

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 FEIS Topic 3, which is one of eight pre-filed testimony areas identified by the Atomic Safety and Licensing Board (Board) in its February 8, 2016 Memorandum and Order (Identifying Additional Areas for Prefiled Testimony) and that primarily relate to NUREG-2168, *Environmental Impact Statement for an Early Site Permit (ESP) at the PSEG Site* (FEIS), dated November 2015 (Exhibit NRC004). The Board requested the following testimony for FEIS Topic 3:

In its response to FEIS Question 21, PSEG clarifies that flow augmentation from Merrill Creek is not for the purposes of safety or non-safety cooling system operability. PSEG acknowledges, however, that such flow augmentation may be necessary to allow power generation to continue, in certain conditions, so as to avoid impacting the salt line in the Delaware River. Should PSEG apply for a construction permit or COL, will the NRC Staff examine at that time PSEG's ability to obtain adequate water supplies from the Merrill Creek Reservoir?

The purpose of my testimony is to address this topic on behalf of PSEG Power, LLC and PSEG Nuclear, LLC (collectively, PSEG), the applicants for the ESP, and provide some additional discussion about the Merrill Creek Reservoir and the availability of water rights for continued power operations during droughts.

Q4. Please summarize your overall conclusions for this testimony.

A4. As discussed below, the Merrill Creek Reservoir is not required for any safety cooling purposes for a new plant at the PSEG Site. PSEG considers it likely that it could transfer water rights from another PSEG-owned facility or it could obtain the water rights from a third party, if necessary, for a new plant at the PSEG Site. If PSEG proceeds with a combined license (COL) that references the ESP, then PSEG would need to consider any new and significant information related to water use and availability, which would include water allocation from the Merrill Creek Reservoir. The NRC Staff would consider PSEG's new and significant evaluation and could consider other information related to water rights from the Merrill Creek Reservoir.

Q5. Please describe the structure of your testimony.

A5. Section II of my testimony below provides some additional information about the Merrill Creek Reservoir, including its background, operations, consideration of consumptive use, and the process for obtaining additional allocation rights. Section III of my testimony then addresses whether the NRC Staff would consider PSEG's ability to obtain adequate water supplies from the Merrill Creek Reservoir should PSEG apply for a COL that references the requested ESP. Section IV provides PSEG's overall conclusions for this testimony on FEIS Topic 3.

II. MERRILL CREEK RESERVOIR

A. General Background on Merrill Creek Reservoir

Q6. What is the source of cooling water for a new plant at the PSEG Site?

A6. A new plant at the PSEG Site would withdraw cooling water from the Delaware River.

Q7. Please discuss the regulation of flow in the Delaware River.

A7. Some additional background on the regulation of flow in the Delaware River is provided in Subsection 2.4.11.2 of the Site Safety Analysis Report (SSAR) (Exhibit PSEG004B). It explains that minimum flows in the Delaware River have been regulated since 1931, with additional regulations established in 1954. Flow management of the Delaware River is accomplished through coordinated releases from reservoirs on its tributaries dictated by the Delaware River Basin Commission (DRBC) Flexible Flow Management Program. Within the Delaware River Basin, nine reservoirs are multipurpose, providing water for water supply, flow augmentation, and flood loss reduction. The Merrill Creek Reservoir, located on Merrill Creek in the central portion of the basin, is dedicated to flow augmentation.

Q8. What is the purpose of the Merrill Creek Reservoir?

A8. The Merrill Creek Reservoir is used for low flow augmentation of the Delaware River during times of drought. The Merrill Creek Reservoir allows certain power plants, classified by the DRBC as “designated units,” to continue to withdraw water from the Delaware River for power generation during declared drought warnings or emergencies. The DRBC approved a Docket, authorizing construction in 1984 with the reservoir being placed in service in 1988. The current Docket for the Merrill Creek Reservoir is provided as Exhibit PSEG014.

Q9. Is PSEG a co-owner of the Merrill Creek Reservoir?

A9. Yes.

B. NRC Regulated Cooling Water Requirements

Q10. Is the Merrill Creek Reservoir required for safety cooling purposes?

A10. No. The Merrill Creek Reservoir is not required for any safety cooling purposes for the new plant at the PSEG Site or for the existing units. It is used as a supplemental water supply to the Delaware River to offset freshwater consumptive uses resulting from power generation, and is solely to allow for the continued operation of designated units during specific, declared drought conditions.

Q11. Please describe how sufficient cooling is ensured for safety cooling purposes.

A11. The safety cooling water surface elevation level (WSEL) requirements for the new plant at the PSEG Site are discussed in SSAR Subsection 2.4.11.5 (Exhibit PSEG004B) as follows:

Tidal flow at the PSEG Site ranges from 400,000 cfs to 472,000 cfs (References 2.4.11-13 and 2.4.11-16). Therefore, the new plant site is located in an area where the tidal flow is much greater than the flow required by the intake structure for the selected reactor technology, thus making the WSEL the critical factor in plant design, as opposed to the available flow in the Delaware River.

During extreme low water conditions, the Delaware River at the new plant location reaches a minimum elevation of -15.9 ft. NAVD, as discussed in Subsection 2.4.11.3.1. The mean lower low water elevation at the Reedy Point NOAA tidal gage station (gage 8551910) is -3.0 ft. NAVD (Reference 2.4.11-10). The intake structure provides a non-safety-related and, depending on the type of reactor technology selected, potentially a safety-related source of water for the new plant. Therefore, the safety-related intake structure for the selected reactor technology will be designed for operation considering the low water conditions identified in this subsection.

Q12. What would happen if there was negligible flow in the Delaware River?

A12. As stated in Safety Evaluation Report (SER) Section 2.4.11.4.2 (Exhibit NRC003), even with negligible flow at Trenton, NJ (1.0 cubic feet per second (cfs)), tidal flow rather than freshwater flow is capable of providing ample and sufficient cooling water supply for the PSEG Site. Whether the Merrill Creek Reservoir is or is not discharging is not a factor in

meeting the low water flow requirements for the PSEG Site, and therefore the availability of flow augmentation from the Merrill Creek Reservoir is not necessary for safety.

C. Merrill Creek Reservoir Operations

Q13. When is the Merrill Creek Reservoir placed into service?

A13. There are several factors affecting when and how the Merrill Creek Reservoir is placed into service for Delaware River flow augmentation. As explained in SSAR Subsection 2.4.11.2 (Exhibit PSEG004B), “[u]nder normal conditions, coordinated management of reservoir flows ensures the maintenance of minimum flows of 1750 cfs at Montague, NJ and 3000 cfs at Trenton, NJ.” Trenton is located approximately 80 miles north of the PSEG Site at river mile (RM) 133. Flow augmentation releases from the Merrill Creek Reservoir are authorized by the DRBC under certain declared drought conditions to offset freshwater consumptive uses from power generation, and be protective of the salt line in the Delaware River.

Q14. Please describe the operations of the Merrill Creek Reservoir in more detail.

A14. As stated in SSAR Sections 2.4.1.2.3 and 2.4.11.2 (Exhibit PSEG004B), the Merrill Creek Reservoir ensures sufficient flows downstream during a drought so PSEG may continue to withdraw water from the Delaware River to maintain power generation at multiple power plants (*i.e.*, the aforementioned “designated units”) on the Delaware River. This flow augmentation from the Merrill Creek Reservoir is initiated when flows at Trenton fall below 3,000 cfs.

Q15. Why is flow augmentation necessary under these circumstances?

A15. Flow augmentation offsets freshwater consumptive use during power generation to assure that the salt line remains at or below the Philadelphia-area freshwater intakes, which are

north of RM 80, or about 28 miles north of the PSEG Site. The Merrill Creek Reservoir does not provide flow augmentation for the purposes of safety or non-safety cooling system operability for any of the PSEG owned designated units; it is intended to allow power generation to continue for these power plants without impacting the salt line in the Delaware River.

Q16. How frequently has the Merrill Creek Reservoir released water for flow augmentation?

A16. Since the Merrill Creek Reservoir was placed into service in 1988, it has released water for drought-related flow augmentation only four times. The Merrill Creek Reservoir release history is shown in Exhibit PSEG015.

D. Consumptive Use

Q17. How is the storage allocation for the Merrill Creek Reservoir determined?

A17. Calculations were performed for each affected unit to determine their proportionate freshwater consumptive use and therefore, their specific storage allocation in the Merrill Creek Reservoir. The consumptive use is calculated for each of the designated units, specific to their geographic location on the Delaware River. Plants further north along the Delaware River have higher freshwater consumptive uses than plants such as Salem Generating Station (SGS) or Hope Creek Generating Station (HCGS), which are located in the portion of the Delaware River which is considered salty or brackish.

Q18. What is the freshwater consumptive use factor for the PSEG Site?

A18. The freshwater consumptive use factor for the PSEG Site is 0.18 (stated as the “relative effect factor” in the DRBC Docket), or stated another way, 18 gallons of every 100 gallons of consumptive use is assumed to be freshwater. That factor is memorialized in

the DRBC Docket for the Merrill Creek Reservoir (Exhibit PSEG014), prepared by the Merrill Creek Owners Group (MCOG). In the case of the SGS and HCGS, the individual plant DRBC Dockets also include bases statements for the freshwater consumptive use.

Q19. Please describe consumptive use in more detail.

A19. Consumptive use occurs via evaporation in the plant cooling systems, regardless of whether a facility is cooled by a once-through system (such as SGS), or with wet cooling towers (such as HCGS and as proposed for the new plant at the PSEG Site). Evaporative losses are readily apparent and visible in the water vapor plume from a wet cooling tower. Less apparent are the evaporative losses from a once-through cooled plant. These occur in the area of the cooling water discharge plume where water heated above ambient conditions evaporates at a higher rate than what occurs at ambient water temperatures.

E. Additional Rights for Merrill Creek Reservoir

Q20. How are the rights for Merrill Creek Reservoir currently allocated?

A20. PSEG holds proportionate ownership rights to the Merrill Creek Reservoir for its existing nuclear and fossil generating stations along the Delaware River. As of the most recent DRBC-approved Docket (Exhibit PSEG014) issued to the MCOG in March 2015, there were approximately 36 generating stations listed as “designated units.”

Q21. What actions would PSEG take if additional Merrill Creek water rights are needed?

A21. If PSEG were to determine that additional Merrill Creek water rights were necessary for the new unit(s) at the PSEG Site, the initial action would be to determine if the rights were available for transfer from either another PSEG-owned facility (such as the Mercer Generating Station, which is located in a freshwater portion of the Delaware River) or a third party owned facility. If water rights needed to be obtained from another MCOG

member, PSEG would enter into negotiations to obtain those rights, which would be followed by a submittal to the DRBC to modify the Docket listing of designated units.

Q22. Would additional rights be available from other MCOG members?

A22. As the initial operation dates for the current designated units range from 1949 to 2003, of which approximately 15 have been in service over 40 years, it is likely that rights would be available for acquisition from older generating stations that typically have higher operating and maintenance costs. PSEG considers it likely that, at the time a decision is made to pursue a COL for a new unit(s) at the PSEG Site, there will be designated units that have either ceased operations or are intending to do so, due to a variety of economic and environmental factors.

Q23. What steps would PSEG need to take with the DRBC for a new unit at the PSEG Site?

A23. When a determination is made that a new unit at the PSEG Site will be entered into the COL process, PSEG will prepare a DRBC docket application for the facility, with specific plant values for water use. The DRBC will review the docket application, hold a required public hearing, and issue a docket for surface water withdrawal with appropriate conditions.

Q24. What would need to be done regarding the allocation of Merrill Creek water rights?

A24. As part of the DRBC process, PSEG would be required to either hold the specific required Merrill Creek water allocation, or would be required to commit to an operating plan that would be put into effect for times of declared drought warnings or emergencies where freshwater flow augmentation discharges from the Merrill Creek Reservoir would be mandated. As noted above, this could include power generation limits at the new

plant, or any of the other plants where PSEG owns water allocations. The details of this operating plan cannot be determined at this time as the specific river conditions, conditions in other reservoirs in the Delaware River system, operational status and current freshwater consumptive-use demands of any of the designated units, and other climate and consumptive-use values are not known.

Q25. Would there be any further changes to the allocation process for the Merrill Creek water rights?

A25. PSEG anticipates that, at the time a freshwater allocation is required for the new plant at the PSEG Site, a revised calculation methodology will be evaluated to more accurately predict the freshwater consumptive use requirements for PSEG designated units and potentially others on the Delaware River. Using a new calculation methodology and computer-based flow and flow dynamics modeling techniques, more precision can be incorporated into the determination of the necessary water allocations from the Merrill Creek Reservoir, than was available when the original allocations were determined in the 1980s.

Q26. What would happen if PSEG could not obtain the additional water rights?

A26. If the acquisition of water rights was not successful, regardless of the reason, the ability to operate the new unit(s) at the PSEG Site, or other PSEG-owned units, may not be allowed during certain infrequent drought conditions in the Delaware River basin.

III. FUTURE NRC STAFF CONSIDERATION OF MERRILL CREEK RESERVOIR ALLOCATION

Q27. Would PSEG consider further the ability to obtain adequate water supplies from the Merrill Creek Reservoir if it applies for a COL for the PSEG Site?

A27. Yes. For the reasons discussed above, it is reasonable to conclude under the National Environmental Policy Act (NEPA) that any additional Merrill Creek Reservoir water rights could be obtained for a new plant at the PSEG Site. However, as required by 10 CFR 51.50(c)(1)(iii), an applicant for a COL that references an ESP must provide: “Any new and significant information for issues related to the impacts of construction and operation of the facility that were resolved in the early site permit proceeding.” PSEG’s identification and evaluation of new and significant information would include consideration of adequate water supplies from the Merrill Creek Reservoir. That would include water use and water withdrawal applications that PSEG is required to make to the New Jersey Department of Environmental Protection and the DRBC.

Q28. Should PSEG apply for a COL, will the NRC Staff examine PSEG’s ability to obtain adequate water supplies from the Merrill Creek Reservoir?

A28. Yes. PSEG anticipates that the NRC Staff will review the water allocation associated with any new unit(s) at the PSEG Site at the time a COL application is submitted. As required by 10 CFR 51.92(b), if an applicant seeks a COL referencing an ESP, then the NRC Staff prepares a supplement to the ESP FEIS. 10 CFR 51.92(e) identifies specific topics to be included in that supplement. Section 51.92(e)(7) states that the supplement will: “Include an analysis of the issues related to the impacts of construction and operation of the facility that were resolved in the early site permit proceeding for which new and significant information has been identified” PSEG expects that the NRC Staff would evaluate the new and significant evaluation undertaken by PSEG, including consideration of any new information on water use and availability.

IV. CONCLUSIONS

Q29. What are your overall conclusions regarding FEIS Topic 3?

A29. PSEG considers it likely, and reasonable under NEPA, that it could (a) transfer water rights from another PSEG-owned facility; (b) obtain the water rights from a third party; or (c) use a new calculation methodology and modeling techniques to demonstrate that PSEG's existing allocations would be adequate to address the freshwater consumptive uses of the new plant at the PSEG Site. If PSEG proceeds with a COL that references the ESP, then PSEG would need to consider any new and significant information related to water use and availability, which would include water allocation from the Merrill Creek Reservoir. The NRC Staff would consider PSEG's new and significant evaluation and could consider other information related to water rights from the Merrill Creek Reservoir.

Q30. Does this conclude your testimony?

A30. 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

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