the ash will remain unchanged, but cartridge filters will not be part of the supercritical CO_2 extraction process; and the amount of solid filter-aid will be reduced. As described in SER Section 4 above, the NRC staff reviewed AREVA's radiation protection program for the proposed process and determined that it will continue to meet the worker protection limits in 10 CFR 20 Subpart C and that there will be no significant increase in individual or cumulative occupational radiation exposure.

3. This new process will be placed in an existing building that formerly housed one of the ammonium diuranate lines and is currently being used for material storage. Increased truck traffic related to equipment delivery will be insignificant and spread over several months. Work will be accomplished by crafts personnel already working at the Richland FFF. Construction activities in this area will not increase the likelihood of high or intermediate-consequence accidents as defined in 10 CFR 70.61. Appropriate IROFS are already in place to cover potential accidents from this construction activity. The NRC staff reviewed AREVA's description of the construction activities and the ISA Summary and determined that there will be no significant construction impact from this new process.

4. The risk of loss of containment events or accidental nuclear criticality have been shown in the ISA Summary provided with this license amendment application to be acceptable per the requirements of 10 CFR 70.61. NRC staff have reviewed the ISA Summary for the supercritical CO_2 extraction process, as documented in Section 3 of this SER, and confirmed that there is no significant increase in the potential for or consequences from radiological accidents.

Based on this evaluation, implementation of the requested amendment does not significantly alter the previously evaluated environmental impacts associated with the licensed operation. There is no significant impact to the environment, and the action of amending the license is eligible for CATEX. Therefore, in accordance with 10 CFR 51.22(c)(11), neither an environmental assessment nor an environmental impact statement is required for this action.

16.0 LIST OF CONTRIBUTORS

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