

9.0 ENVIRONMENTAL PROTECTION

9.1 REGULATORY REQUIREMENTS

The regulatory basis for this review of the Virgil C. Summer Nuclear Station Units 2 and 3 (Summer) environmental protection program applicable to the fresh fuel assemblies for the first reactor core prior to commencement of operation is contained in Title 10 of the *Code of Federal Regulations* (10 CFR) Parts 20, 51, and 70.

9.2 REGULATORY ACCEPTANCE CRITERIA

The acceptance criteria for the U.S. Nuclear Regulatory Commission's (NRC's) Part 70 review of that portion of the Summer's environmental protection program described above are outlined in Section 9.4 of NUREG-1520, *Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility, Rev. 1* (NRC, 2010). While some portions of the acceptance criteria in Standard Review Plan (SRP), Section 9.4 (NRC, 2010) are relevant to this incremental review; other portions are not. For example, an Integrated Safety Analysis of accidents is conducted for fuel cycle facilities, not for reactors. Also, certain regulatory guides and other documents referenced in SRP, Section 9.4 (NRC, 2010) are specific to fuel cycle facilities and are not applicable to reactor reviews.

9.3 STAFF REVIEW AND ANALYSIS

The South Carolina Electric & Gas Company (SCE&G) has submitted a combined operating license (COL) application for two new Westinghouse Advanced Passive 1000 (AP1000) pressurized water reactors (SCE&G, 2011). Assessment of radiological impacts is based in part on the AP1000 Design Control Document (DCD) (Westinghouse, 2008)). This review for the initial fresh fuel is to focus on the incremental impact to environmental protection, if any, related to the receipt, possession, inspection, and storage of special nuclear material (SNM) in the form of fresh fuel assemblies for the first reactor core as applicable under 10 CFR Part 70. The operations relevant to the Part 70 portion of the license include the uncrating and inspection of the fuel assemblies and storing them in the spent fuel storage racks prior to loading into the reactor. The applicant has prepared a Final Safety Analysis Report (FSAR) (SCE&G, 2011) to be consistent with NUREG-0800, *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition* (NRC, 2007). The applicant also prepared an Environmental Report (ER) (SCE&G, 2010), which was submitted with its application for a COL (SCE&G, 2011). The applicant's ER (SCE&G, 2010) addressed the environmental impacts of construction, operation, and decommissioning of the proposed facility. The staff issued its Environmental Impact Statement (EIS) earlier this year as NUREG-1939 (NRC, 2011a).

The analysis of the applicant's radiation protection program confirmed that the incremental effects related to the fresh fuel assemblies for the first core did not change the applicant's as low as is reasonably achievable (ALARA) goals or controls for liquid or air effluents, which includes an analysis of the total effective dose equivalent to the maximally exposed individual (MEI) member of the public who would receive the greatest radiation dose. Population dose estimates also are unaffected. The applicant's monitoring of liquid and air discharges, including monitoring locations and samples, will not be affected. Also, quality control procedures related to collection and analyses of environmental monitoring will be unaffected. In addition, the analysis of incremental effects indicated that ALARA reviews and reports to management will be unaffected. Because the staff's analysis addresses fresh fuel assemblies, there will be no change to the applicant's waste minimization efforts or safe handling of radioactive wastes.

9.4 EVALUATION FINDINGS

The staff used acceptance criteria in Section 9.4.3.2 of the *Standard Review Plan (SRP) for the Review of a License Application for a Fuel Cycle Facility*, NUREG-1520, Rev. 1 (NRC, 2010), to address environmental effects of operation of Units 2 and 3 related to the handling, inspection and storage of the fresh fuel assemblies for the first reactor core prior to commencement of operation. The relevant acceptance criteria in SRP Section 9.4.3.2 (NRC, 2010) address aspects of radiation safety, training and qualification of staff, quality assurance (QA), radioactive waste management, and environmental monitoring information found in the applicant's FSAR (SCE&G, 2011) and the staff's FSER (NRC, 2011) to address these acceptance criteria. Much of this information is also found in the applicant's ER (SCE&G, 2010) and the staff's EIS (NRC, 2011a).

Section 3.4.3 of the staff's EIS (NRC, 2011a) addresses the applicant's gaseous, liquid and solid waste management system (also see Section 11 of the applicant's FSAR [SCE&G, 2011] and Section 3.5 of its ER [SCE&G, 2010]). Because this evaluation is focused on the initial fresh fuel elements for the first reactor core prior to operation, the staff did not address SRP acceptance criteria for the radiological waste management system.

The EIS, Section 5 (NRC, 2011a) addresses radiological impacts from normal operations, including public exposure pathways and doses to the public and the MEI (see EIS, Sections 5.9.2 and 5.9.3 [NRC, 2011a]). In assessing doses to the public from normal operations, the staff used the concentration values found in 10 CFR 20, Appendix B, Table 2. Offsite doses to the public in unrestricted areas are to be ALARA. Storage of the initial fresh fuel elements inside the containment does not provide a measurable contribution to MEI or population doses from direct radiation because of the shielding provided by the containment. Section 5.9.6 of the staff's EIS (NRC, 2011a) addresses operational radiological monitoring, including a description of the applicant's radiological environmental monitoring program (REMP) and associated QA program, which was developed over two decades ago for Unit 1. In Section 11.2 of its COL (SCE&G, 2011), the applicant addresses the radiological monitoring program found in Section 6.2 of its ER (SCE&G, 2010), which includes reporting and QA under the existing REMP. Radiological sampling is addressed in Section 11.5 of the applicant's COL (SCE&G, 2011), which addresses monitor calibration using certified commercial radionuclide sources traceable to the National Institute of Standards and Technology. The staff reviewed the REMP and found it to be adequate for the incremental monitoring of low-level-gamma radiation from the initial fresh fuel elements.

The staff also reviewed Section 5.9.11 of the staff's EIS (NRC, 2011a), which addresses environmental impacts from accidents. To put into some perspective, accidents associated with unirradiated fresh fuel inside the reactor containment, one can look at the bounding results from the following assessment of transportation of spent (irradiated) fuel accident. In Section 7.4.2 of its ER (SCE&G, 2010), the applicant assessed the environmental impacts associated with the transportation of spent nuclear fuel, assuming that there would be a partial loss of cask shielding and partially exposing irradiated fuel rods. The result of this accident assessment was a staff finding of a negligible increase in environmental risk. This scenario easily bounds an accident involving unirradiated fresh fuel located inside the reactor containment. The staff did not identify any accident scenario associated with the initial fresh fuel elements that would result in any significant environmental impact. The staff did not find any significant incremental impacts associated with radiological monitoring or accidents addressed in Sections 5.9.6 and 5.9.11 of the EIS (NRC, 2011a) attributable to fresh fuel elements for the initial core. This is

because these fresh-fuel assemblies stored within the containment are effectively sealed sources with low-level-gamma-radiation emissions of virtually undetectable consequences.

Section 13.1 of the applicant's COL (SCE&G, 2011) addresses organizational responsibilities and qualifications of personnel, including education and experience requirements. In addition, Section 13.1 (SCE&G, 2011) identifies management and technical support functions that are to be in place prior to commencement of operation. These support functions include—in part—radiation monitoring, training, and fueling. The applicant will put in place those aspects of listed functions and programs identified as being applicable to handling, inspection, and storage of the initial fresh fuel elements for the first reactor core prior to any shipments of fresh fuel elements being delivered onsite. Section 13.2 of the COL (SCE&G, 2011) addresses training and incorporates by reference NEI 06-13A, *Template for an Industry Training Program Description*. Section 6.2 of the ER (SCE&G, 2010) also addresses training related to the applicant's REMP. The staff reviewed the applicant's qualifications and training for personnel associated with environmental protection and found them to be adequate for the handling and storage of the fresh-fuel elements for the initial core, without the need for any modifications to its existing requirements.

The staff finds that the applicant has developed a program to implement adequate environmental protection measures during facility operation and during the initial period of handling and storage of the fresh-fuel elements for the first reactor core, including measures related to the receipt, possession, inspection, and storage of SNM in the form of initial fresh fuel assemblies, as applicable under 10 CFR Part 70. These measures include ALARA reviews, gaseous and liquid effluent and environmental monitoring, effluent controls to maintain public doses ALARA as part of the radiation protection program, appropriate sample collection and analysis methods and frequencies, periodic monitoring reports, laboratory quality control procedures, and documentation of federal and state reviews and approvals required for the COL and for operation.

The staff concludes that the applicant's program with respect to the initial fresh fuel elements for the first reactor core, as described in its application and ER, as well as in the staff's FSER and EIS, is adequate to protect the environment and the health and safety of the public; complies with regulatory requirements in 10 CFR Parts 20, 51, and 70; adequately addresses the applicable acceptance criteria in Section 9.4.3.2 of NUREG-1520, Rev. 1; and is, therefore, acceptable to the staff.

9.5 REFERENCES

(NRC, 2007) U.S. Nuclear Regulatory Commission, NUREG-1793, "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design," September 2004.

(NRC, 2007) U.S. Nuclear Regulatory Commission, NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," 2007.

(NRC, 2010) U.S. Nuclear Regulatory Commission, NUREG-1520, Rev. 1, "Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility," May 2010.

(NRC, 2011) U.S. Nuclear Regulatory Commission, NUREG-xxxx, "Final Safety Evaluation Report for the Virgil S. Summer Nuclear Station Units 2 and 3," (2011).

(NRC, 2011a) U.S. Nuclear Regulatory Commission, NUREG-1939, "Final Environmental Impact Statement for the Virgil S. Summer Nuclear Station Units 2 and 3," (2011).

(SCE&G, 2010) South Carolina Electric and Gas, "V.C. Summer Nuclear Station Units 2 and 3 Environmental Report," Rev. 2, 2010.

(SCE&G, 2011) South Carolina Electric and Gas, "V.C. Summer Nuclear Station Units 2 and 3 COLA (Final Safety Analysis Report)," Rev. 5, 2011.