PSEG012

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of PSEG POWER, LLC AND PSEG NUCLEAR, LLC (Early Site Permit Application)	Docket No. 52-043-ESP February 25, 2016

PSEG PRE-FILED TESTIMONY ON SER TOPIC 6 (LONG-TERM ATMOSPHERIC DISPERSION)

I. INTRODUCTION

Q1. Please state your name.

A1. My name is James Mallon. I am the Nuclear Development Manager for the Nuclear Development Department at PSEG Power, LLC.

Q2. Please describe your educational background and expertise.

A2. My Statement of Professional Qualifications is provided as Exhibit PSEG002. As shown in that document, I have a B.A. degree in Physics from Franklin and Marshall College and I have completed graduate business courses for an M.B.A. from the University of Southern Maine. I also hold an ANSI 3.1 Senior Reactor Operator (SRO) certification.

I have 34 years of experience working in the nuclear industry. I have worked at a number of nuclear consulting and utility companies, including Stone and Webster Engineering Corporation (1982-1986), PECO Energy Co (1987-1995), Environmental Dimensions Inc. (1995-1996), Maine Yankee Atomic Power Company (1996-2000), Exelon Nuclear (2000-2008), and PSEG Power, LLC (2008-Present). That experience has included positions related to engineering, radiation protection, health physics, waste management, training, regulatory assurance, licensing, and nuclear development.

At PSEG Power, I was the Early Site Permit Manager during the initial phases of the project, including the decision to pursue an Early Site Permit (ESP), vendor selection, application preparation, and responses to Nuclear Regulatory Commission (NRC) requests for additional information. In 2011, I became the Manager of Nuclear Development, which covers the ESP project and other activities related to small modular reactors and advanced nuclear technology.

Q3. What is the purpose of your testimony?

A3. The purpose of my testimony is to respond to SER Topic 6, which is one of six pre-filed testimony areas identified by the Atomic Safety and Licensing Board (Board) in its January 27, 2016 Memorandum and Order (Identifying Areas for Prefiled Testimony) and that primarily relate to the *Safety Evaluation of the Early Site Permit Application in the Matter of PSEG Power, LLC and PSEG Nuclear, LLC for the PSEG Early Site Permit Site* (SER), dated September 2015 (Exhibit NRC003). The Board requested the following testimony for SER Topic 6:

> Explain, for the non-expert, how the Applicant calculated the long-term atmospheric dispersion for routine releases. What was the extent of Staff's review? Details of the calculations of the GASPAR code are not required.

The purpose of my testimony is to address the first portion of this topic and explain how PSEG Power, LLC and PSEG Nuclear, LLC (collectively, PSEG), the applicants for the ESP, calculated the long-term atmospheric dispersion for routine releases. PSEG defers to the NRC Staff on the second portion of this topic to explain the extent of the Staff's review.

Q4. Please summarize your overall conclusions for this testimony.

A4. My testimony below provides a summary of how PSEG calculated the long-term atmospheric dispersion for routine releases. I conclude that PSEG's approach was reasonable and consistent with NRC guidance.

Q5. Please describe the structure of your testimony.

A5. Section II of my testimony below provides a summary of how PSEG calculated the long-term atmospheric dispersion for routine releases. Section III of my testimony provides PSEG's overall conclusions for this testimony on SER Topic 6.

II. CALCULATION OF THE LONG-TERM ATMOSPHERIC DISPERSION

Q6. What is atmospheric dispersion modeling?

A6. Atmospheric dispersion modeling is the mathematical simulation of how gaseous effluents in air disperse in the ambient atmosphere.

Q7. What is the purpose of atmospheric dispersion modeling for nuclear power plants?

A7. Applicants must demonstrate that a proposed nuclear power plant will satisfy applicable regulatory standards for protection against radiation, such as those in 10 CFR Part 20, Subpart D (Radiation Dose Limits for Individual Members of the Public). The gaseous effluents at the new plant may contain radionuclides which are dispersed by wind after being released. As part of the analysis of these gaseous effluents, applicants consider (1) short-term (accident) diffusion estimates, which relate to the atmospheric dispersion following a design basis accident; and (2) long-term (routine) diffusion estimates, which relate to the atmospheric dispersion as part of routine releases. This testimony addresses the second issue for long-term atmospheric dispersion for routine releases.

Q8. Where is long-term atmospheric dispersion for routine releases considered in the ESP application (ESPA) for the PSEG Site?

A8. Part 2 of the ESPA provides the Site Safety Analysis Report (SSAR) (Exhibits PSEG004B to PSEG004R). SSAR Section 2.3.5 (Exhibit PSEG004B) addresses long-term (routine) diffusion estimates.

Q9. How is radionuclide concentration in the air represented around a nuclear plant?

A9. The measure of radionuclide concentration in air at different locations around the plant is represented by the long-term diffusion estimates, χ/Q values. In general, the χ/Q values decrease as a function of the distance from the release point due to greater dispersion.

Q10. How do you determine maximum individual exposure?

A10. The χ/Q values at the new plant are determined at receptors of interest (*e.g.*, nearest residence) and at the points of maximum individual exposure outside the site boundary. The points of maximum individual exposure are evaluated using a radial grid of sixteen 22½ degree sectors extending to 50 miles (mi.) from the new plant. The downwind distances are measured from the center of the power block, known as the new plant site center, in all directions.

A set of data points are located within each sector at the following distances:

- From the site boundary at increments of 0.25 mi. to a distance of 1 mi. from the plant.
- From a distance of 1 mi. at increments of 0.5 mi. to a distance of 5 mi.
- From a distance of 5 mi. at increments of 2.5 mi. to a distance of 10 mi.
- From a distance of 10 mi. at increments of 5 mi. to a distance of 50 mi.

Q11. How do you estimate the χ/Q values?

A11. The NRC-sponsored XOQDOQ computer program (NUREG/CR-2919, *XOQDOQ: Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations*, PNL-4380, September 1982) is used to estimate the χ/Q values. The primary inputs in the XOQDOQ computer program are the wind speed and wind direction, and are based on three years of on-site meteorological data (January 1, 2006 through December 31, 2008). Conservatively, the χ/Q values for the new plant are determined assuming a ground level release height of 10 meters (33 ft.).

Q12. Please provide more information on the XOQDOQ computer program?

A12. The XOQDOQ dispersion model implements the assumptions outlined in Regulatory Guide 1.111, *Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors*, Revision 1, 1977. The program assumes that the material released to the atmosphere follows a Gaussian (Normal) distribution around the plume centerline. In estimating concentrations for longer time periods, the Gaussian distribution is assumed to be evenly distributed within a given directional sector. A straight-line trajectory is assumed between the release point and all receptors.

Q13. Why is a ground level release height of 10 meters conservative?

A13. This assumption is conservative because the receptors are located at the ground level, and the ground-level release model provides the bounding values for χ/Q.

Q14. How did you determine to use the center of the power block as a release point?

A14. Four reactor technologies are considered at the PSEG Site: ABWR, AP1000, U.S. EPR, and US-APWR. The primary gaseous effluent release pathways for the ABWR, U.S. EPR, and US-APWR are via the associated vent stacks that are adjacent to the corresponding reactor buildings. The vent stacks for these three technologies are located approximately at the center of the power block. The distances between the vent stacks and the site boundary vary slightly for these reactor technologies but are within 10% of the distance between the center of the power block and the site boundary in the SSAR. Therefore, use of the center of the power block provides a reasonable approximation.

The new plant using two AP1000 units has multiple gaseous effluent release points around the center of the power block. The release points associated with one of the reactors are farther away from the site boundary than the modeled center of the power block, while the release points associated with the other reactor are closer to the site boundary than the modeled center of the power block. The release point used to determine the χ/Q values at the PSEG Site is therefore a representative location for all the release points of the two AP1000 units.

Q15. What were the XOQDOQ modeling results for the ESPA?

A15. The χ/Q values are summarized in SSAR Table 2.3-34 (Exhibit PSEG004B), including values predicted by the XOQDOQ model for identified sensitive receptors in the vicinity of the new plant site center due to routine releases of gaseous effluents. The listed maximum χ/Q values reflect several plume depletion scenarios that account for radioactive decay (*i.e.*, no decay, and the default half-life decay periods of 2.26 and 8 days). A complete set of the χ/Q values at the site boundary for routine releases is provided in SSAR Table 2.3-37 (Exhibit PSEG004B).

The largest χ/Q value for the site boundary is 1.6E-05 sec/m^3 in the South direction. Note however that the limiting values for sectors SE to NW (clockwise direction) are disregarded due to the fact that the site boundary for these sectors is bordered by the Delaware River (greater than a mile radially out from new plant site center). Therefore, the only sectors that are used to obtain the limiting χ/Q value for the site boundary are between the NNW and ESE directions (clockwise direction).

The overall maximum annual average χ/Q value (with no decay) is 1.00E-05 sec/m^3 and occurs at the site boundary at a distance of 0.24 mi. to the ENE of the new plant site center. The maximum annual average χ/Q values (along with the direction and distance of the receptor locations relative to the new plant site center) for the other sensitive receptor types are: 2.40E-07 sec/m^3 for the nearest residence occurring in the northwest sector at a conservative distance of 2.8 mi. Table 2.3-35 (Exhibit PSEG004B) summarizes the annual average χ/Q values at the XOQDOQ model's 22 standard radial distances between 0.25 and 50 mi. and for the model's 10 distance segment boundaries between 0.5 and 50 mi. downwind along each of the 16 standard direction radials (*i.e.*, separated by 22.5 degrees).

Q16. How are the results of the XOQDOQ model used to determine resultant doses due to routine gaseous effluent releases?

A16. The results of the XOQDOQ model are used as input to the GASPAR model to determine the resultant doses due to routine gaseous effluent releases. Gaseous radioactive releases and use of the GASPAR model are discussed in SSAR Section 11.3.3 (Gaseous Radioactive Releases) (Exhibit PSEG004R). Per the Board's instructions, I do not provide further details regarding the GASPAR model.

III. <u>CONCLUSIONS</u>

Q17. What are your overall conclusions regarding SER Topic 6?

A17. My testimony provides a summary of how PSEG calculated the long-term atmospheric dispersion for routine releases. I conclude that PSEG's approach was reasonable and consistent with NRC guidance.

Q18. Does this conclude your testimony?

A18. Yes.

I certify that this written testimony was prepared by me or under my direction, and I adopt the testimony as my sworn testimony in this proceeding.

I declare under penalty of perjury that the foregoing written testimony is true and correct to the best of my information, knowledge, and belief.

Executed on February 25, 2016.

Executed in Accord with 10 CFR § 2.304(d)

/s/ James Mallon
James Mallon
Nuclear Development Manager
Nuclear Development Department
PSEG Power, LLC
244 Chestnut Street
Salem, NJ 08079
Phone: (856) 339-7908
E-mail: James.Mallon@pseg.com

DB1/ 86571995