MFFFNPEm Resource

From: Gwyn, Dealis W. [DWGwyn@moxproject.com]
Sent: Tuesday, June 22, 2010 10:21 AM
To: Tiktinsky, David
Subject: DSER Chapter 10
Attachments: tech.gif; Master SER Ch 10 Env comments.doc

Dave,

Attached is the results of our technical accuracy review of Chapter 10 (note most comments are minor editorial suggestions). Also, Chapter 10 does not contain any proprietary info.

If you have any questions, please let me know.

Dealis

Hearing Identifier: MixedOxideFuelFabricationFacility_NonPublic
Email Number: 1748

Mail Envelope Properties (67D173A90CF7A5469AE7A645828044D101FB82BA)

Subject: DSER Chapter 10
Sent Date: 6/22/2010 10:21:14 AM
Received Date: 6/22/2010 10:24:01 AM
From: Gwyn, Dealis W.

Created By: DWGwyn@moxproject.com

Recipients:
"Tiktinsky, David" <David.Tiktinsky@nrc.gov>
Tracking Status: None

Post Office: cltexchg.dcsmox.com

Files	Size	Date & Time
MESSAGE	969	6/22/2010 10:24:01 AM
tech.gif	927	
Master SER Ch 10 Env comments.doc	85056	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

10.0 ENVIRONMENTAL PROTECTION

10.1 Regulatory Requirements

This chapter of the safety evaluation report (SER) contains the U.S. Nuclear Regulatory Commission (NRC) staff's review of environmental protection measures described by the applicant in Chapter 10 of its March 2010 revision of its mixed oxide (MOX) fuel fabrication facility (MFFF) license application (LA) (MOX, 2010a) to possess and use radioactive material. As noted in Chapter 1 of this SER, the MFFF is located in the F-Area of the U.S. Department of Energy's (DOE's) Savannah River Site (SRS). The staff evaluated the information provided by the applicant for environmental protection by reviewing Chapter 10 and other sections of the LA and supplementary information provided by the applicant. In some cases, the staff also performed independent calculations.

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

- Title 10 of the *Code of Federal Regulations* (10 CFR) Section 20.1101(b), "Radiation protection program,, states that "the licensee shall use, to the extent practical, procedures and engineering controls based on sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as reasonably achievable (ALARA).

- 10 CFR § 20.1301(b), "Dose limits for individual members of the public." states that, if the licensee permits members of the public to have access to controlled areas, the limits for members of the public continue to apply to those individuals.

- 10 CFR § 20.1302(c), "Compliance with dose limits for individual members of the public," states that, upon approval from the Commission, the licensee may adjust the effluent concentration values in Appendix B, "Annual Limits on Intake (ALIs) and Derived Air Concentrations (DACs) of Radionuclides for Occupational Exposure; Effluent Concentrations; Concentrations for Release to Sewerage," to 10 CFR Part 20, "Standards for Protection Against Radiation," Table 2, for members of the public, to take into account the actual physical and chemical characteristics of the effluents (e.g., aerosol size and distribution, solubility, density, radioactive decay equilibrium, chemical form).

- 10 CFR § 70.61(b)(2), "Performance requirements" states, in part, that the risk of credible high-consequence events must be limited by engineered or administrative controls or both. Under that section, high-consequence events are those internally or externally initiated events that result in an acute dose of 0.25 sieverts (Sv) (25 rem) or greater total effective dose equivalent (TEDE) to any individual located outside the controlled area. The controls shall be applied to reduce the likelihood of occurrence of the event, so that the event is highly unlikely or its consequences are less severe than the acute TEDE stated above.

- 10 CFR § 70.61(c)(2) states, in part, that the risk of credible intermediate-consequence events must be limited by engineered or administrative controls or both. Under this regulation, intermediate-consequence events are those internally or externally generated events that result in an acute TEDE of 0.05 Sv (5 rem) or greater to any individual outside the controlled area. The controls shall be applied to reduce the likelihood of occurrence of the event, so that the event is unlikely or its consequences are less severe than the acute TEDE stated above.

- 10 CFR § 70.61(c)(3) also states, in part, that the risk of credible intermediate-consequence events must be limited by engineered or administrative controls or both. Under this regulation, intermediate-consequence events are those internally or externally generated events that result in a 24-hour averaged release of radioactive material outside the restricted area in concentrations exceeding 5,000 times the values in Table 2 of Appendix B to 10 CFR Part 20. The controls shall be applied to reduce the likelihood of occurrence of the event, so that the event is unlikely or its consequences are less severe than the concentration values stated above.

10.2 Regulatory Acceptance Criteria

Section 10.4 of NUREG-1718, "Standard Review Plan for the Review of an Application for a Mixed Oxide (MOX) Fuel Fabrication Facility" (NRC, 2000), provides the acceptance criteria for the NRC's review of the applicant's environmental protection program and was used as guidance for the staff's review.

10.3 Staff Review and Analysis

In its LA, the applicant described its commitment to environmental protection in three areas: (1) radiation safety goals (ALARA) for effluent control and waste minimization, (2) design of effluent and environmental monitoring for normal and off-normal operations, and (3) environmental surveillances to monitor the environmental impact from operations during normal and off-normal operations. The staff evaluated information provided by the applicant on ALARA goals and effluent, environmental monitoring programs, and environmental surveillances.

10.3.1 Radiation Safety

The staff evaluated the applicant's radiation safety measures for environmental protection, including the applicant's goals and controls to maintain public doses ALARA, in accordance with 10 CFR § 20.1101, "Radiation protection programs," as well as the applicant's practices to minimize not only the contamination of the facility and the environment but also the generation of radioactive waste. As noted in Chapter 9 of this SER, the goals of the ALARA program include maintaining occupational exposures, as well as environmental releases, as far below regulatory limits as is reasonably achievable. This is to ensure the health and safety of workers and the public located outside the restricted area boundary (RAB) and to protect the environment.

10.3.1.1 ALARA Design Goals for Effluent Control

Gas Effluent ALARA Goals

The applicant defined ALARA design goals for effluent control in Section 10.1.1 of its LA. The first goal is for airborne radioactive effluents released from the MFFF. This goal is not to exceed 20 percent of the effluent concentration limits in 10 CFR Part 20, Appendix B, Table 2, Column 1, as determined at the MFFF RAB. This fraction is consistent with staff expectations that an initial goal of 10 to 20 percent or less of the values in Appendix B to 10 CFR Part 20 can be achieved by almost all materials facility licensees, as stated in Regulatory Guide 8.37, "ALARA Levels for Effluents from Materials Facilities," (NRC, 1973a).

The applicant has also committed to a dose limit for an individual member of the public in the unrestricted area likely to receive the highest dose from the facility. This goal is 0.01 millisieverts (1 millirem (mrem)) per year TEDE, which is well below the 10-mrem constraint on air emissions specified in 10 CFR § 20.1101(d). This fraction is consistent with staff expectations for an initial goal of 10 to 20 percent of the 10 CFR Part 20 constraint described in NUREG-1718, Section 10.4.3, and, therefore, is acceptable to the staff.

Liquid Effluent ALARA Goals

The applicant has not defined liquid effluent ALARA goals, because the MFFF will not discharge liquid effluent directly to the environment. This is acceptable because the applicant's proposal is to transfer low-level waste containing NRC-licensed material from the MFFF to DOE at the SRS in a manner consistent with the SRS waste acceptance criteria (WAC). DOE will take possession of the liquid waste before it reaches the RAB and is responsible for moving it safely. DOE will perform additional treatment before discharging this material. Therefore, DOE would manage any discharges of liquid effluent and would subject them to its ALARA considerations.

10.3.1.2 Air Effluent Controls to Maintain Public Doses ALARA

The heating, ventilation, and air conditioning (HVAC) system and the off-gas treatment ventilation system remove radionuclides and hazardous materials and thus control airborne emissions. Airborne waste from MFFF processes is routed through the HVAC system, which is designed to handle the expected volume of potentially radioactive waste, compartmentalize airborne waste, provide safe shutdown, and achieve an acceptable decontamination factor for each radionuclide. Several design features of the HVAC system, which include items relied on for safety (IROFS), provide confinement of radioactive materials. Ventilation exhaust is passed through multiple banks of filters, including high-efficiency particulate air filters. Airborne emissions are monitored and controlled to maintain doses outside the RAB ALARA.

The applicant's design bases for these systems rely for guidance on NRC Regulatory Guide 3.12, "General Design Guide for Ventilation Systems of Plutonium Processing and Fuel Fabrication Plants," issued 1973 (NRC, 1973b), and the American Society of Heating, Refrigerating and Air-Conditioning Engineers document, "Design Guide for Department of Energy Nuclear Facilities," issued 1993 (DOE, 1993).

The staff concludes that the applicant's commitment to regulatory guides and standards, together with the process controls and procedures that augment engineered controls as part of its ALARA program, ensures that engineered effluent controls will meet the regulatory requirements for capacity, compartmentalization, safe shutdown, and efficiency required during normal and likely facility conditions to maintain public doses ALARA; therefore, it is consistent with the acceptance criteria in Section 10.4 of NUREG-1718 and is acceptable to the staff.

10.3.1.3 Liquid Effluent Controls to Maintain Public Doses ALARA

As noted in Section 10.1.2.2 of the applicant's LA, the MFFF would not have liquid effluents that discharge directly to the environment. Separate systems that have do not interconnect collect and manage liquid radioactive and nonradioactive wastes. Radioactive process fluids are transferred using gravity flow, air jets, and steam jets, where practical. Drains within the radiation control area are routed to the liquid waste system. Liquid radioactive wastes are collected in the aqueous liquid waste system or in the solvent liquid waste system and will be transferred to DOE facilities on the SRS in a manner consistent with the SRS WACs for appropriate storage and disposition by DOE. The staff concludes with reasonable assurance that the applicant's procedures and controls will maintain public doses ALARA, and, therefore, are consistent with the acceptance criteria in Section 10.4 of NUREG-1718 and are acceptable to the staff.

10.3.1.4 ALARA Review and Reports to Management

Sections 9.2.1 and 10.1.3 of the applicant's LA describe the ALARA program and management involvement. MOX Services management receives reports summarizing the ALARA program, including trending information, so that it can compare the analytical results to ALARA goals. The applicant has committed to a program of measuring trends in environmental monitoring and surveillance data against the effluent ALARA goals on a quarterly basis. Abnormal increases in the trend of analytical results are reported to MOX Services management as soon as practical. ALARA goals are evaluated annually, and new goals are established for the following year, as appropriate. In addition, recommendations are made to MOX Services' senior management, as needed, for changes in facilities and procedures to achieve ALARA goals. The staff concludes that the applicant's review and reporting program is likely to maintain ALARA goals and, therefore, is consistent with the acceptance criteria in Section 10.4 of NUREG-1718 and is acceptable to the staff.

10.3.1.5 Waste Minimization

Waste minimization reduces worker and public exposure to radiation and to radioactive and hazardous materials. The applicant has provided an overview of its commitment to waste minimization practices in Sections 9.1.2.3.3 and 10.1.4 of its LA. The applicant's proposal for incorporating waste minimization practices into the design process focuses on recycling and reuse of materials, as well as minimizing the introduction of materials that can become contaminated. During operations, the applicant proposes to rely on waste management procedures to separate and segregate solid and liquid wastes and remove packaging and shipping materials before they enter contaminated areas.

The applicant will use active and passive confinement systems and vacuum systems inside gloveboxes. These systems are designed to allow recycling of materials from the secondary waste streams in the aqueous polishing (AP) process and MOX process scraps back to the main processes. Specific AP process waste minimization steps include acid recovery, silver recovery, and solvent regeneration. Liquid waste is minimized in the AP process by use of recycling to the extent practical. For example, nitric acid is recovered by evaporation from the process and is partly reused as a reagent feedstock for the plutonium dissolution process.

Waste minimization documentation includes a statement of senior management support and identification of management, employees, and organizational responsibilities for waste minimization. Waste minimization goals, which are reevaluated annually, will be established based on operational data. Management is informed quarterly of the trends measured against waste minimization goals. New goals are established for the upcoming year, as appropriate. Recommendations are made to MOX Services' senior management, as needed, for changes in facilities and procedures to achieve waste minimization goals. The staff concludes that the applicant's waste minimization program is likely to maintain ALARA goals and, therefore, is consistent with the acceptance criteria in Section 10.4 of NUREG-1718 and is acceptable to the staff.

10.3.2 Effluent and Environmental Monitoring

10.3.2.1 Concentrations of Radionuclides in Air Effluents and Public Doses

In its environmental report, the applicant provided an estimate of maximum radionuclide concentrations in the controlled area based on annual releases, a 50-percent atmospheric dispersion parameter value (X/Q) of 2.5×10^{-4} seconds per cubic meter, a distance to a receptor from the plant stack of 52 meters (171 feet)~~-~~, and the conservative assumption that releases occur from ground level. This calculation demonstrates that the average concentration in the controlled area immediately outside the restricted area would be less than 40 percent of its ALARA goal. The staff performed an independent calculation using the methodology described in Report 123, “Screening Models for Releases of Radionuclides to Atmosphere, Surface Water and Ground, Recommendations of the National Council on Radiation Protection and Measurements of the National Council on Radiation Protection and Measurements,” dated January 22, 1996 (NCR, 1996), as described in NUREG-1718. In its calculation, the staff assumed a 28-meter (92 feet) stack height, no plume rise, a site-specific 3.6 meter per second annual average wind speed, and a wind direction toward an individual member of the public 100 percent of the time. The staff’s estimate of the X/Q is 5×10^{-5} seconds per cubic meter at a distance of 400 meters (1312 feet). The staff’s calculation demonstrates that the concentration in the controlled area would be less than 10 percent of the applicant’s ALARA goal.

The applicant’s estimate of the maximum potential dose to an individual member of the public in the unrestricted area is ~~-~~4.1×10^{-6} milli~~e~~sieverts (4.1×10^{-4} mrem) per year. The staff performed independent analyses using GENII, the Hanford Environmental Radiation Dosimetry software system. The staff’s result is 2.5×10^{-6} millisieverts (2.5×10^{-4} mrem) per year, which closely agrees with the applicant’s value, well below the design ALARA goal. Both the applicant’s and the staff’s dose estimates to the public are less than ~~a~~ .01 microsieverts (1 microrem) per year.

Based on the staff’s independent calculation, the known or expected concentrations of radioactive material in airborne effluents from the MFFF would be well below the limits in 10 CFR Part 20, Appendix B, Table 2, and, therefore, are consistent with the acceptance criteria in Section 10.4 of NUREG-1718 and are acceptable to the staff.

10.3.2.2 Physical and Chemical Characteristics of Radionuclides in Discharges

With regard to the provisions of 10 CFR § 20.1302(c), the applicant does not propose to adjust the effluent concentration values that appear in 10 CFR Part 20, Appendix B, Table 2, for members of the public, by taking into account the actual physical and chemical characteristics of the effluents (e.g., aerosol size distribution, solubility, density, radioactive decay equilibrium, chemical form). This is because the applicant demonstrated compliance with the annual dose limit of 10 CFR § 20.1301, “Dose Limits for Individual Members of the Public,” by using the dose methodology in 10 CFR § 20.1302(b)(1), and not by using the concentration-based methodology in 10 CFR § 20.1302(b)(2). The applicant’s approach is consistent with the requirements of 10 CFR Part 20 and, therefore, is acceptable to the staff.

10.3.2.3 Air Effluent Discharge Location and Effluent Monitoring

In Section 10.2.1 of its LA, the applicant identified the facility stack located on the roof of the MOX process building as the discharge location for radioactive air effluents from the MFFF. This stack is 28 meters (92 feet) tall and would discharge up to approximately 5,720 c~~C~~ubic meters (202,000~~)~~ cubic feet) per minute of air during normal operations. The applicant has committed in the LA to the use of two redundant continuous air monitors and two fixed samplers of airborne particulate matter to monitor MFFF air effluents. The applicant has also committed in the LA to separately quantify the contributions from the AP and MOX processes, using two additional continuous air monitors, before the two streams are commingled and discharged from the single stack. The applicant will also sample air effluent contributions from areas not used for processing special nuclear material.

Based on Regulatory Guide 4.16, "Monitoring and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Gaseous Effluents from Nuclear Fuel Processing and Fabrication Plants and Uranium Hexafluoride Production Plants," Revision 1, issued December 1985 (NRC, 1985), particulate effluent from the stack would be collected continuously during operations to determine quantities and average concentrations of principal radionuclides that would be released. Table 10.2-2 of the applicant's LA identifies the analytical methodologies used to characterize airborne emissions (e.g., liquid scintillation, alpha spectrometer).

The staff finds that these commitments are consistent with the regulatory requirements for 10 CFR § 20.1302(a) and the staff's review guidance in Section 10.4 of NUREG-1718 and, therefore, are acceptable to the staff.

10.3.2.4 Liquid Effluent Discharge Location and Effluent Monitoring

The MFFF does not discharge radioactive liquid effluents to the environment during normal or off-normal operations. The aqueous ~~or~~ and solvent liquid waste systems collect the liquid radioactive waste and transfer it to the ~~DOE~~ SRS Waste Solidification Building (WSB) for disposition. Tanks used for storage of radioactive material are located inside the MFFF buildings and are equipped with drip pans and leak detection.

10.3.2.5 Environmental Monitoring Program

Preoperational and operational environmental monitoring activities determine baseline values and assess the environmental impact of licensed activities of the MFFF. As noted above, the MFFF would not discharge radio~~active~~nuclides directly to the aquatic environment. Thus, environmental surveillances will focus on potential airborne radiological releases.

Preoperational Environmental Monitoring Program

The MFFF preoperational monitoring program, which begins 2 years before facility operations start, is based on the data collected over several years at the SRS and additional data collected by the applicant. The objectives of the environmental preoperational monitoring program are to establish a baseline of existing radiological and biological conditions at or near the MFFF site; evaluate procedures, equipment, and techniques used in the collection and analysis of environmental data; and train personnel in their use.

Comment [cam1]: More accurately two years before hot start-up.

The applicant will take direct radiation measurements and samples of air, soil, and vegetation with analyses for uranium and plutonium and other radionuclides of interest. These activities will establish a baseline for isotopic composition and concentrations that will then be compared to results from operational environmental surveillances. The applicant's LA Table 10.3-1 identifies preoperational airborne monitoring locations, frequency of sampling, collection methodology, and radionuclide analyses.

The applicant's LA Table 10.3-2 contains an analysis of the lower limits of detection for various radionuclides. Sufficient volumes of samples (e.g., rainwater) are to be collected to ensure the attainment of lower limit of detection thresholds in the analysis.

Preoperational terrestrial sampling and analysis will provide a comprehensive baseline of radiological conditions related to the deposition of airborne emissions in the environs (including water bodies and sediment) of the MFFF.

Operational Environmental Monitoring Program

The applicant's operational environmental monitoring program will be similar to its preoperational monitoring program. However, locations and sampling frequency for air, water, and terrestrial sampling and analysis may be altered, based on results from preoperational or early stage operational emissions monitoring.

To ensure that the regulatory limits for doses to the public found in 10 CFR § 20.1301 are not exceeded, MOX Services has established administrative limits and action levels, as shown in Table 10.3-9 of the LA. If an action level is exceeded for sampling, the applicant would investigate to determine the source of elevated activity. As noted above, emissions data are trended as an analytical tool. Based on the operating history and trending analyses of the facility and operating data, the applicant would adjust operational data and sampling and analysis programs, as necessary.

Quality Control

Analytical quality control, addressed by the applicant in Section 10.3.7 of its LA, is described in laboratory procedures and is consistent with Chapter 15 of the LA. Analytical procedures are consistent with national or international consensus standards, or their performance is equivalent or superior to such methods. Analytical instrumentation is standardized and calibrated in accordance with the manufacturers' recommendations. Calibration standards are traceable to the National Institute of Standards and Technology.

The applicant's preoperational and operational environmental surveillance programs are consistent with applicable regulatory criteria and the staff's review guidance in Section 10.4.3 of NUREG-1718 and, therefore, are acceptable to the staff.

10.3.2.6 Consequence Assessment Methodologies

In its safety assessment, the applicant calculated committed doses to individuals outside the controlled area boundary (i.e., the public) and concentrations of radioactive material in the environment outside the restricted area from each postulated accident to demonstrate that risks from event consequences were reduced to acceptable levels. The consequence assessment methodology used by the applicant for dose consequences at the controlled area boundary is the same methodology used for the site worker, as described in Chapter 9.0 of this SER, with the exception of the value of the atmospheric dispersion factor. The atmospheric dispersion factor that the applicant derived for the distance from the MFFF to the controlled area boundary is 3.7×10^{-6} seconds per cubic meter. The staff confirmed this value using MACCS2 and site-specific meteorological data.

The RAB is approximately 52 meters (171 feet) from the MFFF discharge stack. The atmospheric dispersion factor that the applicant derived for this location is 8.39×10^{-4} seconds per cubic meter. The applicant also derived an atmospheric dispersion factor for the secured warehouse, which contains stocks of depleted uranium. This value is 2.71×10^{-3} seconds per cubic meter, based on a distance from the warehouse to the RAB of approximately 28 meters.

As a result, the equation used to calculate environmental consequences is

$$[EC]_x = \{[\text{Source Term/RF}] \times [X/Q]^{RA} \times [f]_x\}/(3600\ \text{s hr}^{-1} \times 24\ \text{hr}),$$

where source term is the same as described in Chapter 9.0 of this SER, RF is the respirable fraction (which is divided back into the source term to negate the reduction applied for consequence source terms), the value for "f" is the specific activity and the fraction of the total quantity of the material at risk; that is, the radionuclide X, and $[X/Q]^{RA}$ is the value of the atmospheric dispersion factor for either the MFFF stack or the secured warehouse, as described above.

The use of this equation is consistent with the staff's guidance in NUREG/CR-6410, "Nuclear Fuel Cycle Facility Accident Analysis Handbook," issued March 1998 (NRC, 1998), and the regulations in 10 CFR § 70.61(c)(3) and, therefore, is acceptable to the staff.

10.3.3 Integrated Safety Analysis Summary

In its Integrated Safety Analysis (ISA) Summary (MOX, 2010b), the applicant identified various sequences for radiological and non-radiological accidents, which were then evaluated to ensure adequate protection of worker health and safety. Protecting the worker by ensuring that all credible high-consequence events within the controlled area are rendered highly unlikely and that all the intermediate-consequence events within the controlled are rendered unlikely would also ensure that the environmental performance requirements in 10 CFR § 70.61(c)(3) for the area outside the controlled area would be met. The staff determined that adverse environmental consequences could occur only if unmitigated intermediate- or high-consequence events were also present. Because all such events were mitigated, the staff did not identify any accident sequences that would fail to meet the environmental performance requirements.

In Chapter 5 of the LA, the applicant presents the mitigated bounding-event consequences for the five major categories of events: fire, explosion, loss of confinement, load-handling events, and criticality. In Chapter 5 of this SER, the staff evaluates the applicant's ISA Summary and documents its conclusion that the ISA Summary is complete, provides reasonable estimates of the likelihood and consequences of each accident sequence, and provides sufficient information to determine whether the applicant identified adequate engineering or administrative controls for each accident sequence. In its review of Chapter 15 of the LA, the staff evaluated the management measures used to ensure that the IROFS would adequately perform their intended safety functions. The applicant mitigated each event by employing various IROFS, which can be in the form of active or passive engineered controls or administrative controls. After it employed the IROFS to mitigate the consequences of the bounding events, the applicant determined that the occurrence of each bounding event was highly unlikely or unlikely, as required. This, in turn, resulted in a determination, under 10 CFR 70.61(c)(3), that the environmental performance requirements would be met. Thus, there would be no significant adverse environmental impact beyond the controlled area from the bounding events identified above.

Based on the use of IROFS, the implementation of management measures, and quality assurance, the staff finds that the applicant's methodology of public consequence analysis and environmental consequence determination is acceptable.

10.4 Evaluation Findings

The NRC staff issued a final environmental impact statement in January 2005 for this licensing action, as required by 10 CFR § 51.20, "Criteria for and Identification of Licensing and Regulatory Actions Requiring Environmental Impact Statements." After weighing the environmental impacts of the proposed operation of the MFFF, the NRC staff recommended, in the final environmental impact statement, that, unless safety issues mandated otherwise, the proposed license be issued to MOX Services.

The applicant has developed a program to implement adequate environmental protection measures during operation. These measures include: (1) environmental and effluent monitoring and, (2) effluent controls to maintain doses to the public ALARA as part of the radiation protection program. The NRC staff concludes that the applicant's program, as described in its application and environmental report, is adequate to protect the environment and the health and safety of the public and complies with regulatory requirements imposed by the Commission in 10 CFR Part 20; "Standards for Protection Against Radiation", 10 CFR Part 30, "Rules of General Applicability to Domestic Licensing of Byproduct Material"; 10 CFR Part 40, "Domestic Licensing of Source Material"; 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions"; and 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material."

REFERENCES

(DOE, 1993) American Society of Heating, Refrigerating and Air-Conditioning Engineers, "Design Guide for Department of Energy Nuclear Facilities," U.S. Department of Energy, Washington, DC, 1993.

(NCRP 1996) National Council on Radiation Protection and Measurements, Report No. 123, "Screening Models for Releases of Radionuclides to Atmosphere, Surface Water and Ground, Recommendations of the National Council on Radiation Protection and Measurements," Bethesda, MD, January 22, 1996.

(NRC, 2000) U.S. Nuclear Regulatory Commission, NUREG-1718, "Standard Review Plan for the Review of an Application for a Mixed Oxide (MOX) Fuel Fabrication Facility," Washington, DC, August 2000.

(NRC, 2005) U.S. Nuclear Regulatory Commission, NUREG-1767, "Environmental Impact Statement for Construction and Operation of a Proposed Mixed Oxide Fuel Fabrication Facility at the Savannah River Site, South Carolina," Washington, DC, January 2005.

(NRC, 1990) U.S. Nuclear Regulatory Commission, NUREG/CR-4691, "MELCOR Accident Consequence Code System (MACCS)," Washington, DC, February 1990.

(NRC, 1998) U.S. Nuclear Regulatory Commission, NUREG/CR-6410, "Nuclear Fuel Cycle Facility Accident Analysis Handbook," Washington, DC, March 1998.

(NRC, 1973a) U.S. Nuclear Regulatory Commission, Regulatory Guide 3.12, "General Design Guide for Ventilation Systems of Plutonium Processing and Fuel Fabrication Plants," Washington, DC, 1973.

(NRC, 1985) U.S. Nuclear Regulatory Commission, Regulatory Guide 4.16, "Monitoring and Reporting Radioactivity in Releases of Radioactive Materials in Liquid and Gaseous Effluents from Nuclear Fuel Processing and Fabrication Plants and Uranium Hexafluoride Production Plants,” Revision 1, Washington DC, December 1985.

(NRC, 1973b) U.S. Nuclear Regulatory Commission, Regulatory Guide 8.37, “ALARA Levels for Effluents from Materials Facilities,” Washington, DC, 1973.

(MOX, 2010a) Shaw AREVA MOX Services, “Mixed Oxide Fuel Fabrication Facility License Application,” Aiken, SC, March 2010.

(MOX, 2010b) Shaw AREVA MOX Services, “Mixed Oxide Fuel Fabrication Facility Integrated Safety Analysis Summary,” Aiken, SC, March 2010.

10 CFR Part 20; Standards for Protection Against Radiation

10 CFR Part 30, “Rules of General Applicability to Domestic Licensing of Byproduct Material”.

10 CFR Part 40, “Domestic Licensing of Source Material”.

10 CFR Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions”.

10 CFR Part 70, “Domestic Licensing of Special Nuclear Material.”