

APPENDIX F

REPORT BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS



UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, DC 20555 - 0001

February 17, 2011

The Honorable Gregory B. Jaczko
Chairman
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: REPORT ON THE SAFETY ASPECTS OF THE SOUTH CAROLINA
ELECTRIC AND GAS COMPANY COMBINED LICENSE APPLICATION
FOR V.C. SUMMER NUCLEAR STATION, UNITS 2 AND 3

Dear Chairman Jaczko:

During the 580th meeting of the Advisory Committee on Reactor Safeguards (ACRS), February 10-12, 2011, we reviewed the NRC staff's Advanced Safety Evaluation Report (ASER) for the pending South Carolina Electric and Gas Company (SCE&G) Combined License Application (COLA) for the V.C. Summer Nuclear Station (VCSNS), Units 2 and 3. This application conforms to the design-centered review approach (DCRA).¹ The DCRA is Commission policy which allows the staff to perform one technical review and reach a decision for each COLA standard issued outside the scope of the design certification and to use this review and decision to support decisions on multiple COLAs.

The first COLA that receives a complete NRC staff review is designated as the reference COLA (RCOLA). Any subsequent application referencing the same design is designated as a subsequent COLA (SCOLA). In September 2008, the Westinghouse Electric Company (WEC) submitted Revision 17 of the design control document (DCD), describing the standard design for the AP1000 advanced pressurized water reactor. We reviewed the application and issued letter reports in December 2010 (for the DCD amendment and long-term core cooling) and in January 2011 (for the Aircraft Impact Assessment). In parallel, we reviewed Southern Nuclear Operating Company's Vogtle Electric Generating Plant (VEGP), Units 3 and 4, RCOLA and issued a letter report on January 24, 2011.

¹ The DCRA is described in Regulatory Issue Summary (RIS) 2006-06, "New Reactor Standardization Needed to Support the Design-Centered Licensing Review Approach," as endorsed by the Commission's Staff Requirements Memorandum in response to SECY-06-0187, "Semiannual Update of the Status of New Reactor Licensing Activities and Future Planning for New Reactors," dated November 16, 2006.

The VCSNS COLA is an AP1000 SCOLA. Our AP1000 Subcommittee held two meetings (July 21-22, 2010, and January 10-11, 2011) to review various chapters of the SCOLA and the staff's ASER. During these meetings, we met with representatives of the NRC staff, SCE&G and its vendors, and with the public. We also had the benefit of the documents referenced. This report fulfills the requirement of 10 CFR 52.87 that the ACRS report on those portions of the application which concern safety.

CONCLUSIONS AND RECOMMENDATIONS

1. There is reasonable assurance that VCSNS, Units 2 and 3, can be built and operated without undue risk to the health and safety of the public. The SCOLA for VCSNS, Units 2 and 3, should be approved following its final revision.
2. Recommendations 2 through 5 in our January 24, 2011, letter concerning the VEGP, Units 3 and 4, RCOLA are also applicable to the VCSNS, Units 2 and 3, SCOLA.
3. The staff should limit the use of the current version of the HABIT code to neutral density gas dispersion modeling.

BACKGROUND

By letter dated March 27, 2008, SCE&G submitted a combined license application to the NRC for VCSNS, Units 2 and 3, in accordance with the requirements of 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants." In the application, SCE&G stated that VCSNS, Units 2 and 3, would be two Westinghouse AP1000 advanced pressurized water reactor units and would be located at the existing VCSNS site.

As an AP1000 SCOLA, SCE&G has organized and annotated its application to identify: a) sections that incorporate by reference the AP1000 DCD; b) sections that are standard for COL applicants in the AP1000 RCOLA; and c) sections that are site-specific and thus only apply to VCSNS, Units 2 and 3.

DISCUSSION

Our review of the VCSNS, Units 2 and 3, SCOLA was conducted in parallel with our review of both the AP1000 Design Certification Amendment application and the VEGP, Units 3 and 4, RCOLA. As a consequence, the RCOLA and SCOLA on which the staff's ASER is based reference Revision 17 of the DCD, whereas the current version is Revision 18, and there may be a further revision prior to certification rulemaking. Similarly, the SCOLA utilizes standard content in the RCOLA which may be revised prior to approval. Since the remaining licensing steps do not provide for further ACRS review of the DCD, RCOLA, or VCSNS Units 2 and 3 SCOLA revisions that incorporate changes in design and commitments made by applicants during our reviews, the staff should review with us any changes and commitments which deviate significantly from those presented during our review.

Since the VCSNS, Units 2 and 3, SCOLA relies on the standard information found in the RCOLA, the recommendations described in our January 24, 2011, letter concerning the VEGP, Units 3 and 4, RCOLA in the following areas are also applicable to our VCSNS, Units 2 and 3, SCOLA assessment: containment interior debris limitation, in-service inspection/ in-service testing program requirements for squib valves, power uncertainty measurement, and incorporation of DCD or COLA changes. Likewise, the discussion of site-specific probabilistic risk assessment in our January 24, 2011, letter is applicable.

The V. C. Summer Nuclear Station Site

VCSNS is located approximately 30 miles northwest of Columbia, in Jenkinsville, South Carolina. The site location is adjacent to, and elevated about 150 ft. above, the Parr Reservoir which is created by a dam on the Broad River. It is also adjacent to the Monticello Reservoir. A nearby pumped storage facility connects the two reservoirs. VCSNS Unit 1 began commercial operation in 1984. The site location relative to water courses and topography effectively precludes flooding as a hazard to the site. The expanded three-unit nuclear station, in addition to the pumped storage facility, will be served by twelve 230 kV transmission lines.

Offsite Hazards

The review of offsite hazards for VCSNS, Units 2 and 3, included toxic gas that might be released by a transportation accident on the Norfolk Southern rail line located approximately one mile from the plant. SCE&G used a public domain United States Environmental Protection Agency developed computer code, ALOHA, which treats appropriately the modeling of the dispersion of both heavy and neutral-density gases.

Analysis results using ALOHA showed that vapor cloud explosions do not pose a threat to safety-related structures, systems, and components at VCSNS, Units 2 and 3. The analysis was performed using conservative assumptions such as dispersion over flat terrain, whereas the plant is located well above possible release locations on the rail line. Shock pressures were well below 1 psi, which is considered the minimum pressure wave amplitude to cause damage. The analysis also showed that toxic vapor clouds would not lead to control room concentrations that would pose a threat to operators.

For its confirmatory calculations of toxic gas effects, the staff used the HABIT code. However, HABIT only models neutral density gas dispersion and does not consider heavy gas effects. The calculated concentrations are lower than those in the ALOHA analyses, which is to be expected in view of several postulated releases consisting of heavy gases, which disperse more slowly.

In our letter report dated September 16, 1999, we recommended that "the staff should document evidence of the validity and the capability of computer codes endorsed in regulatory guides such as the HABIT code." During our full committee meeting on February 10, 2011, the staff stated that it is pursuing validation of some aspects of the HABIT code. We recommend that use of the current version of HABIT be limited to neutral density gas dispersion modeling.

Seismic Source Model

SCE&G used source models provided by the Electric Power Research Institute. These were updated in light of more recent data and evolving knowledge, particularly for the Charleston and New Madrid Seismic Source Zones. No modifications to the Eastern Tennessee Seismic Source Zone were required. The VCSNS, Units 2 and 3, site-specific safe shutdown earthquake (SSE) was developed in accordance with Regulatory Guide 1.208, "A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion," and information that was used in the VEGP, Units 3 and 4, Early Site Permit review and approval. Following our initial subcommittee meeting in July 2010, the seismic source information was updated.

Seismic Design Parameters

The peak ground acceleration (PGA) values for horizontal and vertical ground motions are 0.23g and 0.22g, respectively. The input seismic design ground motion response spectra (GMRS) for the SSE in the free field at plant grade exceeds the standard AP1000 certified seismic design response spectra (CSDRS) at frequencies of about 15 to 80 Hz (horizontal) and 20 to 80 Hz (vertical). However, the VCSNS site meets the AP1000 DCD criteria for a hard rock site, and the site-specific GMRS is bounded by the AP1000 hard rock high frequency spectrum. The staff concluded that the technical bases described in the AP1000 DCD were applicable to VCSNS, Units 2 and 3, for justifying that high-frequency exceedances of the AP1000 CSDRS are considered to be non-damaging.

Monitoring for Leakage from the Radioactive Waste Discharge Line

Liquid radioactive waste is diluted to below allowable offsite discharge limits by onsite blending with cooling tower blowdown. It then flows offsite through approximately one mile of high density polyethylene (HDPE) pipe downgrade to an outfall at the Parr Reservoir. Piping connections at the onsite blending location will be accessible for inspection, but the downstream portion of the line will be buried along a rail spur and will not be readily accessible for inspection.

Although this material has excellent properties and is acceptable for its intended service, operating experience in nuclear power plants is limited. Localized lack of fusion can occur during the joining of HDPE piping segments in the field. Such defects, if not detected by initial inspection and hydrostatic testing and repaired, can propagate through the pipe wall by slow crack growth. Since many joints will be formed in the field with no provision to inspect them using volumetric (UT) methods, undetected defects may grow and cause leaks during the 60-year service life of the pipe.

Monitoring wells will be relied upon as the only method for detecting groundwater contamination. SCE&G's groundwater monitoring program should be designed to provide for early detection of any leaks that develop in the HDPE waste water discharge line. The monitoring wells should detect contamination close to the pipe along its entire run, before it becomes widespread, and well before compliance with 10 CFR 20.1406 is challenged.

Deviation from RCOLA Standard Approach

As compared to the VEGP RCOLA, the VCSNS, Units 2 and 3, SCOLA included only one additional departure or exemption of note from the DCD. There is a slight increase in the maximum, safety, non-coincident wet bulb temperature of 1.2°F above the AP1000 DCD value of 86.1°F. The effects of this increase were evaluated by the staff and determined to be acceptable.

In summary, we agree with the staff's conclusions as documented in the staff's ASER regarding the safety issues associated with the SCE&G COLA for VCSNS, Units 2 and 3. We conclude that there is reasonable assurance that VCSNS, Units 2 and 3, can be built and operated without undue risk to the health and safety of the public. The SCE&G COLA for VCSNS, Units 2 and 3, should be approved following its final revision.

Sincerely,

/RA/

Said Abdel-Khalik
Chairman

REFERENCES

1. Southern Carolina Electric and Gas Company (SCE&G) Letter, "Combined License Application for V.C. Summer Nuclear Station Units 2 and 3," dated March 27, 2008 (ML081300460)
2. SCE&G Letter, "Combined License Application for V.C. Summer Nuclear Station Units 2 and 3," Revision 2, dated January 28, 2010 (ML100350739) (Rev. 2 was used as the basis for the staff's ASER)

3. During the course of ACRS review, the staff provided the following ASER chapters:

Chapter	Chapter Title	Transmittal Memo to ACRS (Accession Numbers)	ASER (Accession Numbers)
1	Introduction and Interfaces	ML101550427	ML101370358
2	Site Characteristics (without Hydrology)	ML101550273	ML101390008
	Section 2.4 (Hydrology)	ML102450029	ML102140255
3	Design of Structures, Components, Equipment, and Systems	ML101550236	ML103070512
4	Reactor	ML101450515	ML100621218
5	Reactor Coolant System and Connected Systems	ML101550558	ML100670055
6	Engineered Safety Features	ML102080334	ML102980694
7	Instrumentation and Controls	ML101540411	ML101370712
8	Electric Power	ML101540620	ML102370262
9	Auxiliary Systems	ML101540643	ML102670044
10	Steam and Power Conversion Systems	ML101450456	ML101020031
11	Radioactive Waste Management	ML101550661	ML100700102
12	Radiation Protection	ML101550687	ML101820007
13	Conduct of Operations (without Emergency Planning)	ML103200058	ML100840174
	Section 13.3 (Emergency Planning)	ML101550691	ML102020681
14	Initial Test Programs	ML101550695	ML102660181
15	Accident Analysis	ML101550697	ML103070532
16	Technical Specifications	ML101550699	ML101890864
17	Quality Assurance	ML101550701	ML101890606
18	Human Factors Engineering	ML101550703	ML101250016
19	Probabilistic Risk Assessment	ML103010338	ML102950269
19 Appendix 19.A	Loss of Large Areas of the Plant due to Explosions or Fires (LOLA)	ML101590342	Public Version ML103350636 Non-Public Version ML103370008
Appendix A	License Conditions, ITAAC, and FSAR Commitments	ML101550427	ML103360056

4. ACRS Letter, "Report on the Final Safety Evaluation Report Associated with the Amendment to the AP1000 Design Control Document," dated December 13, 2010 (ML103410351)
5. ACRS Letter, "Long-Term Core Cooling for the Westinghouse AP1000 Pressurized Water Reactor," dated December 20, 2010 (ML103410348)
6. ACRS Letter, "Report on the Safety Aspects of the Southern Nuclear Operating Company Combined License Application for Vogtle Electric Generating Plant, Units 3 and 4," January 24, 2011 (ML110170006)