UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD

In the Matter of NEXTERA ENERGY SEABROOK, LLC (Seabrook Station, Unit 1)	Docket No. 50-443-LA-2 ASLBP No. 17-953-02-LA-BD01

Hearing Exhibit

Exhibit Number: NRC006

Exhibit Title: Statement of Professional Qualifications of Jacob Phillip

Statement of Professional Qualifications
Jacob Philip, Senior Geotechnical Engineer
Office of Nuclear Regulatory Research (RES), Division of Engineering
Structural, Geotechnical, and Seismic Engineering Branch
U.S. Nuclear Regulatory Commission

Mr. Jacob Philip is a Senior Geotechnical Engineer with about fifty years of diverse experience in geotechnical and foundation engineering design, construction, and research in private industry and government. In his 11 years of varied experience in private industry, Mr. Philip worked at three international consulting engineering firms both in the U.S. and abroad. His experience in these firms includes the design of concrete foundations for several Nuclear Power Plants (NPP), concrete and asphalt roads, runways, taxiways, and aprons, concrete foundations of several multi-story buildings, concrete structural foundations including raft foundations, pile foundations, caisson foundations socketed into rock, and foundations anchored in rock, etc. A notable foundation design by Mr. Philip is the concrete caisson foundation for the 55-story Southeast Financial Center in Miami, Florida, built in 1980, which was the first of its kind in Miami and, at the time, the tallest multi-story building south of New York City. Mr. Philip has also designed and supervised the construction of several concrete engineering facilities including bridges, culverts, concrete roads and airport pavements. Included in his responsibilities was the development of quarries for extraction of and testing of aggregate quality for concrete and asphalt, supervision of asphalt and concrete batching operations, mix designs for concrete and hot-mix asphalt pavements, and laboratory and field testing of concrete structures for compliance with specifications.

Mr. Philip has almost 39 years of experience at the NRC, which includes the authorship of safety evaluation reports (SER) for several existing NPPs as a member of the Office of Nuclear Reactor Regulation (NRR). He has 35 years of experience in research development and management in RES, which includes the design of concrete seals for the sealing of boreholes and shafts for HLW repositories and the development of durable concrete structures and cementitious materials for NPPs and concrete nuclear waste facilities for the isolation of HLW, LLW, and decommissioned nuclear structures. He managed the development of a synergistic computer code, 4SIGHT, which facilitates the performance assessments (PA) of nuclear waste and decommissioning facilities that employ concrete as the principal engineered barrier to isolate waste. Based on extensive laboratory and field research results on the degradation mechanisms in concrete, the 4SIGHT code can model synergistic degradation effects that may occur in concrete structures. Mr. Philip authored the NRC Regulatory Guide (RG) 1.69, “Concrete Radiation Shields and Generic Shield Testing for Nuclear Power Plants,” authored the NRC Research Information Letter (RIL) 0602, “Assessing the Performance of Cement Based Materials as Engineered Barriers for Isolating Radioactive Waste,” served as the reviewer for the Nuclear Energy Standards Coordination Collaborative (NESCC), which recommended future development of Concrete Codes and Standards for NPPs, and developed a program which developed the report, “Nondestructive Testing (NDT) and Sensor Technology for Service Life Modeling of New and Existing Concrete Structures.” In the report, Nondestructive Test (NDT) methods and sensor technologies are evaluated in the context of providing input parameters to service life prediction models for reinforced concrete structures.

Mr. Philip organized and participated in several International Union of Laboratories and Experts in Construction Materials, Systems and Structures (RILEM) sponsored workshops under the International NUCPERF umbrella, including “Corrosion and Long-Term Performance of Reinforced Concrete in Nuclear Power Plants and Waste Facilities” in 2006, 2009, and 2012. He co-authored technical papers in all the workshops and served as Session chair in each one. For the last 7 years, Mr. Philip has developed and managed research on Alkali-Silica Reaction (ASR) in concrete. He is the NRC project manager for ASR research at the National Institute of Standards and Technology (NIST), “Structural Performance of Nuclear Power Plant (NPP) Concrete Structures Affected by Alkali-Silica Reaction (ASR).” He is a member of the IRSN, France, Observatory of the Durability of Reinforced Concrete Structures (ODOBA) Research Technical Group (OTG), which manages the technical aspects of the 10-15-year research on degradation of concrete in NPP applications. The ODOBA project was launched by IRSN in 2016 to last for a period of at least 10 years. The aim of the project is to study concrete pathologies and their consequences for nuclear structures (e.g., reactor containments). Mr. Philip organized and led the OECD/NEA/CSNI International project ASCET (Assessment of Structures Subject to Concrete Pathologies) with the Canadian Nuclear Safety Commission (CNSC). ASCET is an international project, where experts from several countries presented their results on blind numerical simulations of benchmark tests conducted by the (CNSC) at the University of Toronto (UT), Canada, on concrete affected by ASR.

EDUCATION AND PROFESSIONAL MEMBERSHIPS/AWARDS

B.S., Physics and Mathematics, Karachi University, Pakistan, 1963 (graduated with first class honors)
B.E., Civil Engineering, Karachi University, Pakistan,1967 (graduated with first class honors)
M.E., Geotechnical Engineering, Asian Institute of Technology, Bangkok, Thailand, 1970 (under a full merit scholarship)
P.E., Licensed Professional Engineer (#13963), State of Maryland

NRC’s Meritorious Service Award, 2012. ***Citation:***
In recognition of his sustained outstanding dedication and astute leadership in planning and managing research programs to support the NRC's mission to protect public health and safety and the environment. Mr. Philip expertly oversaw and guided RES research efforts in the development of scientific information, engineering analyses and analytical tools to address a variety of significant technical issues facing the agency and the nuclear industry. In so doing, his initiative, dedication, and zeal to accomplish regulatory objectives and criteria enabled the agency to effectively anticipate and address significant technical issues in waste management, decommissioning, and reactor licensing. In addition, Mr. Philip has demonstrated exemplary level of expertise and performance while at the same time seeking opportunities to continually improve efficiency.

EXPERIENCE

US Nuclear Regulatory Commission, Rockville, MD

NRR, October 1980 to December 1983

In NRR, Mr. Philip authored the geotechnical engineering SERs for the NPPs at Grand Gulf, Perry, Shearon Harris, the S1C Naval Reactor, Dresden, Oyster Creek, and McGuire. He conducted analyses to assess the safety of the General Electric Test Reactor (GETR). He also authored SERs for several tailings dams and ponds. Mr. Philip also authored SERs of licensee uranium tailings impoundment designs for the Office of Nuclear Material Safety and Safeguard (NMSS) and the Office of State Programs (OSP).

RES, January 1984 to present

In RES, Mr. Philip authored several NRC Regulatory Guides including RG 1.198 on Seismic Soil Liquefaction at NPP sites, RG 4.7 on Site Suitability for NPPs, and RG 1.69, on Concrete Radiation Shields and Generic Shield Testing for NPPs. He authored RILs on in-situ measurements of stress in the earth's crust in the eastern United States. He was a panel member at the National Science Foundation (NSF), a task force member on revisions to Appendix A to 10 CFR Part 100, technical lead for the development of engineering guidance documents from IAEA, ANS, ASTM, and ASME and interactions with the National Academy of Sciences, all related to NPPs. For almost 25 years, Mr. Philip developed and managed several research projects conducted by the National Institute of Standards and Technology (NIST) primarily dealing with the performance of concrete and cementitious grouts for vaults to isolate LLW, concrete for newer NPPs, and cementitious grouts for waste incidental to reprocessing, and the decommissioning of NPPs using the entombment in concrete option. As Project Manager, he developed the statements of work (SOW) for research projects, estimated the costs (IGCE), and managed the contracts. Mr. Philip managed the development of a synergistic computer code, 4SIGHT, which facilitates the performance assessments (PA) of nuclear waste and decommissioning facilities that employ concrete as the principal engineered barrier to isolate waste. Based on extensive laboratory and field research results on the degradation mechanisms in concrete, the 4SIGHT code can model synergistic degradation effects that may occur in concrete structures. As part of his efforts in advancing the state-of-practice in the use of cementitious materials in nuclear waste disposal, Mr. Philip was invited to and organized and participated in several RILEM-sponsored workshops under the International NUCPERF umbrella, including "Corrosion and Long-Term Performance of Reinforced Concrete in Nuclear Power Plants and Waste Facilities," in 2006, 2009, and 2012. He co-authored technical papers in all the workshops and served as Session chair in each one.

Mr. Philip managed a major research project on the effectiveness of cementitious/concrete sealing of HLW repository shafts and boreholes. More than 10 NUREG/CR documents were published under this project. He co-authored several technical papers on the subject and presented findings from the research within the US and in an international conference in India. Mr. Philip was the NRC lead representative on the international research effort (DECOVALEX) to study coupled Thermohydromechanical (THM) processes in HLW disposal. Under the

project, he coauthored five papers, one published in the International Rock Mechanics Journal. A state-of-the-art book on THM effects in HLW disposal was also published by the International Rock Mechanics Society.

Since 2012, Mr. Philip has developed and managed research in Alkali-Silica Reaction (ASR) in concrete. He is the project manager for ASR research at the National Institute of Standards and Technology (NIST), "Structural Performance of Nuclear Power Plant (NPP) Concrete Structures Affected by Alkali-Silica Reaction (ASR)." The objective of this research is to develop a technical basis for generic regulatory guidance to evaluate ASR-affected NPP concrete structures throughout its service life with regard to: (1) significance and effects on structural performance and capability to perform intended function under design basis static and dynamic loads and load combinations and (2) characteristics of an aging management program to adequately monitor and manage effects of ASR degradation such that intended functions are maintained through the period of extended operation of renewed licenses. He is a member of the IRSN, France, ODOBA Research Technical Group (OTG) which manages the technical aspects of the 10-15-year research on degradation of concrete in NPP applications. The ODOBA project was launched by IRSN in 2016 for a period of at least 10 years. The aim of the project is to study concrete pathologies and their consequences for nuclear structures (e.g., reactor containments). The project is led in collaboration with the NRC, Canadian Nuclear Safety Commission (CNSC), Belgian Technical Safety Authority (Bel V), and Technical Research Center of Finland (VTT). Mr. Philip organized and led the OECD/NEA/CSNI International project ASCET (Assessment of Structures Subject to Concrete Pathologies) with the CNSC. He is presently in discussions to develop an international OECD//NEA/CSNI project to assess the ASR-affected concrete structures at Gentilly, Canada, with CNSC and other international partners. Mr. Philip also coordinates research activities with DOE and EPRI on concrete for NPP applications for subsequent license renewals (SLR).

January 1974 to October 1980

Project Engineer, Dames and Moore, Consulting Engineers, Cranford, New Jersey

Mr. Philip was a Project Engineer with Dames and Moore, an international consulting engineering firm, which was a world leader in the areas of geotechnical and environmental engineering. Initially, he was a staff engineer, one of several engineers who worked under a designated principal investigator (PI). Later, he was a PI who is the lead engineer on specific consulting engineering projects for a wide array of clients. The jobs involved both office engineering design (foundations of nuclear and fossil plants, tailings dams, multi-story building foundations) and field supervision for QA/QC in the construction of concrete foundations (individual and spread footings, pile and caisson foundations, structural fills and backfills), dams, site preparation, and other earthwork.

As a PI, Mr. Philip was the lead engineer on the project and supervised a team of four to five engineers and up to five technicians. He would write a proposal for the job, estimate the cost, and submit a bid. If the proposal was accepted, he would manage the project from the planning

stage through to the field investigations, analyses, and preparation of the report to the clients. Mr. Philip authored over a dozen and a half project reports on diverse projects for clients.

Mr. Philip's most notable project was the Foundation Investigation and Consultation, Office Tower and Annex Building, Miami, Florida for the Southeast Financial Center. He designed the 10-12-foot diameter concrete caissons for this 55-story structure, which was, at that time, the tallest multi-story building south of New York City. It was the first concrete Caisson Foundation design for a multi-story building in Miami. There was an article, "Friction Licks Bad Rock," in the *Engineering News Record* magazine, June 10, 1982, page 14, that reported on this first-of-a kind foundation design in Miami, Florida. The structural engineering consultants on this project were Skidmore, Owings, and Merrill, a world-famous consulting engineering firm, in the area of high-rise buildings.

As a lead field engineer, Mr. Philip was responsible for field and laboratory testing (soils and concrete materials), soils and rock borings and sampling, logging (borehole gamma ray logging), development of boring logs from the boring program, installation of and monitoring of field instrumentation (e.g., extensometers), monitoring foundation construction, including pile driving operations, and conducting site surveys. He supervised foundation construction and earthwork at the Callaway NPP, Fulton, Missouri; foundation investigations for additions to the Yankee Rowe NPP, Rowe, Massachusetts; and construction of the foundations for the Hope Creek NPP.

July 1972 to December 1973

Chief Materials Engineer, Netherlands Airport Consultants, The Hague, Netherlands

Mr. Philip was employed as the Project Manager for the design of the International Airport, Jeddah, Saudi Arabia. He later worked as the Lead Materials Engineer (soils, concrete, and asphalt) supervising the construction of the runway, taxiways, and apron for the Jeddah International Airport, Saudi Arabia.

As Project Manager, Mr. Philip supervised a team of four engineers in the geometric design of the airfield pavements and pavement design. He supervised the same team of engineers in estimating earthwork quantities (cut and fill), quantities for base and subbase elements of the pavements, and hot-mix asphalt and concrete pavement overlays for the preparation of contract documents.

In addition, Mr. Philip supervised a team of three engineers and 15 technicians in the laboratory and field testing of airfield pavement elements (e.g., grain-size analysis, compaction, subgrade modulus, aggregate testing, concrete and hot-mix asphalt materials testing) to ensure compliance with job specifications. He provided expert advice to the International Civil Aviation Organization (ICAO) and the Saudi Arabian Department of Civil Aviation on the design of airport pavements.

August 1970 to June 1972

Chief Materials Engineer with Orval Landis and Associates, Consulting Engineers (Headquartered in Kansas City, Kansas)

Mr. Philip was employed as the Chief Materials Engineer for this US headquartered consulting engineering firm for the design and construction of roads, airfields (runway, taxiway, and apron), and concrete bridges and drainage structures. As part of his duties, he:

- participated with a team of engineers in the geometrical design of the roads and airfields and concrete/asphalt/soil-cement pavement design. Mr. Philip did design calculations, prepared engineering drawings, and estimated quantities of construction elements for job pricing.

- supervised three engineers and 20 technicians in activities related to the performance of construction materials (soils, concrete, and asphalt). This activity involved laboratory and field testing to ensure compliance with specifications on the job.

- managed the estimation of construction quantities for the project and was responsible for verifying contractor job billing, preparing tender documents, and using 'CPM' techniques for tracking and scheduling construction activities.

- independently managed the operations of a crushing plant, a concrete production plant, and an asphalt plant. Mr. Philip had the responsibility that the materials from the plants were in compliance with the job specifications. Any materials not in compliance were rejected, the plant temporarily shut down, and adjustments made in the specific plant elements, e.g., the spacing of the aggregate jaw crushers, plant hopper openings, and the speed of the belt conveyors.

July 1968 to May 1970

Graduate school at the Asian Institute of Technology, Bangkok, Thailand

Mr. Philip attended graduate school under a full merit scholarship based on excellent grades for the Bachelor of Engineering degree. His thesis was published as a paper in the peer-reviewed Japanese journal, "Soils and Foundations," Volume 15, #2 1975.

January 1968 to June 1968

Assistant Engineer, Frederic R Harris, Consulting Engineers (Headquartered in NY, NY)

As a Junior Materials Engineer (soils, concrete, asphalt), Mr. Philip worked on a new freeway project utilizing then state-of-practice design and construction techniques for this international consulting firm. As part of his duties, he:

- worked with a team of engineers in the geometric design of the freeway, estimation of earthwork quantities, and preparation of contract documents.

- performed calculations for the design of bridge pile foundations, box and pipe culverts.

- supervised 15 technicians in the materials laboratory; in the testing of soils (laboratory and field), concrete materials (designing concrete mixes, compression and beam testing) asphalt materials (Marshall tests for hot mixes, bitumen testing), and aggregate testing for job compliance.

- Inspected and certified bridge concrete pile driving operations, roadway embankment and asphalt overlays, operations of the aggregate crushing plant and the production plants for ready mix concrete and hot mix asphalt.