**BEFORE THE**

**GEORGIA PUBLIC SERVICE COMMISSION**

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| **IN THE MATTER OF: GEORGIA POWER COMPANY’S SEVENTH SEMI-ANNUAL VOGTLE CONSTRUCTION MONITORING REPORT** | **DOCKET NO.: 29849** |
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**PUBLIC DISCLOSURE**

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|  | **DIRECT TESTIMONY** |  |
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|  | **AND EXHIBITS** |  |
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|  | **OF** |  |
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|  | **WILLIAM R. JACOBS, JR., PhD.** |  |
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**ON BEHALF OF THE**

**GEORGIA PUBLIC SERVICE COMMISSION**

**PUBLIC INTEREST ADVOCACY STAFF**

**December 7, 2012**

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STF-WRJ-1 Resume of William R. Jacobs, Jr., Ph.D.

STF-WRJ-2 Graph of Planned versus Actual CFC Engineering Package Issuance

# I. INTRODUCTION

**Q. PLEASE STATE YOUR NAME, TITLE AND BUSINESS ADDRESS.**

**A**. My name is William R. Jacobs, Jr., Ph.D. I am an executive consultant with GDS Associates, Inc. My business address is 1850 Parkway Place, Suite 800, Marietta, Georgia, 30067.

**Q. DR. JACOBS, PLEASE SUMMARIZE YOUR EDUCATIONAL BACKGROUND AND EXPERIENCE.**

**A**. I received a Bachelor of Mechanical Engineering in 1968, a Master of Science in Nuclear Engineering in 1969 and a Ph.D. in Nuclear Engineering in 1971, all from the Georgia Institute of Technology. I am a registered professional engineer and a member of the American Nuclear Society. I have more than thirty years of experience in the electric power industry including more than twelve years of nuclear power plant construction and start-up experience. I have participated in the construction and start-up of seven nuclear power plants in this country and overseas in management positions including start-up manager and site manager. As a loaned employee to the Institute of Nuclear Power Operations (“INPO”), I participated in the Construction Project Evaluation Program, performed operating plant evaluations and assisted in development of the Outage Management Evaluation Program. Since joining GDS Associates, Inc. in 1986, I have participated in rate case and litigation support activities related to power plant construction, operation and decommissioning. I have evaluated nuclear power plant outages at numerous nuclear plants throughout the United States. I served on the management committee of Plum Point Unit 1, a 650 Megawatts Electric (“MWe”) coal fired power plant under construction near Osceola, Arkansas. As a member of the management committee, I assisted in providing oversight of the Engineering, Procurement and Construction (“EPC”) contractor for this project. My resume is included in Exhibit STF-WRJ-1.

**Q. DR. JACOBS, WHAT IS THE NATURE OF YOUR BUSINESS?**

**A**. GDS Associates, Inc. (“GDS”) is an engineering and consulting firm with offices in Marietta, Georgia; Austin, Texas; Corpus Christi, Texas; Manchester, New Hampshire; Madison, Wisconsin; Augusta, Maine; and Auburn, Alabama. GDS provides a variety of services to the electric utility industry including power supply planning, generation support services, rates and regulatory consulting, financial analysis, load forecasting and statistical services. My department, Generation Services, provides fossil and nuclear plant monitoring, plant ownership feasibility studies, plant management audits, production cost modeling and expert testimony on matters relating to plant management, construction, licensing and performance issues in technical litigation and regulatory proceedings.

**Q. WHOM ARE YOU REPRESENTING IN THIS PROCEEDING?**

**A**. I am representing the Georgia Public Service Commission (“Commission”) Public Interest Advocacy Staff (“Staff”).

**Q. WHAT IS YOUR INVOLVEMENT WITH THE VOGTLE 3 AND 4 PROJECT?**

A. I am the Commission’s Independent Construction Monitor (“CM”) for the Vogtle Units 3 and 4 Project (“Project”). As such, my duties are to assist the Staff in providing regulatory oversight of all aspects of the Project and to keep the Commission informed of significant Project issues or changes in the projected cost and schedule as they occur. I have presented testimony in the First, Second, Third, Fourth, Fifth and Sixth Semi-Annual Vogtle Construction Monitoring (“VCM”) proceedings describing the construction monitoring activities, the status of the Project and any concerns or significant issues that I identified.

**Q. WHAT IS YOUR ASSIGNMENT IN THIS PROCEEDING?**

My assignment is to present the results of the Staff and CM’s Project oversight from certification of the Project to the present with emphasis on the time period covered by the Seventh Semi-Annual Vogtle Construction Monitoring Report, January 1, 2012 through June 30, 2012. I will provide a description of the construction monitoring activities that have occurred since the May 30, 2012 testimony I rendered in this docket. I will describe the current status of the Project and will update the Commission on issues that have the potential to impact the schedule or cost of the Project that I have discussed in prior testimony in this docket and identify any new issues that have arisen since the Sixth Semi-Annual Vogtle Construction Monitoring filing. Finally I will make a recommendation regarding the costs submitted by Georgia Power Company (“Company”) for verification and approval.

# II. Description of Construction Monitoring Activities

**Q. PLEASE DESCRIBE THE CONSTRUCTION MONITORING PROGRAM THAT THE STAFF AND INDEPENDENT CONSTRUCTION MONITOR HAVE IMPLEMENTED TO MONITOR THE CONSTRUCTION OF THE VOGTLE 3 AND 4 PROJECT.**

A. The Staff and the CM continue to be very active in monitoring the Project. These activities include monthly meetings with Staff and Company personnel to discuss Project status, regular trips to the Vogtle Project site to observe the monthly EPC meeting and to witness firsthand construction activities and progress. The CM has observed readiness review meetings in which Company and Consortium[[1]](#footnote-1) personnel review the Consortium’s plan for key activities, attended training on the ITAAC[[2]](#footnote-2) process and accompanied Company senior management on a visit(s) to Shaw Modular Solutions. In addition, the CM team has continued its review of the Company’s process for handling Project invoices from Westinghouse and Shaw. This includes review of the Project cost control procedures and sampling of processed invoices. Other activities conducted by the Vogtle Construction Monitoring team include:

* Review of weekly Metrics reports issued by the Company;
* Review of monthly Project status reports issued by the Company;
* Review of monthly EPC status reports;
* Review of the Company’s Semi-Annual Construction Monitoring Reports;
* Preparation of discovery requests for additional information as needed following review of the monthly status reports, semi-annual construction monitoring reports or meetings with the Company;
* Participation in Nuclear Regulatory Commission (“NRC”) public meetings;
* Review of public correspondence between the Company and the NRC via the NRC website;
* Review of correspondence between the Consortium and the Company;
* Review of trade articles and journals related to new nuclear power plant development.

**Q. HOW DO YOU KEEP THE STAFF INFORMED ABOUT THE CURRENT STATUS OF THE VOGTLE 3 AND 4 PROJECT?**

A. I discuss the status of the Project and any issues or concerns that have arisen with the Staff in frequent conference calls, meetings and other written communication. Each week I forward to the Staff the Company’s Weekly metrics report along with my comments and observations. In addition, I submit two monthly reports to the Staff. At the beginning of each month I submit a Construction Monitor report that describes the current status of the Project’s existing issues or concerns and identifies any new significant issues or concerns. A copy of this report is provided to Commissioners each month. In addition, following each monthly EPC meeting I submit a summary of the meeting and my observations to both the Staff and the Company which is reviewed and edited by the Staff for further clarification and accuracy. In this report I also include comments and clarifications provided by the Company to ensure that the report is factually accurate.

# III. Project Status

**Q. WHAT IS THE CURRENT SCHEDULE FOR THE PROJECT?**

A. That question is difficult to answer because at this time there is no Integrated Project Schedule (“IPS”) that all parties agree with and support. Per the EPC Agreement, the Guaranteed Substantial Completion Date (“GSCD”) for Unit 3 is April 1, 2016 and April 1, 2017 for Unit 4. These are the certified Commercial Operation Dates (“COD”). The Company has acknowledged that the GSCDs are not achievable in response to STF 32-16 and in Mr. McKinney’s testimony in the 6th VCM proceeding. In the 7th VCM report the Company states that the Project will be finished “no earlier” than November 2016 for Unit 3 and November 2017 for Unit 4. Most recently on the witness stand Mr. McKinney stated that the Company is using November 2016 for Unit 3 and November 2017 for Unit 4 as the Project CODs but the Consortium is using a date that is “slightly later.” When pressed on the meaning of slightly later Mr. McKinney clarified that the Consortium is using early to mid-2017 for Unit 3 COD.

**Q. WHAT IS THE BASIS OF THE NOVEMBER 2016 DATE THE COMPANY IS USING?**

A. November 2016 is the Unit 3 COD from the IPS that the Consortium provided to the Company in June 2012. It is based on receipt of the Combined License (“COL”) in February 2012 plus the 57-month duration contemplated in the EPC Agreement. This duration starts with installation of rebar in the Nuclear Island (“NI”) to Commercial Operation for Unit 3.

**Q. DO YOU CONSIDER THE NOVEMBER 2016 DATE TO BE REASONABLE AND ACHIEVABLE?**

A. As discussed in more detail in the Schedule Analysis section of my testimony, I do not consider the November 2016 date to be reasonable or achievable. This date does not consider the delays in placement of First Nuclear Concrete that have been experienced and also does not consider the current status of module fabrication and assembly. Both of these factors must be incorporated for a schedule to be considered reasonable and achievable.

**Q. HOW IS THE PROJECT BEING MANAGED BY THE COMPANY AT THIS TIME?**

A. At this time the Company manages the Project using six-month look ahead schedules provided by the Consortium.

**Q. CAN THE VOGTLE PROJECT BE PROPERLY MANAGED USING A SIX-MONTH LOOK AHEAD SCHEDULE?**

A. No. It is not prudent to manage a project of the size and complexity of the Vogtle 3 and 4 Project without a fully Integrated Project Schedule that is accepted by all parties. Furthermore, Staff would consider any additional costs the Company may seek to recover that result from its failure to have a fully Integrated Project Schedule to be imprudent.

**Q. WHY DOES A PROJECT OF THIS MAGNITUDE NEED AN INTEGRATED PROJECT SCHEDULE?**

A. I previously discussed the reasons the Vogtle Project needs a realistic, agreed upon IPS in some detail in my testimony in the 6th VCM proceedings. The need for an IPS is so important to the Project that I will repeat the rationale here. The Vogtle Project needs a realistic, agreed upon IPS as generally outlined in the Institute of Nuclear Power Operations (INPO)[[3]](#footnote-3) Principle Number 4 for nuclear power plant construction. Principle Number 4 is “xxxxxxxxxxxxxxxxxxxxxx xxxxxxxxxx.” The INPO principle describes the importance of having a realistic and understood schedule. The attributes of INPO Principle Number 4 best describe the importance of a realistic schedule and are presented below:

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The importance of a realistic schedule is demonstrated in the attributes associated with INPO Principle No. 4 shown below.

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**Q. DOES THE COMPANY CURRENTLY HAVE IN ITS POSSESSION A FULLY INTEGRATED PROJECT SCHEDULE FROM THE CONSORTIUM THAT IS CONSISTENT WITH THE CRITERIA IN INPO PRINCIPLE NO. 4 – XXXXXXXXXXXXXXXXXXXXXXXXX XXXXXXXXXXX?**

A. No.

**Q. HAVE YOU CONDUCTED ADDITIONAL ANALYSIS OF THE PROJECT SCHDUELE?**

A. Yes I have. My analysis of the current Project schedule is provided in Section VI of this testimony.

**Q. WHAT IS THE CURRENT STATUS OF THE PROJECT BUDGET?**

A. As reported in the Company’s 7th VCM report, as of June 30, 2012, the Total Project Cost to date was $127 million under budget with Total Construction and Capital Cost being $121 million under budget and Total Construction Schedule Financing Cost being $7 million under budget. These budget variances are due primarily to timing differences between actual expenditures and the budget and should not impact Total Project Cost. More plainly, the Project is under budget because the Consortium has not completed the milestones necessary to receive milestone payments as anticipated in the EPC Agreement. Thus, the Consortium has been paid less at this time than projected by the EPC Agreement because they have not accomplished work according to scheduled milestones. The Current Forecast of Total Project Cost is $6.201 billion, which is $88million above the currently certified amount of $6.113 billion.

**Q. HAVE YOU IDENTIFIED ADDITIONAL COST PRESSURES THAT COULD RESULT IN INCREASED PROJECT COSTS?**

A. Yes I have. Additional cost drivers that could impact Project costs include additional capital costs due to schedule delay, additional financing costs due to schedule delay, costs resulting from a settlement of the current litigation with the Consortium and costs resulting from current, and future change notices received from the Consortium. The cost of schedule delays is potentially one of the largest cost drivers that could increase Project costs as it leads not only to increased direct construction costs but also to additional financing costs. The cost of a one year delay in the Project is in the range of hundreds of millions of dollars. The current Company estimate of $6.2 billion includes schedule delay costs only through November 2016 and 2017 CODs for Units 3 and 4. Although the Company has not acknowledged any cost liability in the current $930 million dollar litigation (100% Owners), it is possible that a settlement of these issues or the outcome of the litigation could result in additional Project costs. The Company could also be faced with future litigation if the Consortium and Company cannot resolve the disputes that may arise as this complex Project continues.

In addition, the Consortium has submitted numerous potential change notices with the Company that could have significant cost impact. For example, the Consortium has submitted a potential change notice for XXXXXXXXXXX xxxxxxxxxxxx that is estimated at more than $xxxxxxxx. Other potential change notices that could have significant cost impact include:

* xxxxxxxxxxxxxxxxxxxxxxxxxx;
* xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx;
* xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx;
* xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx;
* xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx.

**Q. PLEASE DESCRIBE THE CONSTRUCTION ACTIVITIES UNDERWAY AT THE VOGTLE PROJECT SITE.**

A. A large number of both safety related (nuclear island related) and non-safety related activities are underway at the Vogtle Project site. Non-safety related construction activities are progressing well. These include:

* Placement of the Unit 3 Turbine Building foundation;
* Assembly of the Unit 3 Condenser;
* Placement of the Unit 3 Cooling Tower foundation;
* Development of the River Water Intake system;
* Construction of the 230 kV transmission switchyard.

Some safety related activities including fabrication of the Containment Vessel Bottom Heads for Units 3 and 4 and construction of the Unit 3 Containment Vessel Lower Ring, although behind the original schedule, are progressing well. However, a key critical path activity, placement of the nuclear island foundation, an activity called First Nuclear Concrete (“FNC”) has been delayed many times from the original scheduled date of October 2011. The initial delay was the result of the Consortium’s failure to receive approval of the Design Control Document (“DCD”) from the NRC in a timely manner.[[4]](#footnote-4) The delays in FNC are discussed in the next section of my testimony. Another key critical path activity is assembly of structural modules in the Module Assembly Building (“MAB”). Structural modules are assembled in the MAB from sub-modules fabricated at Shaw Modular Solutions in Lake Charles, Louisiana. Module assembly activities were halted in August 2012 due to a lack of delivery of sub-modules to the site and have not yet resumed.

The Vogtle Project construction site is being maintained in a neat and orderly fashion. Worker safety is a top priority and continuously emphasized by Company and Consortium management.

# IV. REVIEW OF CONSORTIUM PERFORMANCE

**Q. HOW WOULD YOU CHARACTERIZE PERFORMANCE OF THE CONSORTIUM AT THIS POINT IN THE PROJECT?**

A. While the Consortium has made good progress in the design and construction of some non-safety related structures such as the turbine building and cooling towers, I would characterize the performance of the Consortium to date in certain key safety-related activities that are on the critical path as unsatisfactory.

**Q. PLEASE PROVIDE SUPPORT FOR YOUR CHARACTERIZATION OF THE CONSORTIUM’S PERFORMANCE.**

A. My characterization of Consortium performance as unsatisfactory is supported by my review of the Consortium’s performance of key critical path activities including placement of First Nuclear Concrete, fabrication of sub-modules and assembly of structural modules, development of the detailed plant design in a timely manner that meets the licensing basis and conduct of critical QA source inspections of safety related material.

**FNC Placement**

Placement of FNC is a critical path activity and a major milestone identified in the EPC Agreement. Steps leading up to FNC include receipt of the COL which occurred in February 2012 and installation of an extensive amount of rebar on the nuclear island mudmat. The installed rebar must be in accordance with applicable civil engineering codes and conform to the design specified in the Design Control Document approved by the NRC. The scheduled date for FNC following receipt of the COL was xxxxxxxxxxxxxx.

Rebar installation began shortly after the COL was issued and was progressing well until March, 2012 when an NRC inspector found that the rebar being installed did not match the rebar design shown in the DCD. It is disconcerting that the rebar deficiency was found by an NRC inspector. FNC was initially delayed to xxxxxxxxxxx as this issue was evaluated. Subsequently, FNC was further delayed to mid-xxxxxxxxxxx to allow for revision of the rebar design to agree with the DCD, removal of some of the previously installed rebar and installation of more than 800 rebar splices (called cadwelds) to bring the installed rebar into design conformance with the DCD. Subsequent delays in FNC include:

* Delayed to xxxxxxxxxxxxxx from xxxxxxxxxxxxxxxxxx;
* Delayed to xxxxxxxxxxxxxxxx (from xxxxxxxxxxxxxxxxxxx;
* Delayed to xxxxxxxxxxxxxxxxxxxxxxx (from xxxxxxxxxxxxxxxxx xxxxxxxxxxx;
* Delayed to xxxxxxxxxxxxxxxx (from xxxxxxxxxxxxxxxxxxxxxx);
* Delayed to xxxxxxxxxxxxxxx (from xxxxxxxxxxxxxxxxxxxxx xxxxxxxxxx
* Delayed to xxxxxxxxxxxxxxxxxxxxxxxx estimate from xxxxxxxx xxxxxxxxxxxxxxxx

During this time period other rebar issues were identified including receipt and installation of rebar that did not meet the bend radius requirement and identification of an issue with the design of the shear reinforcement rebar.

In summary, rebar installation which was originally scheduled to take 3 months will take at least 10.5 months and result in a 7.5 month delay. This delay of 7.5 months from May 15, 2012 to December 28, 2012 on a key critical path activity and the discovery of design and material issues by the NRC is a prime example of unsatisfactory performance by the Consortium. Note that the failure of the rebar design to conform to the DCD has far wider implications as discussed below under “Development of Detailed Design Packages.”

**Design, Fabrication and Assembly of Structural Modules**

The Consortium’s inability to design, fabricate and assemble structural modules to meet the Project schedule is another example of unsatisfactory Consortium performance that I would characterize as even worse than their FNC performance.

Modular construction techniques are used to fabricate several of the plant’s major structures and were touted as a major advancement over the past nuclear plant design and construction processes where structures were built on-site. These modular construction techniques were intended to lower cost and shorten construction schedules as compared to the prior construction methods. Sub-modules made of steel plates and reinforcing rods are designed by Westinghouse and manufactured at the Shaw Modular Solutions (“SMS”) facility in Lake Charles, Louisiana. Many of these sub-modules are quite large weighing many tons and measuring over 60 feet in length. They are shipped by truck to the Vogtle Project site and then welded together in the MAB to form completed modules. The largest module which forms the Auxiliary Building, CA20, consists of 72 sub-modules welded into a single structure. When assembly of the module is complete, the module is moved on the heavy haul road to a location near the NI. CA-20 is then set on the NI foundation by the Heavy Lift Derrick. The walls of the module are then filled with concrete to complete the structure.

Fabrication of the critical CA20 and CA01 sub-modules is far behind schedule due to numerous design, fabrication and quality assurance problems that have been encountered. Major design changes including an increase in the number of Nelson studs and a change in the type of steel used in some sub-modules resulted in significant delays. In some cases SMS found it was impossible to physically construct the sub-module as designed. Time after time promised delivery dates of sub-modules to the Vogtle site were missed.

When fabrication of some sub-modules was completed, the required quality assurance paperwork was of such poor quality that the completed sub-modules could not be shipped. Quality Assurance (QA) paperwork problems included lost paperwork, missing signatures, and illegible notes. On some occasions, resolution of the quality assurance paperwork issues took longer than fabrication of the sub-module. One extreme example is sub-module xxxxxxxxx, a critical corner sub-module needed for the assembly of CA20. Fabrication of xxxxxxx was completed in April 2012 but as of this writing, this sub-module has not yet been shipped to the Vogtle site due to paperwork deficiencies.

Another example of unsatisfactory Consortium performance is failure to use the correct type of weld on certain modules. When it was determined that the type of steel for sub-module walls needed to change, the type of weld used in fabrication should have been changed to a full penetration weld to meet code. This was not done and some modules were fabricated with the wrong type of weld. These modules will require repair at the Vogtle site to meet code before they can be used.

SMS clearly lacked experience in the nuclear power industry and was not prepared for the rigor and attention to detail required to successfully manufacture nuclear components.

**Development of Detailed Design Packages**

Detailed design packages called Certified for Construction (“CFC”) engineering packages must be developed from the AP1000 Standard Plant Design provided in the DCD. CFC packages are needed to support procurement activities and to allow development of detailed construction work packages. Consortium performance has been unsatisfactory in the timely development of CFC packages and in ensuring that the CFC packages conform to the licensing basis as shown in the approved DCD.

Throughout 2010, 2011 and 2012 the Consortium consistently failed to meet the schedule for issuance of CFC engineering packages on a monthly basis. The Consortium’s delay in issuance of CFC packages is clearly shown in the graph of planned versus actual CFC package delivery on page 21 of the Company’s xxxxxxxxxxxxxxxxxxxxxx.(Exhibit STF-WRJ-2) This graph shows that per the August 2010 schedule, issuance of slightly more than xxx CFC packages should have been completed by xxxxxxx. As of the xxxxxxxxxxxx xxxxxxxxxxx, approximately xxx or only xxxxx of the CFC packages have been issued some x months after they were scheduled to be complete. However, the impact of these late deliveries has been mitigated by the slippage in the Project schedule.

Even more important than the timely issuance of the CFC packages is the requirement for CFC packages to conform to the licensing basis that the NRC approved in issuing the DCD. Lack of conformance to the licensing basis was identified as an issue when the NRC discovered that the nuclear island rebar installation did not agree with the design shown in the DCD. Recognizing that failure of the design to conform to the licensing basis was a significant issue, the Consortium, in conjunction with the Southern Nuclear Company, undertook a review of all documents related to the first year of construction and documents in the site data center. This review was called the Construction to Licensing Basis (“C2LB”) review. Over 30,000 documents were reviewed, resulting in identification of xx required design changes, xxx issues that did not require license amendments and xx issues that require license amendments to resolve. Conformance of the plant design to the licensing basis is critical to safe plant operation and to licensability of the Project. The Consortium’s failure to ensure that the plant design conforms to the licensing basis is a significant performance failure by the Consortium. In spite of theC2LB review, additional issues with the rebar design have been identified and have further delayed FNC.

**Conduct of QA Source Inspections**

Per the EPC Agreement, the Consortium is responsible for conducting inspections of components and material at the manufacturer’s facility prior to shipment to the site. This activity, called source inspection, is conducted by the Consortium’s quality assurance organization. Numerous components and material have been shipped to the site with quality issues that should have been identified by source inspections at the manufacturer. Examples include:

* Sub-modules from SMS with missing Nelson studs;
* Rebar from subcontractor Gerdau Ameristeel that did not meet the bend radius requirement;
* Embeds with inadequate stud welding from subcontractor Cives Steel Company.

Nuclear plants must be constructed of material and components of the highest quality. This quality is ensured in part through adequate inspection at the lowest tier sub-contractor working on safety related components, systems, or structures up through the last sub-contractor prior to shipment to the site. Consortium performance in this area has been unsatisfactory.

# V. REVIEW OF NRC PERFORMANCE

**Q. PLEASE COMMENT ON THE ROLE OF THE NUCLEAR REGULATORY COMMISSION WITH RESPECT TO THE VOGTLE PROJECT.**

A. The role of the NRC is to protect the health and safety of the public by ensuring that the Vogtle Project can be operated safely when completed. The NRC takes their responsibility to protect the health and safety of the public very seriously and their decisions are not influenced by schedule or cost impacts on the Project. Having said that, I have found the NRC to be supportive of the Vogtle Project and to have adopted new practices to expedite resolution of some issues. Examples include:

* Expedited approval of License Amendment Requests (“LAR”);
* Scheduling of regular weekly meetings to review issues;
* Discussion of preliminary filings rather than wait for filing of final documents;
* Discussions to reach a common understanding of ITAAC acceptance criteria.

**Q. PLEASE PROVIDE A BRIEF OVERVIEW OF THE 10 CFR PART 52 REGULATORY PROCESS.**

A. The current regulatory process requires the technology provider to receive approval of the nuclear power plant design (Design Control Document) and the utility to receive its license to construct and operate (Combined License) prior to beginning construction of safety related activities. This process is defined in 10 CFR Part 52. The advantage of the Part 52 process is that if the process is followed as intended, it provides design certainty. Lack of design certainty was one of the major contributors to cost overruns during the first round of nuclear construction in the 1970’s and 1980’s. However, the Part 52 process does require the plant to be built as designed (its design basis).

**Q. AS YOU STATE ABOVE, IS IT CORRECT THAT FOR THE VOGTLE PROJECT THE NRC HAS EXPEDITED THE LARs NEEDED TO SUPPORT CONSTRUCTION?**

A. Yes, the NRC has to date issued every submitted LAR in a timely manner as needed to support the construction schedule of the Vogtle Project.

# VI. SCHEDULE ANALYSIS

**Q. HAS THERE EVER BEEN A COMPLETE, FULLY INTEGRATED PROJECT SCHEDULE FOR THE VOGTLE PROJECT?**

A. No there has not. Over time the Consortium has continued to add key elements to the Project schedule including critical logic ties, engineering activities and procurement activities linked to the engineering schedule. Staff’s understanding is the Consortium’s current IPS does not include a schedule of fabrication or assembly of sub-modules for the critical structural modules. Since assembly and installation of the structural modules are key critical path activities, an IPS without these activities has no real meaning. That is, it cannot be used to make an accurate and reasonable forecast of the CODs for the Project.

**Q. WHAT IS THE BASIS OF YOUR SCHEDULE ANALYSIS?**

A. The basis of my schedule analysis is the schedule duration contemplated in the EPC Agreement. The April 1, 2016 date for Unit 3 GSCD in the EPC Agreement is based on an agreed upon 54-month schedule from FNC. The critical milestone for FNC contained in Exhibit E-2 of the EPC Agreement is xxxxxxxxxxxxxxx. Fifty four months from xxxxxxxxxxxxxxxxxxxxxxxx, the GSCD for Unit 3.

**Q. USING FNC AS A CRITICAL MILESTONE, WHAT IS YOUR ASSESSMENT OF THE CURRENT PROJECT SCHEDULE?**

A. As of the writing of this testimony, FNC is scheduled to occur in December 2012, some 14 months later than the FNC date in the EPC Agreement. Based on this, I conclude that the current actual delay to the Project is at least14 months. Therefore, ignoring other issues that I discuss later, Unit 3 COD should occur no earlier than June 2017 based on an actual known and undisputed Project delay to date.

**Q. YOU DESCRIBE THE DELAY IN FNC AS THE ACTUAL DELAY THAT HAS OCCURRED TO DATE. ARE THERE OTHER KNOWN DELAYS THAT COULD DELAY UNIT 3 COD BEYOND JUNE 2017?**

A. Yes. After achieving FNC, subsequent critical path activities are the setting of structural modules CA20 and CA01. As discussed above, both of these modules are far behind schedule.

**Q. WHAT IS THE CURRENT STATUS OF MODULE FABRICATION AND ASSEMBLY?**

A. Fabrication and assembly of two critical modules, CA20 and CA01 are far behind schedule. The date to set the completed CA20 module on the NI foundation to support the GSCD from the Level I IPS dated July 23, 2010[[5]](#footnote-5) is February 9, 2012. As of this writing, of the 72 sub-modules that make up CA20, xx have been shipped to the site, xx are in document review, xx are in fabrication and x is waiting to begin fabrication. Assembly of CA20 in the MAB had started but was halted after 5 sub-modules were assembled due to a lack of delivery of sub-modules needed to continue assembly of CA20. There has been no assembly work in the MAB since August 2012. Assembly of CA20 sub-modules is planned to begin in 2013 once a sufficient backlog of sub-modules are on site.

The situation for CA01 is even worse. The Company has identified CA01 as the “Primary Critical Path” for the Project. CA01 consists of 47 sub-modules of which x have completed fabrication, x are in production, with the remaining sub-modules either on hold or in various stages of pre-fabrication and none have been shipped to the site. The schedule date to set CA01 on the NI foundation to support the GSCD is May 9, 2012.

It is possible that critical path activities of fabrication, assembly and setting of modules CA20 and CA01 will likely delay the COD more than the current 14 month FNC delay. The last forecast that the Company provided for CA20 “ready for set” is December 2013, some 22 months after the required set date of February 2012 needed to support the Unit 3 GSCD of April 1, 2012. This forecast was provided in the September 10, 2012 Weekly Metrics report.

**Q. HAS THE COMPANY PROVIDED AN UPDATED FORECAST OF WHEN MODULES CA20 OR CA01 WILL BE READY TO BE SET SINCE THE SEPTEMBER 10, 2012 WEEKLY METRICS REPORT?**

A. No they have not. The reason is that they simply do not have the information needed to provide updated forecasts. At the time of this writing, the Consortium has not provided the Company with accurate and reasonable updated fabrication schedules for the CA20 and CA01 modules. In addition, past schedules provided by the Consortium have proven to be extremely optimistic and unreliable. Until the Company is provided realistic schedules for fabrication and assembly of the required modules, it is not possible to forecast when these critical structures will be ready.

**Q. PLEASE SUMMARIZE YOUR CURRENT ANALYSIS OF THE PROJECT SCHEDULE.**

A. I believe that the Project is currently at least 14 months late based solely on the delay in FNC. This is based on achieving FNC in December 2012. If FNC is delayed beyond December the Project will be delayed accordingly. I believe that the Company is correct that the critical path at this time is the fabrication and assembly of structural modules CA20 and CA01. While it is not possible to estimate the amount of delay due to these modules, I believe as explained above that it is possibly greater than the current 14 months due to the FNC delay. Finally, given the performance of the Consortium to date and its inability to meet milestone dates in the key safety-related areas, additional further delays should be anticipated. It is not possible to estimate the amount of these future delays at this time.

**Q. COULD THE DELAY IN THE COMMERCIAL OPERATING DATES BE SIGNIFICANTLY LONGER THAN 14 MONTHS?**

A. Yes. Many of the upcoming activities on the Project are technically and logistically very challenging. Given the Consortium’s numerous examples of poor performance on many safety related activities to date, it would be reasonable to assume further schedule expansion.

**Q. AT THIS TIME CAN YOU GIVE AN ACCURATE FORECAST OF COD FOR THE PROJECT?**

A. No, I cannot. With so much uncertainty in the Consortium’s ability to fabricate and assemble structural modules, with so many First of a Kind activities yet to come and given the Consortium’s performance to date, I cannot provide what I believe to be an accurate forecast of COD for the Project. That is why I am recommending that delay scenarios of 24, 36 and 48 months be evaluated.

**Q. DO YOU BELIEVE THAT SIGNIFICANT SCHEDULE COMPRESSION CAN BE ACCOMPLISHED TO RECOVER SOME OF THESE DELAYS?**

A. No I do not. As I have previously explained the Consortium has not been able to meet any significant critical safety related milestones in accordance with the EPC schedule. Evidence of this is seen in the status of FNC, module fabrication, and CFC engineering package development. Based on past performance, I see no evidence that the Consortium will be able to perform the remaining First of a Kind construction activities in a shorter duration than projected in the EPC Agreement.

# VII. OTHER ISSUES AND CHALLENGES

**Q. PLEASE DESCRIBE OTHER FUTURE ISSUES OR CHALLENGES YOU HAVE IDENTIFIED FOR THE VOGTLE PROJECT.**

A. The Vogtle Project is the first new nuclear power plant to begin construction in over 30 years. The design is new, the modular construction of nuclear power plants is new, the regulatory environment under 10 CFR Part 52 is new and most of the people involved are new to new nuclear plant construction. Some of the challenges facing the Project include:

* Development of a realistic IPS that is agreed to and supported by all parties;
* Ensuring that the Project is designed and constructed in accordance with the design basis;
* Implementing First of a Kind construction activities including fabrication and assembly of structural modules and fabrication and assembly of the Shield Building;
* Completion of the 875 ITAAC per unit as required to support the Project Schedule;
* Resolution of the claim litigation without impacting the Project design and construction activities;
* Management of existing and future change notices from the Consortium.

# VIII. CONCLUSIONS AND RECOMMENDATIONS

**Q. WHAT ARE YOUR CONCLUSIONS REGARDING THE VOGTLE 3 AND 4 PROJECT AT THIS TIME?**

A. My conclusions are as follows:

* I have found the performance of the Consortium in the critical safety related areas to be unsatisfactory.
	+ Key critical path activities including placement of First Nuclear Concrete are far behind schedule.
	+ Issuance of critical design information is also far behind schedule and in many cases has not been in conformance with the licensing basis defined in the DCD.
	+ Fabrication, delivery and assembly of key structural modules are far behind schedule and the Consortium has not provided a schedule or plan going forward. Assembly of the Auxiliary Building CA20 structural module was halted in August 2012 after only 5 of 72 sub-modules had been assembled. Assembly of the CA01 module has not begun. The schedule impact of these delays is unknown at this time but could be significant.
* The Project is at least 14 months late compared to the Guaranteed Substantial Completion Dates of April 1, 2016 for Unit 3 and April 1, 2017 for Unit 4. Delay in the fabrication and assembly of structural modules could result in additional schedule delay.
* A complete and realistic Integrated Project Schedule that includes all critical project elements including modules and is agreed to and supported by all parties is necessary as soon as possible for prudent management of the Project.
* The cost drivers that I have identified including schedule delay and Consortium change notices will result in substantial cost pressure on the Project.

**Q. WHAT IS YOUR RECOMMENDATION TO THE COMMISSION BASED ON YOUR ANALYSIS OF THE PROJECT SCHEDULE?**

A. I recommend that the Commission order the Staff and Company to work jointly in development of additional delay scenarios of 24, 36 and 48months.

**Q. WHAT IS STAFF’S RECOMMENDATION CONCERNING VERIFICATION AND APPROVAL OF THE COSTS REQUESTED BY THE COMPANY?**

A. Subject to the recommendations of other Staff witnesses, Staff recommends that the costs requested by the Company in this Seventh Semi-Annual Review be verified and approved by the Commission. For purposes of my recommendation, “verification and approval” of costs means a determination that such costs have actually been spent on the Project.

**Q. DOES THIS CONCLUDE YOUR TESTIMONY?**

A. Yes it does.

EXHIBIT STF-WRJ-1

Resume of William R. Jacobs, Jr.

**EDUCATION**: Ph.D., Nuclear Engineering, Georgia Tech 1971

MS, Nuclear Engineering, Georgia Tech 1969

BS, Mechanical Engineering, Georgia Tech 1968

**ENGINEERING REGISTRATION**: Registered Professional Engineer

**PROFESSIONAL MEMBERSHIP:** American Nuclear Society

**EXPERIENCE**:

Dr. Jacobs has over thirty-five years of experience in a wide range of activities in the electric power generation industry. He has extensive experience in the construction, startup and operation of nuclear power plants. While at the Institute of Nuclear Power Operation (INPO), Dr. Jacobs assisted in development of INPO’s outage management evaluation group. He has provided expert testimony related to nuclear plant operation and outages in Texas, Louisiana, South Carolina, Florida, Wisconsin, Indiana, Georgia and Arizona. He currently provides nuclear plant operational monitoring services for GDS clients. He is assisting the Florida Office of Public Counsel in monitoring the development of four new nuclear units in the State of Florida. He provides testimony before the Florida Public Service Commission concerning the prudence of expenditures for these nuclear units. He has assisted the Georgia Public Service Commission staff in development of energy policy issues related to supply-side resources and in evaluation of applications for certification of power generation projects and assists the staff in monitoring the construction of these projects. He has also assisted in providing regulatory oversight related to an electric utility’s evaluation of responses to an RFP for a supply-side resource and subsequent negotiations with short-listed bidders. He has provided technical litigation support and expert testimony support in several complex law suits involving power generation facilities. He monitors power plant operations for GDS clients and has provided testimony on power plant operations and decommissioning in several jurisdictions. Dr. Jacobs has provided testimony before the Georgia Public Service Commission, the Public Utility Commission of Texas, the North Carolina Utilities Commission, the South Carolina Public Service Commission, the Iowa State Utilities Board, the Louisiana Public Service Commission, the Florida Public Service Commission, the Indiana Regulatory Commission, the Wisconsin Public Service Commission, the Arizona Corporation Commission and the FERC.

A list of Dr. Jacobs’ testimony is available upon request.

1986-Present GDS Associates, Inc.

As Vice-President, Dr. Jacobs directs GDS' nuclear plant monitoring activities and has assisted clients in evaluation of management and technical issues related to power plant construction, operation and design. He has evaluated and testified on combustion turbine projects in certification hearings and has assisted the Georgia PSC in monitoring the construction of the combustion turbine projects. Dr. Jacobs has evaluated nuclear plant operations and provided testimony in the areas of nuclear plant operation, construction prudence and decommissioning in nine states. He has provided litigation support in complex law suits concerning the construction of nuclear power facilities.

1985-1986 Institute of Nuclear Power Operations (INPO)

Dr. Jacobs performed evaluations of operating nuclear power plants and nuclear power plant construction projects. He developed INPO Performance Objectives and Criteria for the INPO Outage Management Department. Dr. Jacobs performed Outage Management Evaluations at the following nuclear power plants:

 Connecticut Yankee - Connecticut Yankee Atomic Power Co.

 Callaway Unit I - Union Electric Co.

 Surry Unit I - Virginia Power Co.

 Ft.Calhoun - Omaha Public Power District

 Beaver Valley Unit 1 - Duquesne Light Co.

During these outage evaluations, he provided recommendations to senior utility management on techniques to improve outage performance and outage management effectiveness.

1979-1985 Westinghouse Electric Corporation

As site manager at Philippine Nuclear Power Plant Unit No. 1, a 655 MWe PWR located in Bataan, Philippines, Dr. Jacobs was responsible for all site activities during completion phase of the project. He had overall management responsibility for startup, site engineering, and plant completion departments. He managed workforce of approximately 50 expatriates and 1700 subcontractor personnel. Dr. Jacobs provided day-to-day direction of all site activities to ensure establishment of correct work priorities, prompt resolution of technical problems and on schedule plant completion.

Prior to being site manager, Dr. Jacobs was startup manager responsible for all startup activities including test procedure preparation, test performance and review and acceptance of test results. He established the system turnover program, resulting in a timely turnover of systems for startup testing.

As startup manager at the KRSKO Nuclear Power Plant, a 632 MWE PWR near Krsko, Yugoslavia, Dr. Jacobs' duties included development and review of startup test procedures, planning and coordination of all startup test activities, evaluation of test results and customer assistance with regulatory questions. He had overall responsibility for all startup testing from Hot Functional Testing through full power operation.

1973 - 1979 NUS Corporation

As Startup and Operations and Maintenance Advisor to Korea Electric Company during startup and commercial operation of Ko-Ri Unit 1, a 595 MWE PWR near Pusan, South Korea, Dr. Jacobs advised KECO on all phases of startup testing and plant operations and maintenance through the first year of commercial operation. He assisted in establishment of administrative procedures for plant operation.

As Shift Test Director at Crystal River Unit 3, an 825 MWE PWR, Dr. Jacobs directed and performed many systems and integrated plant tests during startup of Crystal River Unit 3. He acted as data analysis engineer and shift test director during core loading, low power physics testing and power escalation program.

As Startup engineer at Kewaunee Nuclear Power Plant and BeaverValley, Unit 1, Dr. Jacobs developed and performed preoperational tests and surveillance test procedures.

1971 - 1973 Southern Nuclear Engineering, Inc.

Dr. Jacobs performed engineering studies including analysis of the emergency core cooling system for an early PWR, analysis of pressure drop through a redesigned reactor core support structure and developed a computer model to determine tritium build up throughout the operating life of a large PWR.

**SIGNIFICANT CONSULTING ASSIGNMENTS**:

Georgia Public Service Commission – Selected as the GPSC’s Independent Construction Monitor for the Plant Vogtle 3 and 4 nuclear construction projects. Assists the Commission staff in providing oversight of all aspects of the Plant Vogtle 3 and 4 project. Provides testimony in the semi-annual hearing before the GPSC on the Vogtle project.

South Carolina Office of Regulatory Staff – Assisted the South Carolina Office of Regulatory Staff in evaluation of South Carolina Electric and Gas’ request for certification of two AP1000 nuclear power plants at the V.C. Summer site.

Florida Office of Public Counsel – Assists the Florida Office of Public Counsel in monitoring the development of four new nuclear power plants in Florida including providing testimony on the prudence of expenditures.

East Texas Electric Cooperative – Represented ETEC on the management committee of the Plum Point Unit 1 a 650 Mw coal-fired plant under construction in Osceola, Arkansas and represents ETEC on the management committee of the Harrison County Power Project, a 525 Mw combined cycle power plant located near Marshall, Texas.

Arizona Corporation Commission – Evaluated operation of the Palo Verde Nuclear Generating Station during the year 2005. Included evaluation of 11 outages and providing written and oral testimony before the Arizona Corporation Commission.

Citizens Utility Board of Wisconsin – Evaluated Spring 2005 outage at the Kewaunee Nuclear Power Plant and provided direct and surrebuttal testimony before the Wisconsin Public Service Commission.

Georgia Public Service Commission - Assisted the Georgia PSC staff in evaluation of Integrated Resource Plans presented by two investor owned utilities. Review included analysis of purchase power agreements, analysis of supply-side resource mix and review of a proposed green power program.

State of Hawaii, Department of Business, Economic Development and Tourism – Assisted the State of Hawaii in development and analysis of a Renewable Portfolio Standard to increase the amount of renewable energy resources developed to meet growing electricity demand. Presented the results of this work in testimony before the State of Hawaii, House of Representatives.

Georgia Public Service Commission - Assisted the Georgia PSC staff in providing oversight to the bid evaluation process concerning an electric utility’s evaluation of responses to a Request for Proposals for supply-side resources. Projects evaluated include simple cycle combustion turbine projects, combined cycle combustion turbine projects and co-generation projects.

Millstone 3 Nuclear Plant Non-operating Owners – Evaluated the lengthy outage at Millstone 3 and provided analysis of outage schedule and cost on behalf of the non-operating owners of Millstone 3. Direct testimony provided an analysis of additional post-outage O&M costs that would result due to the outage. Rebuttal testimony dealt with analysis of the outage schedule.

H.C. Price Company – Evaluated project management of the Healy Clean Coal Project on behalf of the General Contractor, H.C. Price Company. The Healy Clean Coal Project is a 50 megawatt coal burning power plant funded in part by the DOE to demonstrate advanced clean coal technologies. This project involved analysis of the project schedule and evaluation of the impact of the owner’s project management performance on costs incurred by our client.

Steel Dynamics, Inc. – Evaluated a lengthy outage at the D.C. Cook nuclear plant and presented testimony to the Indiana Utility Regulatory Commission in a fuel factor adjustment case Docket No. 38702-FAC40-S1.

Florida Office of Public Counsel - Evaluated lengthy outage at Crystal River Unit 3 Nuclear Plant. Submitted expert testimony to the Florida Public Service Commission in Docket No. 970261-EI.

United States Trade and Development Agency - Assisted the government of the Republic of Mauritius in development of a Request for Proposal for a 30 MW power plant to be built on a Build, Own, Operate (BOO) basis and assisted in evaluation of Bids.

Louisiana Public Service Commission Staff - Evaluated management and operation of the River Bend Nuclear Plant. Submitted expert testimony before the LPSC in Docket No.U-19904.

U.S. Department of Justice - Provided expert testimony concerning the in-service date of the Harris Nuclear Plant on behalf of the Department of Justice U.S. District Court.

City of Houston - Conducted evaluation of a lengthy NRC required shutdown of the South Texas Project Nuclear Generating Station.

Georgia Public Service Commission Staff - Evaluated and provided testimony on Georgia Power Company's application for certification of the Intercession City Combustion Turbine Project - Docket No. 4895-U.

Seminole Electric Cooperative, Inc. - Evaluated and provided testimony on nuclear decommissioning and fossil plant dismantlement costs - FERC Docket Nos. ER93-465-000, etal.

Georgia Public Service Commission Staff - Evaluated and prepared testimony on application for certification of the Robins Combustion Turbine Project by Georgia Power Company - Docket No. 4311-U.

North Carolina Electric Membership Corporation - Conducted a detailed evaluation of Duke Power Company's plans and cost estimate for replacement of the Catawba Unit 1 Steam Generators.

Georgia Public Service Commission Staff - Evaluated and prepared testimony on application for certification of the McIntosh Combustion Turbine Project by Georgia Power Company and Savannah Electric Power Company - Docket No. 4133-U and 4136-U.

New Jersey Rate Counsel - Review of Public Service Electric & Gas Company nuclear and fossil capital additions in PSE&G general rate case.

Corn Belt Electric Cooperative/Central Iowa Power Electric Cooperative - Directs an operational monitoring program of the Duane Arnold Energy Center (565 Mwe BWR) on behalf of the non-operating owners.

Cities of Calvert and Kosse - Evaluated and submitted testimony of outages of the River Bend Nuclear Station - PUCT Docket No. 10894.

Iowa Office of Consumer Advocate - Evaluated and submitted testimony on the estimated decommissioning costs for the Cooper Nuclear Station - IUB Docket No.RPU-92-2.

Georgia Public Service Commission/Hicks, Maloof& Campbell - Prepared testimony related to Vogtle and Hatch plant decommissioning costs in 1991 Georgia Power rate case - Docket No. 4007-U.

City of El Paso - Testified before the Public Utility Commission of Texas regarding Palo Verde Unit 3 construction prudence - Docket No. 9945.

City of Houston - Testified before Texas Public Utility Commission regarding South Texas Project nuclear plant outages - Docket No. 9850.

NUCOR Steel Company - Evaluated and submitted testimony on outages of Carolina Power and Light nuclear power facilities - SCPSC Docket No. 90-4-E.

Georgia Public Service Commission/Hicks, Maloof& Campbell - Assisted Georgia Public Service Commission staff and attorneys in many aspects of Georgia Power Company's 1989 rate case including nuclear operation and maintenance costs, nuclear performance incentive plan for Georgia and provided expert testimony on construction prudence of Vogtle Unit 2 and decommissioning costs of Vogtle and Hatch nuclear units - Docket No. 3840-U.

Swidler& Berlin/Niagara Mohawk - Provided technical litigation support to Swidler& Berlin in law suit concerning construction mismanagement of the Nine Mile 2 Nuclear Plant.

Long Island Lighting Company/Shea & Gould - Assisted in preparation of expert testimony on nuclear plant construction.

North Carolina Electric Membership Corporation - Prepared testimony concerning prudence of construction of Carolina Power & Light Company's Shearon Harris Station - NCUC Docket No. E-2, Sub537.

City of Austin, Texas - Prepared estimates of the final cost and schedule of the South Texas Project in support of litigation.

Tex-La Electric Cooperative/Brazos Electric Cooperative - Participated in performance of a construction and operational monitoring program for minority owners of Comanche Peak Nuclear Station.

Tex-La Electric Cooperative/Brazos Electric Cooperative/Texas Municipal Power Authority (Attorneys - Burchette & Associates, Spiegel &McDiarmid, and Fulbright &Jaworski) - Assisted GDS personnel as consulting experts and litigation managers in all aspects of the lawsuit brought by Texas Utilities against the minority owners of Comanche Peak Nuclear Station.

1. The Consortium consists of Westinghouse Electric Company, and Stone and Webster a wholly owned subsidiary of the Shaw Group. [↑](#footnote-ref-1)
2. ITAAC stands for Inspections, Tests, Analyses and Acceptance Criteria. ITAAC are prescribed in the Design Control Document and provides the Regulator with objective evidence that the plant and its equipment were procured and constructed in accordance with the certified design. [↑](#footnote-ref-2)
3. INPO sets performance objectives, criteria, and guidelines industry-wide for nuclear power plant construction and operation. The intent is to promote operational and construction excellence and improve the sharing of experience between nuclear power plants operators. All United States commercial nuclear power plant operators are paid members of INPO. [↑](#footnote-ref-3)
4. The Design Control Document contains the basic design of the AP1000. The DCD must be approved by the NRC before a COL can be issued to a utility allowing safety related construction to begin at the nuclear power plant site. [↑](#footnote-ref-4)
5. The July 23, 2010 IPS is important because it is the first issuance of the IPS with a Unit 3 COD of April 1, 2016 which is the GSCD. Prior IPSs showed a COD of January 2016 for Unit 3 reflecting float in the early Project schedules. [↑](#footnote-ref-5)