PSEG Nuclear LLC
P.O. Box 236, Hancocks Bridge, New Jersey 08038-0236

PSEG Nuclear LLC

PJM INTERCONNECTION, LLC
TRANSMISSION EXPANSION ADVISORY COMMITTEE

RE: ARTIFICIAL ISLAND OPEN WINDOW SUBMISSION PROCESS

PSEG NUCLEAR LLC'S
POST-TECHNICAL CONFERENCE COMMENTS

On May 19, 2014 PJM held a technical conference to review the current status of its evaluation of the various projects submitted during the open window period for the Artificial Island Request for Proposal. During that conference, PJM also responded to various questions on technical and constructability issues related to how it was evaluating the projects. PJM requested that stakeholders should submit their comments and concerns within 14 days. PJM stated that they will be considering the stakeholders' comments in their final evaluation and selection of the winning proposal.

For these reasons, in in accordance with the 14 day comment period established by PJM, PSEG Nuclear LLC now submits the following Post-Technical Conference Comments.

I. COMMENTS

Regulatory Risk of Reliance on Static VAR Compensators (SVCs) for Maintaining Transient Grid Stability for the Nuclear Units at Artificial Island

It is the position of PSEG Nuclear that the use of Static VAR Compensators (SVC's) or any other Flexible AC Transmission System (FACTS) device as part of a comprehensive solution to address angular stability and voltage constraints at Artificial Island be avoided if at all possible. Use of SVC's to help maintain angular stability in the Artificial Island region of the grid poses unknown and potentially challenging regulatory risks. The licensing basis for the Salem and Hope Creek nuclear units are based on compliance with 10CFR 50 Appendix-A General Design Criterion 17 which requires a plant's offsite sources:

> ..be designed and located so as to minimize to the extent practical the likelihood of their simultaneous failure under operating and postulated accident and environmental conditions…. provisions shall be included to minimize the probability of losing electric power from any of the remaining supplies as a result of, or coincident with, the loss of power generated by the nuclear power unit or the loss of power from the transmission network.

NRC Standard Review Plan – NUREG 0800 provides the primary guidance to NRC reviewers for ensuring a licensee complies with NRC regulations. Chapter 8 of NUREG 0800 provides review guidance regarding the design, analysis and testing of the offsite electrical system such that it meets the requirements of GDC 17. NUREG 0800 Chapter-8 states:

> The results of the grid stability analysis must show that loss of the largest single supply to the grid does not result in the complete loss of preferred power. The analysis should consider the loss, through a single event, of the largest capacity being supplied to the grid, removal of the largest load from the grid, or loss of the most critical transmission line. This could be the total output of the station, the largest station on the grid, or possibly several large stations.

Relative to the upgrades being endorsed by PJM, the document further states

> The (NRC) reviewer should verify that adequate procedures, administrative controls, and protocols are in place to ensure that no modifications to the offsite power system circuits credited for satisfying GDC 17 are implemented by offsite transmission system operating authorities, responsible for maintenance, modification, and operation of the offsite transmission grid, without the performance of a proper safety evaluation. The safety evaluation of transmission system modifications is required to ensure that the transmission grid configuration, stability, and capability remain within the assumptions of the plant safety analyses.

To date, the domestic nuclear utility industry has met the above described criteria predominantly through proven means of passive transmission infrastructure (i.e. transmission line construction) as determined through detailed grid stability studies. The introduction of an active, software controlled FACTS device like an SVC presents a significant departure from traditional industry means of compliance with GDC 17. As such, the NRC may likely impose design, testing and operational requirements for these SVCs that will be substantially more invasive and rigorous than what is typically experienced by RTOs and developers of transmission projects. Offsite source / grid reliability and its impact on plant operations has been an area of increased NRC concern resulting in increased NRC-FERC coordination relative to regulation of the grid. NRC engagement in the SVC portion of the AI project, regardless of its ultimate location, is especially likely given the following unique attributes of Artificial Island:

- The AI site is the second largest nuclear installation in the country with well-known stability challenges as evidenced by the size and complexity of the AIOG.
- The worst case consequences that will result from a contingency induced stability event coincident with an SVC failure include loss of all offsite power to the three co-located nuclear units at AI as well as potential collateral impacts to the offsite sources at neighboring regional nuclear plants. These consequences will influence the NRC to require an in-depth review of the acceptability of the SVC design in providing adequate prevention of this event.
- This will be a first-of-a-kind application of SVCs in addressing transient angular stability. All known applications of this technology address reactive support of voltage and voltage stability (not angular stability). In addition, this FOAK application will require significant transient performance requirements in a region of the grid that has severely limited stability margin.
- The transient modeling performed by PJM assumes an instantaneous response time for the SVC to source its required reactive output during a limiting transient to maintain angular stability. The NRC will, at the very minimum, require validation of the actual response time along with drift sensitivities associated with the hardware and, will, most likely, impose a requirement to assess response time impacts from a common mode software failure of the SVC controller.

- Given the above critical, first of a kind attributes associated with this solution and the potential consequences of failure of the SVC to respond as intended, the NRC may treat this design with the same regulatory oversight as that afforded to a safety related digital upgrade at a nuclear station. This will require in depth third party verification and validation of the software code, specific QA requirements and regulatory approval for software development and testing, heightened assessment of cyber security design constraints and validation of all factory and final acceptance testing. All these reviews will culminate in a safety evaluation report (SER) from the NRC following all factory and acceptance testing prior to placing the system in service. These design validation requirements can add anywhere from 24 to 36 months of additional licensing review to the project and an indeterminate impact on the cost of the SVC scope of the project.
- The above design validation activities will be mandated by the NRC on the part of the licensee – PSEG Nuclear. It is not clear from a commercial and contractual standpoint how PSEG Nuclear can be directly engaged in the design, implementation and long term maintenance and testing of these SVC's with a non-affiliated third party having total schedule and budget responsibility for the project.

II. CONCLUSION

Based on the above described regulatory factors, it is the position of PSEG Nuclear that, at a minimum, PJM take into consideration the regulatory induced cost and schedule risks associated with the use of SVCs when performing the final assessment of design options for the AI stability project. Ultimately, PSEG Nuclear believes it would be in the best interest of long term grid reliability that an entirely passive approach (i.e. additional, robust 500kV transmission infrastructure in lieu of active FACTS devices) be used to resolve the stability constraints that currently challenge system operations at Artificial Island.

III. COMMUNICATIONS

All communications concerning these comments should be directed to the following persons:

Vilna Waldron Gaston Associate General Regulatory Counsel PSEG Services Corporation 80 Park Plaza – T5G Newark, New Jersey 07102 (973) 430-3856 (973) 430-5983 (facsimile) Vilna.Gaston@PSEG.com	Leonard J. Rajkowski Director, Engineering Services PSEG Power PO Box 236 Hancocks Bridge, NJ 08038 (856) 339-5142 Leonard.Rajkowski@PSEG.com

Submitted on behalf of:

PSEG Nuclear LLC

By: *Vilna Waldron Gaston*
Vilna Waldron Gaston
Associate General Regulatory Counsel
PSEG Services Corporation
80 Park Plaza – T5
Newark, New Jersey 07102
(973) 430-3856
Vilna.Gaston@pseg.com

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