HIGH BRIDGE
ASSOCIATES

Expert Report of Ron Seagraves

For

<u>Southern Alliance for Clean Energy, et al. v. Florida Power & Light Co.,</u>
Case No. 1:16-cv-23017 (S.D. Fla.)

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1 SUMMARY

This report contains my opinions regarding the likely cost and technical challenges associated with the proposal to build cooling towers for Turkey Point Power Plant Units 3 and 4. My firm, High Bridge Associates, Inc. (High Bridge) was retained by Florida Power & Light Company (FP&L) to assess the Turkey Point 3&4 Cooling Towers Cost Estimate as presented in the May 14, 2018, Expert Report of Bill Powers (Powers) for Plaintiffs in the case of *Southern Alliance for Clean Energy, et al. v. Florida Power & Light Co.*, Case No. 1:16-cv-23017 (S.D. Fla.). Our review of the Powers report concentrated primarily on cost estimate accuracy, adequacy of the technical basis, and expected schedule duration.

Based on our review, the proposal to build cooling towers as proposed in the Powers Report would cost approximately $1.84 billion in capital costs, and approximately $109.2 million a year in additional operating costs. Our estimate excludes the cost to do other potential projects at the Turkey Point facility, such as removal of the cooling canals, installation of additional groundwater recovery wells, or other projects not specifically identified in the Powers Report.

The Powers Report contains a series of significant inaccuracies and omissions, which resulted in the substantial underestimation by Powers and which are summarized below:

- Total Capital cost including contingency for the closed loop cooling tower system ranges between $323.5 million and $405.5 million for Powers versus $1.84 billion for High Bridge.
- Total annual O&M costs required to operate the Closed Loop Cooling System are $8.5 million for Powers versus $109.2 million for High Bridge.

Similarly, review of Powers technical basis indicated numerous miscalculations and oversights which are summarized below:

- The effects of environmental conditions on evaporative cooling tower performance and design were not adequately considered, resulting in unsound cost estimating basis.
- The monumental challenges and complexities of implementing a cooling tower retrofit at PTN Units 3 and 4 were dramatically understated.
- Inadequate consideration was given to the project physical requirements to maintain Ultimate Heat Sink (UHS) and to the regulatory rigor that such changes will incur to obtain approval from the Nuclear Regulatory Commission.
- Supply, storage, and treatment requirements for reclaimed water from Miami-Dade Water and Sewer Department (MDWASD) were downplayed to a substantial degree resulting in significant cost estimate deficiencies. A 60 MGPD makeup water treatment plant costs over $400 million.
- Forced outage duration assumptions were at the low range anticipated by High Bridge and the cost estimate reflected a flawed accounting basis for full utility cost recovery.

Additionally, given the magnitude and complexity of design, regulatory, and construction requirements, High Bridge concluded that Powers 4.5 year schedule duration is more likely to span seven to nine years.

2 EXPERT QUALIFICATIONS

2.1 Professional Summary of Ron Seagraves

Mr. Seagraves is a seasoned professional with over 35 years of project management, construction management, risk management, and executive consulting experience in the nuclear, petrochemical, oil and gas, and fossil industries. As Vice President and Director of the Center of Estimating Excellence and Special Studies, he has managed detailed cost estimating and high level independent cost assessments for various customers and projects. Mr. Seagraves is responsible for the continuing improvement and implementation of the High Bridge best-in-class process for scoping and estimating operating nuclear plant modifications, new nuclear construction, and decommissioning projects. Since joining the Chattanooga office in September 2016, Mr. Seagraves has managed estimate development for modification projects for multiple nuclear utilities/owners within the US and Europe at 29 different nuclear sites. These estimates have covered all stages of the project life cycle including conceptual to design issued and construction ready. The High Bridge process supports independent bottom-up estimating as well as review and validation of existing estimates.

Mr. Seagraves' 38 years of experience includes engineering, construction, start-up, and capital improvement of nuclear and fossil power facilities. Project management, specialty consulting and staffing, and subject matter expertise for multiple commercial construction and engineering companies and public utilities. Key responsibilities have included overall project management; project scope development and control; schedule development; cost and schedule performance management; variance and risk analyses; enterprise and project risk management, resource management; contract negotiation; development of financial tracking programs and systems; and cash flow and fiscal budget development.

For additional details, please refer to attached curriculum vitae.

3 COST ESTIMATE ASSESSMENT

3.1 Assessment Approach

High Bridge reviewed the 109 page Powers Expert Report and the basis for its estimated cost range. This report is comprised of several pages of Turkey Point 3&4 analyses, 40 pages of analyses of other reference project data, and 66 pages of Attachments including a one-page cooling tower vendor price quote.

In order to prepare this report, High Bridge utilized information and costs contained within its July 2015 cost estimate and conceptual engineering scope basis to retrofit Turkey Point Units 3 and 4 with the addition of cooling towers to take the place of the existing canal cooling system. However, the 2015 Report addressed a more limited scope and did not include all necessary elements to construct the cooling tower system that is described in the Powers Report. High Bridge also updated information to reflect 2017 dollars and various significant scope changes. This update included using reclaimed municipal sewage as the makeup water source for Units 3, 4, and 5; adding a reclaimed water line from MDWASD; adding a reclaimed water make up storage reservoir; adding a reclaimed water treatment plant; installing a Zero Liquid Discharge system to the cooling tower blowdown system; mitigation of wetland impacts associated with construction of the new system; modifications to the ultimate heat sink (UHS); canal modifications and significant site civil impacts necessary to implement cooling towers; and other construction infrastructure scope created as a result of deferring construction of Turkey Point Units 6 and 7. These items were not part of the conceptual cost estimate prepared in 2015, and these costs assumed that the reclaimed water pipeline and infrastructure would be constructed by Turkey Point Units 6 and 7.

3.2 Cost Estimate Conclusions

The Powers Report estimated a capital cost range of $404.5 million to $322.5 million in 2017 dollars using two-40 cell (80 cells) or two-54 cell (108 cells) cooling towers supplied by SPX Corporation. High Bridge estimates the capital cost to be approximately $1.84 billion in 2017 dollars using two-37 cell matrix GEA Counter-flow Model: 606049-74B-32.81-FCF units (74 cells). Specific High Bridge findings for the Powers Report cost estimate include:

1. Significant shortcomings in the technical basis, quantitative price outcome, and the qualitative process used to develop the cost estimate.
2. Failure to fully appreciate and account for extensive site facilities and infrastructure required to utilize reclaimed municipal sewage water in the main power turbine condensers and the evaporative cooling towers.
3. Lack of recognition that converting from a Canal Cooling System to a Cooling Tower System utilizing reclaimed municipal sewage water is a major first of a kind (FOAK) project built at a wetlands site with major complexities and uncertainties.
4. Overlooks or minimizes the sizeable complexities, risks, and uncertainties associated with this major project at an operating nuclear power plant in the very early conceptual stage of design maturity.

3.3 High Bridge Assessment of the Powers Report Cost Estimate and Lack of Technical Basis

Over 90 percent of the Powers report addresses other reference project historical cost information and outlines the case for why retrofitting a power plant cooling water system with a closed loop cooling tower is technically possible, economically feasible, and environmentally desirable. Very little of the analysis addresses the Turkey Point overall site and Units 3 and 4 specific technical challenges, issues, and Florida state location climatic parameters that drive the costs for licensing, design, construction, and operational performance of the proposed cooling towers.

The Powers Report cost estimate is simplistic and based entirely on a cooling tower vendor price quote, and an estimate for project infrastructure for permitting, design, and construction developed based on a rule of thumb factor of three times the vendor cooling tower price that does not recognize the complexities and challenges of the Turkey Point Site. Powers openly admits this fact in Attachment A which states that: "*Budget is tower only, not including basins. Infrastructure cost is estimated by some at 3 times the cost of the wet tower, including such things as site prep, basins, piping, electrical wiring and controls, etc. Subsurface foundations such as piling can add significantly and may be necessary for a seacoast location.*" This example represents a high-level overview of assumptions and minimizes the formidable technical, logistical, and regulatory challenges of converting the Canal Cooling System to Cooling Towers utilizing reclaimed sewer water.

The Powers Report is insufficient to provide a realistic comprehensive cost estimate for the conversion of the CCS system to mechanical cooling towers. The Powers Report summarizes the history of many dissimilar projects that added cooling towers or that had other characteristics in common with the Turkey Point Units 3 & 4 proposed modifications. However, the report ignores major factors that impact the design and the costs of the Turkey Point modifications. First, mechanical draft cooling towers heat removal capacity is based on the evaporation of water. Therefore, the environmental conditions at the plant are of paramount importance. Comparisons with cooling tower installations at plants in California, Minnesota, Vermont or Arizona with very different humidity levels and temperatures have limited relevance to the realities of Turkey Point.

The report provides considerable background information on the general topic of cooling power plants. It cites numerous examples of power plants of different types and provides a summary of mechanical draft cooling tower applications. However, the report is superficial in its analysis and conclusions regarding the Turkey Point Units 3 & 4 cooling tower modification and the required site infrastructure systems and facilities.

This approach is inadequate to address the complexities of retrofitting a major modification like the closed loop cooling tower system to an operating nuclear plant. Work at a nuclear site, especially inside the protected area, forces numerous inefficiencies on the craft labor. These restraints force tasks to take longer and to cost more. In addition, Turkey Point Units 3 & 4 use a unique closed cooling water system based on approximately 10 square miles of cooling canals. When seen from above, the plant site resembles a large wetlands area. There are limited access roads or staging areas for large construction projects.

In reality, this cooling tower retrofit project would be a major site infrastructure project that consists of five projects all performed in the same general area that need to be coordinated and managed to avoid interferences. The projects consist of:

1. Adding the cooling towers
2. Modifying the Discharge Canal to accept a large pumping station structure
3. Modifying the return canal to increase its capacity for the Ultimate Heat Sink
4. Installing a tie-in to the MDWASD, including a Recycled Water Treatment Facility and storage pond
5. Installing a Zero Liquid Discharge system to the cooling tower blowdown system.

Based on the High Bridge technical critique (Refer to Section 4 of this report) of the Powers Report, significant deficiencies in the Powers estimated cost for Turkey Point 3&4 cooling towers include:

- No engineering analyses or conceptual site arrangement assumptions/definitions for project.
- No recognition or analysis of risk issues applicable for early stage/low design maturity status.
- No risk Monte Carlo assessment or identification of cost estimate confidence level ranges.
- No inclusion of project contingency funds to address estimate accuracy and discrete risks.
- No recognition that south Florida climate (humidity and average air/cooling water temperatures) impacts cooling tower performance compared to its cost estimate reference projects in California, Arizona, Minnesota, Vermont, and Massachusetts.
- No specific analyses recognizing scope elements and costs required for using
    - reclaimed municipal sewage as the makeup water source,
    - adding a reclaimed water line from MDWASD,
    - adding a reclaimed water make up storage reservoir,
    - adding a water treatment plant,
    - adding a Zero Liquid Discharge system to the cooling tower blowdown system, and
    - mitigation of wetland impacts.
- Assumes the availability of Unit 6 and Unit 7 infrastructure, when that project has been deferred.
- No modifications to the ultimate heat sink (UHS) or recognition/understanding of this safety system impact on the licensing requirements and scope.
- Understating the cost for likely substantial tie-in outage duration involving UHS safety system and canal modifications and resulting loss of power generation revenues.

3.4 High Bridge Cost Estimate

High Bridge updated its 2015 cost estimate to reflect 2017 present day dollars for same basis comparison to the Powers Report. It updated the conceptual engineering scope basis to retrofit Turkey Point Units 3 and 4 with the addition of cooling towers to take the place of the existing canal cooling system to reflect various scope changes and impacts. High Bridge used its extensive library of projects, utilized conceptual engineering analyses, and developed a quantified basis for estimated costs for areas of change. High Bridge observed its corporate processes and various industry standards that provide guidance for documenting scope and developing estimated costs. Industry guidance observed include the Association for the Advancement of Cost Engineering (AACE), Project Management Institute Body of Knowledge (PMBOK), and Department of Energy (DOE) Order 413,3 regarding Capital Projects.

These industry practice guidance sources and High Bridge experience all recognize the importance of thorough scope definition and understanding of requirements coupled with the development of a contingency allowance to cover estimate accuracy and project risks at the early stage of project development. The High Bridge estimate utilized the 2015 project risk register and Monte Carlo probabilistic simulation to define contingency requirements to achieve cost estimate certainty. The Powers report disregarded these industry professional practice guides for cost estimating and included no contingency allowance to cover estimate accuracy uncertainties of discrete event project risks.

Table E-1 below provides a Summary Comparison of Estimated Capital Costs by Powers ($322.5 million to $404.5 million) and High Bridge ($1.84 billion) in 2017 dollars. The High Bridge estimate includes all the specific items mentioned above that were not itemized in the Powers Report. It also includes allowances for contingency/risks and lost generation revenue due to the estimated project tie-in outage duration. Also shown are Annual O&M Costs by Powers ($8.5 million) and High Bridge ($109.2 million) which includes expected performance penalties due to net additional parasitic electric loads for cooling tower operations.

The table shows two cost columns for Powers to accurately reflect the range of cost cited in the report. Powers high range assumes 108 cooling tower cells while the low range assumes 80 cooling tower cells. (The High Bridge column is based on 74 cells as specified in the 2015 engineering analysis.)

Table E-1: Summary Comparison of Estimated Costs by Powers and High Bridge

Cost Estimate Comparison

Expert Report of Bill Powers, P.E. vs High Bridge Associates

	Basis for Expert Report Bill Powers, P.E.		Basis for High Bridge Associates
Technical Characteristics			
Total Heat Rejection Capability MMBTU/Hr	16,800	12,300	13,100
Number of Cooling Tower Cells	108	80	74
Cooling Tower & Infrastructure Costs			
Cooling Tower Design, Procure, & Install	$79.0	$58.5	$51.8
Cooling Tower Infrastructure	$237.0	$175.5	**Details Below**
Design Engineering	Covered in $237.0 Above for 108 C.T. Cells 3.0 X $79.0	Covered in $175.5 Above for 80 C.T. Cells 3.0 X $58.5	$17.2
Cooling Tower Fndn, Basin, & Pump Pits			$70.6
Cooling Tower Pumps			$26.8
Cooling Tower Piping			$29.8
Canal Reconfiguration & UHS Mods			$64.0
Electrical Power Equip, Raceway, Cable			$19.5
Instrumentation & Controls			$4.9
Constr. Facilities, Equip, & Infrastructure			$6.7
Craft Support Labor			$8.5
Small Tools & Consumables			$2.1
Post 2015 Safety Culture Impacts @15% Labor			$30.0
Construction Field Non-Manual			$25.7
Project Mgt & Controls, Contract Mgt, and Project Oversight			$53.6
Subtotal	**$316.0**	**$234.0**	**$411.2**
Additional Direct Capital Costs			
Reclaimed Water Line from MDWASD	$0.0	$0.0	$87.0
Reclaimed Water Storage Reservoir	$15.0	$15.0	$35.0
Reclaimed Water Treatment Facility	$0.0	$0.0	$400.0
Zero Liquid Discharge (ZLD) Facility	$33.5	$33.5	$33.5
Project Mgt & Controls, Contract Mgt, and Project Oversight	$0.0	$0.0	$83.3
Subtotal	**$48.5**	**$48.5**	**$638.8**
Other Associated Capital Costs			
Lost Generation Costs for Dual Unit Tie-In Outages - 7.5 Months	$40.0	$40.0	$182.5
Wetlands Remediation - Reclaimed Water Line from MDWASD	$0.0	$0.0	$0.5
Wetlands Remediation - Reclaimed Water Treatment @ TP Site	$0.0	$0.0	$4.3
NRC Fees for License Amendment Reviews	$0.0	$0.0	$35.0
State, Local, & Army Corps Environmental Permits	$0.0	$0.0	$1.0
Subtotal	**$40.0**	**$40.0**	**$223.3**
Direct Capital Contingency			
AACE Recommended Contingency for Class 4/5 Estimate	$0.0	$0.0	$566.0
Subtotal	**$0.0**	**$0.0**	**$566.0**
Capital Cost Total - Closed Loop Cooling System	**$404.5**	**$322.5**	**$1,839.4**
Annual O&M Costs			
Cooling Tower Operations	$7.5	$7.5	$70.0
5% Net Impact to Generation for CT System Loads	$0.0	$0.0	$13.1
Reclaimed Water Treatment Facility	$0.0	$0.0	$25.1
ZLD System	$1.0	$1.0	$1.0
Annual O&M Cost Total - Closed Loop Cooling System	**$8.5**	**$8.5**	**$109.2**

3.5 Industry Cost Estimating Guidance and High Bridge Risk Analysis

High Bridge found it unusual that the Powers Report did not include any discussion of estimate accuracy, risks, and contingency estimated cost allowances appropriate for this project at such and early stage of conceptual design maturity. Not recognizing Turkey Point Site characteristics and challenges, and not understanding the scope and magnitude of the construction infrastructure, are the likely causes for this omission. This resulted in an enormous understatement of estimated project costs in the Powers Report.

Various industry rule of thumb guidance references were mentioned earlier. The Association for the Advancement of Cost Engineering (AACE) guidance for contingency allowances to provide for risk and estimate accuracy as a function of design maturity is reflected below on **Table E-2 & Table E-3**:

Table E-2: AACE Guidance for Contingency Allowances to Provide for Risk and Estimate Accuracy

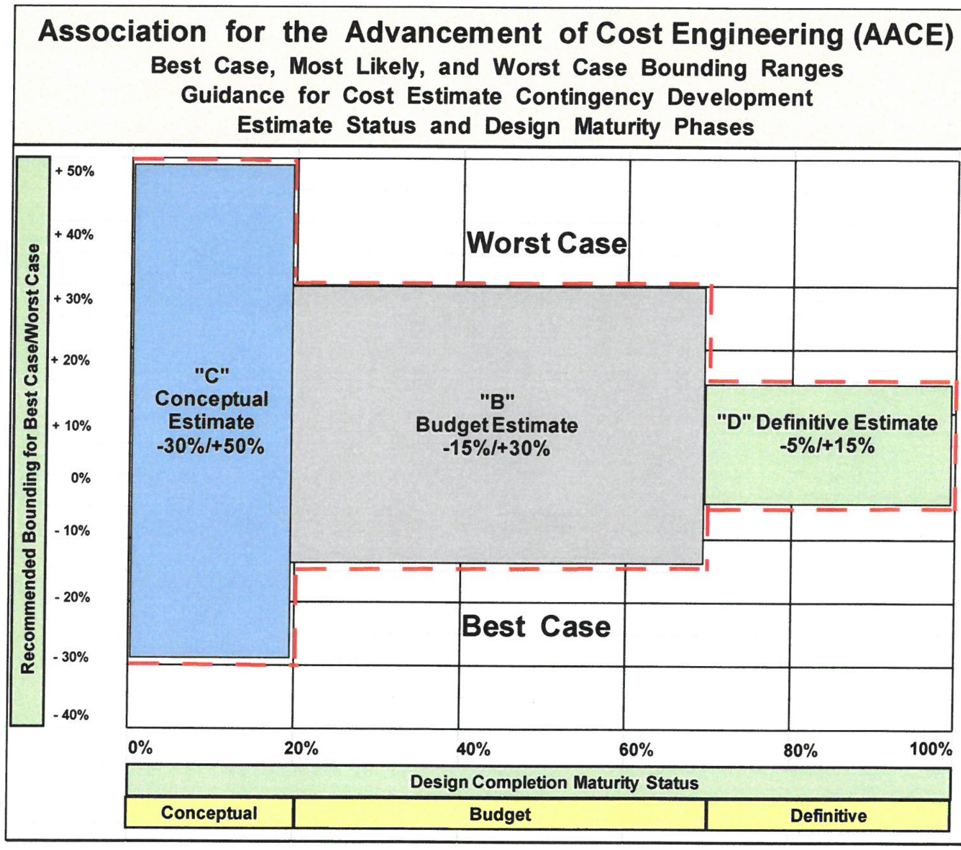

Table E-3: AACE Cost Estimate Classification Matrix for the Process Industries

COST ESTIMATE CLASSIFICATION MATRIX FOR THE PROCESS INDUSTRIES

	Primary Characteristic	*Secondary Characteristic*		
ESTIMATE CLASS	**MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES** Expressed as % of complete definition	**END USAGE** Typical purpose of estimate	**METHODOLOGY** Typical estimating method	**EXPECTED ACCURACY RANGE** Typical variation in low and high ranges [a]
Class 5	0% to 2%	Concept screening	Capacity factored, parametric models, judgment, or analogy	L: -20% to -50% H: +30% to +100%
Class 4	1% to 15%	Study or feasibility	Equipment factored or parametric models	L: -15% to -30% H: +20% to +50%
Class 3	10% to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%
Class 2	30% to 75%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: -5% to -15% H: +5% to +20%
Class 1	65% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: -3% to -10% H: +3% to +15%

Notes: [a] The state of process technology, availability of applicable reference cost data, and many other risks affect the range markedly. The +/- value represents typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50% level of confidence) for given scope.

The Turkey Point 3&4 Cooling Tower Project clearly falls into the conceptual design maturity range and straddles Estimate Class 4 and Class 5. With design completion of less than 10%, a contingency parametric or rule of thumb value of 50% is appropriate. This data was available for consideration in the Powers Report but was not utilized to develop its cost estimate.

In 2015, High Bridge developed a Turkey Point 3&4 Cooling Tower Project Risk Register and performed a Monte Carlo probabilistic simulation to define contingency requirements to achieve cost estimate certainty during that effort. That analysis yielded a contingency of 44.45% to achieve a confidence level of 100% for its cost estimate which is consistent with the AACE guidance cited above. High Bridge elected to utilize the previous 44.45% contingency for purposes of the analysis.

4 TECHNICAL ASSESSMENT

4.1 Summary Assessment of Powers Report Approach

The May 14, 2018, expert report prepared by Bill Powers, P.E., Powers Engineering does not provide an adequate technical basis or estimate of cost for the conversion of the Turkey Point cooling canal system to mechanical cooling towers. The report summarizes the history of many dissimilar projects that added cooling towers or that had other characteristics in common with the Turkey Point Units 3 & 4 proposed modifications. However, the report does not recognize major factors that impact the design and the costs of the Turkey Point modifications. The heat removal capacity of mechanical draft cooling towers is based primarily on climatic conditions that enable the evaporation of water. Therefore, the environmental conditions at the plant location are of paramount importance. Comparisons with cooling tower installations at plants in California, Minnesota, Vermont or Arizona have limited relevance to the requirements and conditions at Turkey Point.

The report provides background information on the general topic of cooling for power plants. It cites numerous examples of power plants of different types at various locations and provides an eclectic summary of mechanical draft cooling tower applications. However, the report is superficial in its analysis and conclusions regarding the Turkey Point Units 3 & 4 cooling tower modification and the required site infrastructure systems and facilities. The report outcomes rely on a budgetary price quote from a cooling tower vendor to obtain a cost estimate for the cooling tower. It then takes the cost estimate for the cooling tower equipment and factors it three times to estimate the cost of the site infrastructure for connecting the cooling towers to the plant.[1]

This approach is inadequate to address the complexities of retrofitting a major modification like the closed cooling water system to an operating nuclear plant. Work at a nuclear site, especially inside the protected area of a nuclear plant forces numerous inefficiencies on the craft labor. These restraints force construction activities to take longer and to cost more. In addition, Turkey Point Units 3 & 4 use a unique closed Cooling Canal System based on approximately 10 square miles of cooling canals. The site has limited access roads and staging areas for large construction projects.

This proposed cooling tower retrofit project would be a major site infrastructure project that consists of five interrelated projects all being performed in the same general area that would need to be coordinated and managed to avoid interferences.

The projects are:

1. Adding the cooling towers
2. Modifying the Discharge Canal to accept a pumping station, which is a large intake structure
3. Modifying the return canal to increase its capacity for the Ultimate Heat Sink
4. Installing a tie-in to the MDWASD, including a Reclaimed Water Treatment Facility and storage pond
5. Installing a Zero Liquid Discharge (ZLD) system to the cooling tower blowdown system.

The Powers Report recognizes that FP&L and the MDWASD have recently agreed to evaluate the potential use of reclaimed sewage water for the makeup to the cooling canals. Originally, the use of reclaimed sewage effluent was to be included in the planned Turkey Point Units 6 & 7 nuclear plant design. These plants have been deferred, and now the entire cost of making this connection would have to be incorporated in the costs of the cooling tower modification for proposed Units 3 & 4. However, the Powers Report relies upon a vendor-provided rule of thumb to estimate the cost of the atypical modifications necessary to install cooling towers at Turkey Point. The rule of thumb is, at best, a generic value and in no way tailored for the specifics of the Turkey Point estimate.

The Powers Report contains several significant errors or incorrect assumptions as follows:

Modification Not Safety Related and Does Not Require NRC Involvement[2] – The Powers Report incorrectly considers the cooling tower modification to not be safety related and that it should not involve Nuclear Regulatory Commission (NRC) involvement and oversight. However, the cooling tower retrofit directly impacts the Ultimate Heat Sink that currently relies upon the Cooling Canal System for heat removal during accident scenarios. The proposed elimination of the Cooling Canal System forces modifications to the safety related Ultimate Heat Sink. This would necessitate the preparation of safety analysis of the proposed changes and the NRC's acceptance of the adequacy of the proposed modifications. This would also require a modification to the Updated Final Safety Analysis Report (UFSAR), potentially new technical specifications, and other modifications to the plants' licensing bases. Moreover, the cooling tower modification would also require many non-safety related modifications to the Updated FSAR to accurately capture the new design. This licensing effort can probably be accomplished within the schedule proposed in the Powers Report but will cost more than the Powers Report estimates and represents a significant project risk that adds to the necessary project risk contingency. We have parametrically estimated the NRC approval costs using FP&L experience for Units 6 and 7.

[1] Expert Report of Bill Powers, P.E., Powers Engineering, In the case of Southern Alliance for Clean Energy, et. al. vs. Florida Power and Light Company, Case No.: 1:16-cv-23017-DPG (S.D. Fla.), May 14, 2018, pg. 19
[2] ibid, pg. 35

Moreover, all environmental impacts of a nuclear plant's operation are reviewed by the NRC not the EPA. The entire scope of this project that is within the confines of the Turkey Point site require the NRC involvement and oversight.

Makeup Water Treatment Facility Sizing and Understanding of Water Chemistry Requirements - The Powers Report notes the need for a cleanup system to make use of the reclaimed sewage water for cooling tower makeup. The Powers Report assumes that the cleanup system would be straightforward and would only be required to protect the cooling towers. However, the makeup water also would have to meet the more stringent water chemistry requirements of the Turkey Point Units 3 & 4 main power generation steam turbine condensers. A large and complicated facility would be needed to achieve the water chemistry and purity required and is not recognized in the Powers Report. The High Bridge estimated $400 million cost for this makeup water treatment facility alone nearly equals the maximum estimated cost of $404.5 million for the total cooling tower and infrastructure modification included in the Powers Report.

Makeup Water Storage Pond Capacity and Liner - The Powers Report reasonably assumes that the power plants need to be able to operate for 14 days following a hurricane has incapacitated the cleanup plant. The Storage Pond would need to be sized to supply the necessary 60 million gallons per day (MGD) flow rate for the makeup of Turkey Point Units 3, 4, & 5 for fourteen days without recharge. That results in a capacity of 840 million gallons. The Powers Report calculated a capacity of only 490 million gallons based on an incorrect value of 35 MGD makeup.[3] In addition, it incorrectly assumed that the Storage Pond could be unlined. An unlined system would interact with saline groundwater, which would change the water chemistry and require retreatment before it could be used in the cooling towers. The increase in capacity coupled with the need for a liner and possibly a leakage detection system results in a cost more than double the Powers $15 million estimated cost.

Inadequate Understanding of Final Infrastructure and Cooling Tower Tie-In Plant Outage - The Powers Report did not understand the magnitude and complexity of scope involved, along with the resulting estimated cost of the forced outage necessary for this modification to be accomplished. Much of the work could indeed take place while the plant is in operation, albeit at the forced inefficiencies mentioned previously. However, the installation of the Pump Pit, which adds the six large pumps necessary to lift the water from the Discharge Canal to the cooling towers, would need to take place with the plants in cold shutdown. The Pump Pit would be a large intake structure and pumping station that by itself is a major civil structural design and construction project that cannot reasonably be accomplished with the plants in operation. The Cooling Tower retrofit would also require the installation of Earthen Berms in the Discharge Canal to control the flow of water once the cooling towers are in operation, the installation of the Ultimate Heat Sink modifications necessary for the transfer canal to be put into operation, and installation of the canal liner at the plant intake and discharge structures will all require both units in cold shutdown. [4]

Inadequate Understanding of Electrical Power, Instruments & Controls (I&C) and Switchyard Modification Scopes - New power and control systems would need to be added to the plant and I&C cables pulled into the plant. New panels would need to be added to the control rooms of the power plants, which is work that could only be done during an outage. Finally, the startup and test cycle would need to be accomplished to demonstrate the proper operation of the cooling towers, the Reclaimed Water Treatment Facility, and the Zero Liquid Discharge systems before the plant could be placed back into operation. This is estimated to be a 6 to 9-month outage of both units. The cost of replacement power must be recognized, not only the differential cost of makeup power. The Powers Report assumed a 24-week outage, which is just under the minimum outage time High Bridge estimates for this project. Not only did it underestimate the extent of the outage necessary to install this modification, the report calculated the cost of replacement power to be the difference in the cost between the cost

[3] ibid, pg. 25

[4] Subsequent License Renewal Analysis for Turkey Point Units 3 and 4: Technology Assessment for Using Mechanical Draft Cooling Towers for Closed-Cycle Cooling, Enercon Services, NEETPX064-PR-002, Rev. 0, 8/03/2015, pg. 7

of electricity from the nuclear plants and from the next available generator to provide the power. This is an incorrect accounting of the cost of the outage that does not recover all the costs necessary for the utility to operate.

4.2 Evaporative Cooling Towers in Different Regions Cannot be Compared Accurately

4.2.1 Environmental Conditions have a Dominant Impact on Cooling Tower Performance

Cooling towers remove heat from liquid systems primarily via evaporation. The rate of evaporation is controlled by the temperature of the water, the ambient air temperature and the local relative humidity or wet-bulb temperature. Generally, the higher the average ambient wet-bulb temperature, the more cooling tower surface area is required to achieve the same heat removal. The Powers Report cites power plants in Arizona (Palo Verde Nuclear Plant), Minnesota (Prairie Island Nuclear Generating Plant), and Vermont (Vermont Yankee). None of these plants have environmental conditions remotely similar to Turkey Point.

Ultimately, the Powers Report cost estimate is based solely upon a budgetary estimate provided by SPX Thermal Equipment and Services for a West Coast location using the environmental data from Turkey Point Unit 5. It is not clear why that data is selected rather than the more up-to-date data contained in the Turkey Point Units 6 & 7 COLA documentation, but in any case, the cost of the cooling towers is not the major portion of the estimated cost from SPX. The SPX engineer proposed using a factor of three for the cost of installation. The basis for this rule of thumb is not explained, but clearly any error in the cooling tower cost is magnified by this methodology. The resultant heat removal capacity of the initial sizing is too large for the plants, so the number of cells is arbitrarily reduced to generate the cost range in the Powers Report.[5] It is not clear what bearing all of the discussion about other plants in different regions of the country have on the conclusions of the report.

4.2.2 Environmental Conditions have a Major Impact on Cooling Tower Design

The approach used for addressing the technical basis for the cost estimate for Turkey Point ignores the costs imposed on cooling tower designs. Cooling towers in northern climates need to make special provisions for freeze protection that are not a concern for Turkey Point. The SPX cooling tower design used in the report contains additional structural design elements to address the seismic issues of a West Coast application but contains no provisions for tidal surges and hurricanes.

These errors are magnified by using a rule of thumb based on construction costs from hard rock sites, from new construction installations, or from virgin sites using work rules from last century. When these inherent assumptions are then ratioed by inflation/escalation rates, or by size of heat load, the errors become magnified.

Turkey Point is built on reclaimed tidal marsh lands. All heavy construction needs careful site preparation and extensive use of engineered backfill. The cost of bringing these materials to the site and installing them properly would be significant. The cooling towers specified for the site are 120 feet wide, 2,200 feet long, and 60 feet tall. They are going to be located as described in the Powers Report directly adjacent to the discharge canal; a water-saturated soil adjacent to the discharge canal. The proposed cooling towers would impose significant static and dynamic loads on the soil that would have to be supported by careful foundation preparation. The amount of civil preparation and structural foundation work necessary to install them at Turkey Point fall outside of the typical "rule of thumb" estimating practice used in the report.

[5] Expert Report of Bill Powers, P.E., Powers Engineering, In the case of Southern Alliance for Clean Energy, et. al. vs. Florida Power and Light Company, Case No.: 1:16-cv-23017-DPG (S.D. Fla.), May 14, 2018, pg. 19

4.3 The Challenges of Cooling Tower Retrofit Project

4.3.1 Tie-in Complexity

The Turkey Point cooling tower modification would take place inside the exclusion area or the protected area of an operating nuclear plant. That puts it within the security oversight mandated by federal law and NRC regulation. All activities within those boundaries are subject to work stoppages for drills, training, and random security checks. Ingress and egress to the work site is strictly controlled and additional work rules are imposed on all construction activities that have a deleterious impact on worker efficiency. The Powers Report does not recognize and did not analyze any resulting impact on the construction of the Turkey Point cooling towers and other required infrastructure construction activities due to the proximity to operating nuclear power plants. These requirements have been substantially enhanced this century in response to ever changing threat models. There is no comparison between these work rules now to those that applied last century. Both sets of work rules are more stringent than for new site construction.

The Turkey Point Cooling Canal System is a closed-cycle, open-channel, natural flow system that is incompatible with the addition of cooling towers without significant modifications. Pumps would need to be added to the plant discharge canal to pump the water up to the top of the cooling towers with enough pressure to energize the sparger spray headers. These pumps would need to move approximately 1,500,000 gallons per minute from the discharge canal to the cooling towers. Flow rates of that magnitude create large hydraulic loads on any structure that direct this flow toward the pumps. For this reason, the pump pit for these two sets of pumps would need to be carefully designed to avoid turbulence and hydraulic forces that could destroy the structure and generate additional maintenance costs. The design would require extensive civil/structural construction effort that will force the shutdown of the two nuclear plants and potentially even the drainage of portions of the plant discharge canal to support the construction.

4.3.2 Pre-Existing Conditions Add Scope

Construction at an operating nuclear plant is complicated by physical conditions in addition to operational restrictions. The plant site is optimized for operations; not for construction. The addition of cooling towers, the Reclaimed Water Treatment Facility, the Makeup Storage Pond, the Zero Liquid Discharge Systems, the Pipeline tie-in to the MDWASD treatment facility, and all the civil work to expand and line the new Ultimate Heat Sink cooling water system represent six simultaneous large construction projects involving complicated interfaces:

- The bulk of the Turkey Point site is dominated by the existing Canal Cooling System.
- The barge unloading area is near retired unit 1 and unit 2, as well as operating unit 5. Additionally, the heavy haul road runs through this congested site area.
- The site has no designated laydown area suitable for staging the required quantities of heavy equipment and material.
- The overhead transmission lines from the operating power plants limit the height of packages and crane operations.
- These proposed projects would require a great deal of excavation for foundations and footings, and the site is not uniformly capable of supporting these activities. Large quantities of engineered backfill may be required that will further occupy the limited shipping and receiving facilities necessary to receive components and bulk commodities to support the construction.
- Buried utilities and abandoned construction services from previous projects, that may or may not be well documented, challenge and interfere with these civil construction projects.

These site exigencies add scope to the project that adversely impact cost estimates that assume an undeveloped site. For these reasons, contingencies are added to construction estimates. The Powers Report did not include contingencies for expected complexities of construction projects on developed sites.

4.3.3 Cost Impacts of Construction at an Operating Nuclear Plant

The Powers Report uses un-escalated costs for green field sites to predict the cost to retrofit cooling towers to Turkey Point. The Turkey Point cooling tower project would be constructed primarily within the exclusion area of operating nuclear plants but with important tie-ins inside the protected area for the main control room and intake and discharge structures. There are physical barriers between these areas that cannot readily be penetrated without additional security overwatch. This imposes unique and restrictive requirements on the personnel who can be on the construction crew as well as work rules and operational restrictions the govern the performance of the work. Movement between these security areas is controlled, monitored and restricted. These requirements have their foundations in the needs for nuclear security and safeguards and are enforced by federal statutes and NRC regulations.

Therefore, the cost of construction within the security envelope of a nuclear power plant is significantly higher than for a green field site. The construction contractors can demand a premium for this work because they need to perform additional screening and qualifications for the craft labor over their normal practice. Moreover, the labor efficiency once construction begins is adversely affected by the need for security screening, restrictions to movement from one area to another, and additional training, drills and personnel screening procedures that disrupt normal activities.

Additionally, the layout of the new components, systems and structures may require a relocation of the sites security boundaries and barriers. These can be extremely complicated to move because they are not simple fences or bollards. They may include sensors, cameras, and in extreme cases, the addition of security watch towers and hard points. These features represent costs that are not captured in cost estimates for the installation of cooling towers on green field sites.

4.3.4 Non-Optimal Design Compromises

The addition of cooling towers to an existing site involve compromises in the design. A green field design would maximize the efficiency of the construction project. Integrating cooling towers into already operating power plants necessarily will involve inefficiencies in the design due to the need to minimize disruption of plant activities and impacts on the existing facility design. For instance, this project will involve the construction of a larger Reclaimed Water Treatment Facility and a 100-acre storage pond. These must be made to fit in the northern portions of the site because the southern area is covered by the existing Cooling Canal System, which would have to remain in operation while the cooling towers are being constructed and tested.

The cooling tower modification for Turkey Point would require redundant circulating water pumps because the existing plants' circulating water pumps were not designed for the additional pressure drop required to accommodate cooling towers. Other less impactful design compromises are necessary for this retrofit application that will increase the cost above what would be expected for a new build plant.

4.4 Additional Scope for the Turkey Point 3 & 4 Cooling Tower Modification

4.4.1 Ultimate Heat Sink

A major complexity of the addition of cooling towers to the Turkey Point nuclear plants is that the Ultimate Heat Sink for the safety related cooling of the nuclear reactors uses the existing Cooling Canal System. Substituting the cooling towers for the existing cooling system eliminates the plants' Ultimate Heat Sink. This safety related system would need to be reestablished by modifications to the cooling water canals. Assuming that the canals would remain in place, this would involve the deepening and widening of the return canal to increase the water volume to meet the UHS requirements. If the cooling canals were fully eliminated (e.g., removed), then some other water volume would need to be identified. In addition, this new water volume needs to be in a lined reservoir to minimize salinization due groundwater in-leakage. A new connection would need to be constructed between the plants' discharge canal and this new ultimate heat sink reservoir that does not short circuit the cooling towers.

This involves extensive civil construction in an area of the site that is not readily accessible for heavy earth moving equipment. This is an extensive safety related construction project that impacts the licensing basis for both Turkey Point units. This project requires formal NRC design and regulatory review and approval. The Powers Report did adequately address the cost impacts of these requirements or the impact on the cooling tower modification cost estimate. Moreover, the report specifically concluded that there would be no requirement for the NRC to review any aspect of the cooling tower modification. These costs need to be included.

4.4.2 Tie-in to Miami Dade Waste Water Treatment Plant

The Powers Report acknowledges the need for the cooling towers to use reclaimed water from the Miami-Dade Water and Sewer Department, but it significantly underestimates the extent of the costs necessary to accomplish this. This connection would consist of an approximately 10-mile pipeline of likely 60" diameter pipe from a MDWASD plant to the site. Several routing possibilities were developed for the Turkey Point Units 6 & 7 plants before they were deferred. Most of this piping would be installed using open trenching but some 40% of the pipeline would require horizontal directional drilling or micro tunneling to install the pipeline. The pipeline needs to cross several canals and navigate along existing rights of way to avoid legal delays.

This is a cost not enveloped by the cooling tower vendor's rule of thumb about the cost of installation. It represents a large public private partnership with a cost impact that needs to be included in the cost of the cooling tower modification.

4.4.3 Water Pre-Treatment System

In addition to the cost of the tie-in to the MDWASD treatment plant, it needs to be treated before it can be used by the Turkey Point nuclear units. The plants' main power steam turbine condensers need to be protected against the residual chemicals in the reclaimed makeup water from municipal sewage. The Powers Report acknowledges the need for a Reclaimed Water Treatment Facility (RWTF) but did not include any costs for this. The extent of this facility to address the residual chemicals in the water is quite substantial.

This pre-treatment system will consist of nitrogen, phosphorus and disinfection of the reclaimed water. The treatment systems need to be sized for the 60 million gallons per day (MGD) flow rate agreed to recently which would result in a water treatment system that would look more like a municipal water treatment facility. It would include chemical treatment, large full flow sand filters, settling ponds, and a range of other subsystems that all add to the costs.[6]

As noted in the Powers Report, the nuclear plants would not be able to operate without this processing plant operation. To minimize the cost, a Storage Pond of cleaned water would be necessary to provide 14 days of cooling tower makeup. However, the Powers Report used the lowest value for the makeup requirements for just the cooling towers for Turkey Point Units 3 & 4, ignoring Unit 5 which would rely on the same MDWASD source. Following a major storm that incapacitated the RWTF, FP&L would likely need the generating power of all operable units rather than just the two nuclear plants. The Powers Report assumed a storage pond 25 feet deep covering 60 acres would be adequate based on a 35 MGD flow rate. If a flow of 60 MGD is substituted to address the 45 MGD for Turkey Point 3 & 4 and 15 MGD for Unit 5, the 25-foot deep storage pond would cover 103 acres. The Powers Report also assumed that an unlined pond would be acceptable, but that ignores the fact that the proponents of the cooling towers oppose the use of unlined water bodies at the facility (such as the cooling

[6] Reclaimed Wastewater Reuse Plan, Turkey Point Generation Station, Golder Associates, Inc., 1776866-0004-4-R-0, June 2017

canals themselves). Therefore, it is likely that this pond of suspect water would be required to be lined regardless the water chemistry.

4.4.4 Civil Work to Erect Dams and to Widen Water Ways

The Cooling Tower modification to the plants' discharge canal would require the construction of many earthen berms to direct flow into the cooling tower system and to prevent flow directly into the return canal to the inlet. Also, the canal would need to be deepened and widened to minimize silting resulting from the outflow from the cooling tower into the modified canal. None of these costs are adequately enveloped by the cooling tower vendor's rule of thumb.

4.4.5 Zero Liquid Discharge System

The Powers Report makes a case for the use of a Zero Liquid Discharge System rather than a deep well injection for cooling tower blowdown. The Powers Report included a cost of $33.5 million for the ZLD. The original estimate performed by High Bridge in 2015 was based on the continuation of the deep well injection approach previously used. However, the cost estimate has been updated to include the $33.5 million for the ZLD system proposed in the Powers Report which appears to be approximately correct based on High Bridge research.

4.5 Forced Outage Costs

The Powers Report correctly identified that the construction of the cooling towers would require the shutdown of the Turkey Point Units 3 & 4 to complete the project. It assumed a 24-week duration of the forced outage based on the experience of other retrofit applications. This top-down estimate would result in a duration of slightly less than 6 months. Indeed, much of the construction work could take place while the plants are in operation, albeit with the forced inefficiencies imposed on the construction work mentioned previously. However, the integration of the Pump Pit into the canal system is a major construction project that would require several months to accomplish. This is a major civil structural design and construction project and may require the drainage of the plant discharge canal. There is a high risk that it cannot reasonably be accomplished with the plants in operation.

Furthermore, the addition of the earthen berms in the discharge canal and the work necessary to tie in the new cooling water flows to the existing design will require the plants to be shut down while the work takes place. New power and control systems need to be added to the plant and I&C cables pulled into the plant. New panels will need to be added to the control rooms of the power plants, which is work that can only be done during an outage. Finally, the startup and test cycle need to be accomplished to demonstrate the proper operation of the cooling towers, the Reclaimed Water Treatment Facility, and the Zero Liquid Discharge systems before the plant can be placed back into operation. It is estimated that this will require a forced outage of from 6 to 9-month duration for both units; not 24 weeks.

The cost of a forced outage is the cost of replacement power necessary to replace the lost capacity. The Powers Report uses the novel approach of only calculating the differential cost to calculate the cost penalty of a forced outage. The Powers Report assumed a 24-week outage, which is just under the minimum outage time High Bridge estimates for this project. Not only did it under estimate the extent of the outage necessary to install this modification, the report calculated the cost of replacement power to be the difference in the cost between the cost of electricity from the nuclear plants and from the next available generator to provide the power. This is an incorrect accounting of the cost of the outage that does not recover all the costs necessary for the utility to operate.

4.6 Nuclear Licensing vs EPA Permitting

4.6.1 The Ultimate Heat Sink is Safety Related

This modification would have a major safety-related impact on both Turkey Point Units 3 & 4. Both plants rely upon the existing Canal Cooling System for their Ultimate Heat Sink. The UHS is required to remove decay heat from the reactors after shutdown. All safety related heat rejection during postulated nuclear events is sent to the UHS. The Cooling Tower modification would make the existing Canal Cooling System unavailable and force a redesign of the UHS.

This is obviously a design change that would require the interaction of the Nuclear Regulatory Commission. A major design change needs to be made to the UHS and that forces a licensing basis revision, which impacts all relevant regulatory documents. The Powers Report ignores the costs for this major plant modification.

4.6.2 Cooling Tower Modification Adds Environmental Issues

The Powers Report incorrectly assumes that the addition of cooling towers to the Turkey Point Units 3 & 4 would be an easy modification as far as the EPA is concerned. In the first place, nuclear plants environmental impacts are addressed by the NRC that represents the plant for federal environmental reviews. While the impact on the site of the installation of the cooling towers may have a low impact on the environment, the inclusion of the rest of the infrastructure necessary to support the cooling towers operation with reclaimed municipal sewage and with ZLD systems would be more significant. None of this is adequately described in the existing Environment Impact Statement or the existing plant licensing documents. All of this would require costs and time to accomplish. Much of this parallel activity that can be accomplished in the schedule proposed in the Powers Report. However, the costs for these activities need to be addressed.

5 SCHEDULE ASSESSMENT

The Powers Report asserts that permitting and construction of the Turkey Point Unit 3 and Unit 4 Cooling Tower System can be accomplished in the same 4.5 years required for a cooling tower retrofit for the 1,500 MW coal-fired Brayton Point Station which was achieved between January 2008 and May 2012. As noted in detail in the Technical Assessment section of the High Bridge report, the regulatory, design, and construction requirements necessary to accomplish a cooling tower retrofit for an operating 2-unit nuclear power plant in a sensitive marshland environment bear few similarities to Brayton Point Station.

While many factors and influences preclude development of a precise project schedule, High Bridge offers a more realistic opinion of how the Turkey Point Unit 3 and Unit 4 Cooling Tower System implementation would likely unfold. Given the complex regulatory and design issues combined with the fact that many of the constructions activities cannot be accomplished in parallel, High Bridge estimates that the project would be a challenging seven to nine year duration.

6 Testimony in Other Cases

I have not testified as an expert witness, at deposition or trial, in any other case in the past four years.

7 Compensation

High Bridge Executive Consultants are paid $250 per hour.

8 Curriculum Vitae for Ron Seagraves

High Bridge Associates, Inc. and Work Management, Inc.
September 2016-Current
Vice President / Executive Consultant / Director of Estimating Services
High Bridge Associates provides planning, scheduling, estimating, project controls, construction management, independent assessment, and process improvement services to the energy, power, industrial, and government business sectors. Currently has direct management responsibility for the Center for Estimating Excellence and Special Studies and the development and implementation of large scale estimates, independent assessments, and project control systems for utility clients. Project estimates have included next generation nuclear plants, major nuclear operating plant modification, decommissioning, and new construction projects as well as major fossil plant environmental projects. Also, development of overall project control systems, project control procedures, and other special studies. Responsible for developing business opportunities, recruiting personnel, and managing project activities for various owner and engineer/constructor customers. Using recent business successes as an impetus for expansion, responsible for starting up an engineering division to provide conceptual engineering packages in concert with existing cost estimate products.

CNSI Inc.
November 2013 – September 2016
PRESIDENT AND OWNER

- Management Staffing and Consulting Company for the commercial industry
- Offered professional assessment and staffing services including but not limited to project management, project controls, construction specialist staffing, and subject matter expertise
- Evaluated technical and management issues in support of large projects at nuclear utilities
- Provided management and technical support for completing firm price contracts and large assessments and estimates
- Performed cost, estimate, and schedule assessments of firm price construction projects

Constellation Energy/Exelon
January 2014 – December 2015
SENIOR PROJECT MANAGER

- Senior Project Manager for Various Projects at Calvert Cliffs Nuclear Plant
- Performed comprehensive project management for all areas of assigned projects spanning contract management to enterprise risk management
- Managed budgets of over $1 billion for large capital projects at 3 sites, including high priority projects; responsible for projects including Independent Spent Fuel Storage Installation (ISFSI), Power Block Roof Replacement, and PAA Injection

Progress/Duke Energy
January 2012 – January 2013
DIRECTOR OF EMERGENCY DIESEL PROJECTS

- Director of Emergency Diesel Projects including new Emergency Diesel Installations
- Developed conceptual plans for installation of new emergency diesels including engineering and installation plans

Constellation Energy
July 2007 December 2012
SENIOR PROJECT MANAGER

- Project Manager for ISFSI at Calvert Cliffs Nuclear Plant; project consisted of expansion of existing ISFSI facility and license extension for Spent Fuel Storage
- Developed the project business case, project charter, project plan, communications plan, and risk management tools

ASSISTANT PROJECT DIRECTOR

- Provided project management for a FGD installation at coal plant outside Baltimore
- Duties included setting up organizational and management infrastructure, staffing plans, project plans, risk management plans, schedule and budget reporting, development of business plans, and overall project management
- Assisted with contract negotiations of major contracts valued at over $800 million.

Crystal River Nuclear Plant
June 2005 – July 2007
CONSTRUCTION MANAGER

- Construction Manager for all phases of work associated with a Self-Managed Steam Generator Replacement (SGR) Project for Crystal River Nuclear Plant
- Direct report to project manager
- Duties included direct management oversight of the SGR construction task managers and subcontractors.
- Direct management responsibility for project field engineering, project safety, procurement, training, document Control, and Construction Management.
- Responsibilities also included development of Bottoms Up Estimate for SGR Project, development of long range Staffing Plan, development of Risk Management Plan and Communication Plan Project Plan, Task Plan Procedures, Reporting Procedures, WBS.

Prairie Island SGRP
April 2004 – November 2004
NIGHT SHIFT MANAGER
SGR Project Manager

- Utility Night Shift Manager for all phases of work associated with the Steam Generator Project for Prairie Island Nuclear Plant.
- Duties included direct management oversight of the SGR Contractor.
- Direct management responsibility for utility project engineering, field engineering, outage control center representatives, scheduling and construction coordinators.
- Coordinated and managed all day-to-day activities and issues during the SGRO.

Calvert Cliffs Unit 2 RVHP
February 2003 – January 2004
PROJECT MANAGER INSTALLATION

- Project Manager responsible for all installation tasks associated with the Reactor Head Replacement Project including:
  - Developed schedule and drafted WBS
  - Coordinated the primary and dependent work activities
  - Provided support for draft of RFP for Head Replacement
  - Supported bid evaluations
  - Developed the construction plan
  - Provided input to evaluation of replacement scenarios, specific to rigging, re-use of component internals

Sequoyah Nuclear Plant
June 2001 to February 2003
ASSISTANT INSTALLATION MANAGER

- Assisted the TVA Installation Manager in all aspects of pre-planning the SGR project to review the contractor procedures and work plans, Interface with contractor and plant for integration of contractors' scope of work with station and oversee the schedule development and review. Additional duties are as follows:

- Provided input to development of outage schedule. Assessed and assisted in resolution of conflicting activities, including horizontal and vertical slice reviews
- Provided assistance to containment coordination in the development of containment laydown plans and material routing
- Provided input and implementation of project specific safety plans
- Provided input and coordination between project and plant Safety, HP and ALARA staff
- Provided interface and coordination for all Oversight Supervisors (Civil, Electrical, Welding, Mechanical) to counterpart Bechtel SGRP supervision
- Provided review and input to development of WP&IR's. Ensures compliance to plant norms, standards and procedures whenever applicable
- Assisted in review and development of project specific training and qualification programs
- Assisted in review of project welding program; provided input where required to review SPM to ensure compliance to standard welding codes and appropriate WPS
- Assisted Lead Containment Coordinator in development of plan for protection of permanent plant equipment
- Assisted Lead Electrical Coordinator in review of SGR plan for temporary electrical power and communications
- Assisted Lead Civil Coordinator in review of SGR plans and procedures involving heavy lifts, haul routes and the erection of temporary facilities

Farley Nuclear Plant
October 1999 - 2001
PROJECT COORDINATOR

- SGR Project Coordinator reporting directly to SGR Installation Manager and Plant Outage Manager, in support of Southern Nuclear Corp. for Unit 1and 2 SGRP at Farley Nuclear Plant.
- Duties included the following: established communication meetings between SGR Group and Plant personnel, provided oversight for schedule and WP&IR development and review, evaluated WBS and resource loading, assigned craft and distribution of planned hours for specific activities, developed laydown drawings for material and equipment for containment, provided oversight for schedule implementation, performed role of task manager for containment mob/ demob, laydown for containment and areas both inside and outside the Protected Area

Big Rock Nuclear Plant
September 1997 – October 1999
PROJECT MANAGER DECOMMISSIONING

- Project Manager for Major Component Removal
- Provided Project Management for utility under decommissioning of a nuclear generating plant.
- Duties included providing overall management for the utility of prime contractor performing removal of large component project (i.e. reactor vessel, steam drum, and demolition of containment building, turbine building, and all structures and foundations)
- Direct interface with Dry Fuel Storage and Fuel Pool Clean-out projects
- Developed and released Request for Proposal (RFP)
- Assisted in proposal review, evaluation preparation, and selection of contract award and in contract negotiations
- Developed incentive plan for major contractor; contract value of $50+ million
- In charge of review and approval of contractor QA Program and Procedures
- Developed integration plan between major contractor and station

Millstone Nuclear Plant
January 1997 - September 1997
CONSTRUCTION MANAGER

- In charge of repairs and upgrades of drywell for Unit 1 restart

- Served as liaison between contractors and utility
- Managed all planning and contractor work activities for pipe replacements and modifications in drywell

Various Nuclear and Conventional Plants
January 1994 - January 1997
SUPERINTENDENT / PROJECT MANAGER

- Duties included all phases of planning, costing, scheduling, manpower, and subcontractors
- Projects ranging from $30 thousand to $3 million in size, including pipe replacements and steam generator replacements
- Pipe Replacements included Millstone 1 and Dresden 2
- SGRPs included VC Summer and Ginna
- Decommissioning included Shoreham

Charleston, SC
October 1989 to November 1993
PROJECT / PROCESS ENGINEERING MANAGER

- A large metal fabrication facility that specialized in metal expansion joints, pressure vessels, ductwork, and high volume manufacturing.
- Duties included oversight of planning and estimating; managed weld engineering, new process line development, and contract administration for subcontractors
- Established welding procedures and weld training/testing
- Established and managed engineered metal stamping process
- Engineered contracts ranging from $20K to $21M

Charleston, SC
August 1986 – November 1989
DIVISION MANAGER

- An independent NDT inspection lab, providing services to private contractors, private shipyards, US Navy, Air Force and power companies.
- Worked with NAVSEA and Mil. Standard Codes, also with ASME, AWS, ANSI, and ASTM
- Qualified Level II tested in accordance with ASNT-TC-1A for MT, PT and RT, also Level I UT
- Duties included full responsibility for managing lab for inside and outside work
- Provided welding consulting including welding procedure development, welder training and certification
- Served as Expert Witness for weld failure analysis litigation

Various Nuclear and Conventional Plants
October 1985 – July 1986
WELDING SUPERVISOR

- Supervised pipe replacements at Mojave Generating Station and Four Corners, New Mexico
- Performed CRDM overlays at Indian Point Station and Salem Unit 2

Vogtle Nuclear Plant
March 1985 – September 1985
WELDING TECHNICIAN

- Performed welding of loop piping for Unit 2 new construction
- Trained and tested welders on automated welding equipment
- Also in charge of maintenance, calibration, and equipment inventory

Beaver Valley Nuclear Plant
October 1984 – February 1985
PROJECT SUPERINTENDENT

- Performed training of plant welders on Dimetrics Goldtrack welding systems for feed water valve ID overlay

Browns Ferry Nuclear Plant / Edwin I. Hatch Nuclear Plant/ Peach Bottom Nuclear Plant
August 1983 to August 1984
SUPERINTENDENT

- Superintendent for overlays of sweepolets on recirc and RHR piping at Browns Ferry Plant
- Night shift superintendent for replacement of reactor recirculating piping

Vogtle Nuclear Plant
November 1982 – August 1983
WELDING SPECIALIST

- Duties included preparing welding procedures and training approximately 40 welders on Dimetrics automated welding systems
- After training was completed, went into field as welding superintendent for loop piping and feedwater piping

Atlanta, GA
March 1980 - September 1982
WELDER/WELDING FOREMAN

- Duties included supervising of all local welding operations, dispatching mobile units, estimating field and shop welding, scheduling and assigning work, and training personnel.
- Extensive expertise with SMAW, GTAW, and GMAW welding of stainless, carbon, cast, aluminum, titanium, plate and pipe
- Inspection of Quality Control

Charleston, SC
June 1976 – November 1979
WELDER/FOREMAN

- In charge of 15 man welding crew
- Operating automatic and manual machines
- Instructor for welding school
- Inspection of weld preps for QC inspection
- Manufacturer of LNG Aluminum Spheres

EDUCATION

- Trident Technical College
- Welding Technology
- Goose Creek High School, Charleston, SC

SPECIALTY TRAINING

- Clemson University- Continuing Education
- Project Manager Training Course
- QA Training Course
- Primavera Project Planning
- Power Draw (Macintosh)
- Auto-Cad 13
- PMI Training
- Risk Management Training

MEMBERSHIPS

- Project Management Institute- PMI
- American Welding Society - AWS
- American Society Non-Destructive Testing - ASNT
- Former Member Advisory Committee Trident Technical College
- American Nuclear Society- ANS