**BEFORE THE**

**GEORGIA PUBLIC SERVICE COMMISSION**

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| **IN THE MATTER OF: GEORGIA POWER COMPANY’S TWENTY-FIFTH SEMI-ANNUAL VOGTLE CONSTRUCTION MONITORING (“VCM”) REPORT** | **DOCKET NO. 29849** |
|  |  |

**Direct TESTIMONY**

**OF**

**DonALD N. Grace P.E.**

**ON BEHALF OF THE**

**GEORGIA PUBLIC SERVICE COMMISSION**

**PUBLIC INTEREST ADVOCACY STAFF**

**DECEMBER 1, 2021**

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# INTRODUCTION

Q. Please state your name, position, and business address.

A. My name is Don Grace, and I am the Vice President of Engineering for the Vogtle Monitoring Group (“VMG”). I am one of the key personnel engaged by the Georgia Public Service Commission (“GPSC”) Public Interest Advocacy (“PIA”) Staff since April 2018 to independently evaluate Southern Nuclear Company’s (“SNC”) ability to successfully manage completion of the Vogtle 3 & 4 Nuclear Project (“Project”). I have over 50 years of hands- on experience in all phases of the electrical generating plant life cycle (i.e., Licensing/Permitting, Engineering, Construction, Start-up Testing and Commissioning, Operations & Maintenance, and Decommissioning) for nuclear and fossil fuel plants. I have a B.S in Marine Engineering from the U.S. Naval Academy (having graduated with distinction), an MBA from Harvard Graduate School of Business (having been awarded a fellowship) and have been a registered Professional Engineer in the field of Power Generation for over 45 years. A copy of my curriculum vitae is attached as Exhibit A.

**Q. PLEASE PROVIDE ADDITIONAL INFORMATION REGARDING THE OTHER KEY VMG TEAM MEMBERS, AND THE ROLES THEY PLAY IN SUPPORTING YOUR TESTIMONY.**

A.There are two additional key members of VMG that support my testimony. Mr. Dinos Nicolaou has an MBA degree and is a highly experienced Project Controls professional with over 45 years in developing and maintaining Earned Value Management System (“EVMS”) based Integrated Project Schedules (“IPS”). He has performed dozens of independent cost and schedule reviews of other major projects. Mr. Ray Bryant is a highly experienced construction management professional with over 40 years in construction management with a focus on nuclear electrical and security oversight. Mr. Bryant functions as a full-time on-site construction monitor at the Project site. Other subject matter experts are engaged on an as needed basis.

**Q. WHAT ARE YOUR CRITERIA FOR SUCCESSFUL MANAGEMENT OF THE COMPLETION OF VOGTLE 3 AND 4?**

A.While costs both before and since the 17th VCM Order still need to be reviewed for prudency, successful management also includes SNC’s ability to safely complete the Project in a quality manner and within a reasonable cost and schedule.

**Q.** **HAVE YOU PREVIOUSLY TESTIFIED BEFORE OTHER REGULATORY AGENCIES, AND SPECIFICALLY BEFORE THE GPSC?**

A. I have previously provided testimony to the GPSC in Docket 29849 for the Vogtle Unit 3 and Unit 4 Project in December 2018, December 2019, June 2020, December 2020, and June 2021, and in GPSC Docket 43838 for the Vogtle Unit 3 in September 2021. Also, I have testified before the Mississippi Public Service Commission, the Arizona Corporation Commission, the Arkansas Attorney General’s Office, and the Federal Energy Regulatory Commission (FERC). I have also testified before the Nuclear Regulatory Commission as the Chairman of the Boiling Water Reactor Owners’ Group.

**Q. WILL YOUR TESTIMONY INCLUDE THE IMPACTS OF COVID-19?**

A. VMG has included analysis regarding the COVID-19 impact to the extent that Georgia Power Company (“Company”) has reported this impact, and later in the testimony VMG provides an initial challenge to the Company’s assertion as provided in VCM 25 that the Project Schedule has been delayed roughly 3 to 4 months because of COVID-19.

**PURPOSE OF TESTIMONY**

Q. What is the purpose of your Testimony?

A. Based on what is known regarding SNC’s performance to date, and the potential risks going forward, the primary purpose of this testimony is to advise the Commission of VMG’s independent assessment of forecast ranges of the U-3 and U-4 CODs and the Total Project Cost Estimate at Completion (TPC EAC 100% Ownership). In addition, VMG’s goal is to provide additional observations regarding future risks that could potentially be manifested which are not included in our independent assessment of the U-3 and U-4 CODs and the TPC EAC.

**Q. PLEASE PROVIDE YOUR SUMMARY ASSESSMENT AND OBSERVATIONS**

A. VMG’s analysis indicates that the U-3 and U-4 CODs will most likely not be achieved any earlier than November 2022/2023, respectively, and perhaps as late as February 2023/2024, respectively. VMG also conclude that the Regulatory Required TPC of $ 17.1 billion (“B”) will be exceeded by roughly $ 3 B to $ 3.4 B (depending primarily on the CODs) resulting in a TPC range of roughly $ 20.1 B to $ 20.5 B. These new forecasts represent another 5 months of schedule slip, and another $ 1 B cost increase, from previous VMG forecasts. This further slip of schedule and further increase in cost is largely attributable to the more recently discovered Construction Quality issues, especially those related to non-compliances in meeting the design requirements of the Institute of Electrical and Electronics Engineers (“IEEE”) Standard 384 (titled Standard Criteria for Independence of Class 1E Equipment and Circuits).

Additional observations regarding the going forward efforts are as follows:

* Because of the recent NRC Special Investigation and the resultant increased NRC oversight, this presents a risk of further slowing down on-going efforts, further delaying the CODs, and thereby further increasing the TPC EAC.
* With the Company’s increased focus on Construction Quality, together with the increased NRC over-sight, an acceptable level of quality will be obtained so that both U-3 and U-4 can be operated safely.
* VMG is also concerned, that apart from nuclear safety systems, the potential exists for greater than normal equipment reliability issues that may be experienced during the first operating cycle resulting in the first Refueling Outage potentially being longer than should be expected for a new nuclear plant.

**ANALYSIS OF PROJECT SCHEDULE**

**Q: PLEASE ELABORATE ON THE CONSTRUCTION QUALITY ISSUES THAT THE PROJECT HAS BEEN EXPERIENCING AND WHY THESE ISSUES ARE HAVING A SIGNIFICANT IMPACT ON THE PROJECT SCHEDULE?**

A: During VCM 24 VMG had noted that the Project was experiencing Construction Quality problems, and that the NRC was in the process of conducting a Special Investigation to review these problems as it related to the Company not meeting the requirements of the IEEE-384. It was also noted that corrective and preventive measures were being taken by the Company (and being reviewed by the NRC) to both identify and correct the then existing problems, and to improve Construction Quality for the yet to be performed work activities. At the time of VMG’s VCM 24 testimony, the extent of the problems, and the amount of rework that was necessary, were not known either in terms of the man-hours to correct them and the extent to which the integration of this emergent work would impact the overall schedule going forward. It is still difficult to determine exactly how the future schedules and costs to complete will be impacted, however, VMG has attempted to incorporate an estimate into its analyses. The Company’s forecasts of the U-3 and U-4 CODs, and of Total Project Cost (TPC), had deviated substantially from VMG’s forecasts, but the Company’s now reporting of “risk adjusted” CODs and TPC are starting to converge with VMG’s forecasts. The remaining differences, can primarily be attributed to the following:

* For the U-3 COD, the assumed time duration between the Risk Adjusted Dates for the Start of Fuel Load to COD (discussed in more detail, later in this section),
* For the U-4 COD, the assumed schedule lag from the U-3 COD to the U-4 COD (discussed in more detail, later in this section), and
* For the TPC EAC, the differences of assumed CODs (and resultant schedule delay costs; discussed in greater detail in the Cost Analysis Section).

**Q: WHAT ARE VMG’S PRIMARY CRITICISMS WITH THE COMPANY’S MEANS AND METHODS FOR DEVELOPING THEIR FORECASTS?**

A: As VMG has stated in past testimonies, the Company’s prior forecasts of the U-3 and U-4 CODs have repeatedly been demonstrated to be unrealistic and unreliable. Also, VMG has been critical of the potential consequences of the Company’s emphasis on pursuing an unrealistic schedule at any cost, and to this end have referenced the INPO document titled “Principles for Excellence in Nuclear Project Construction”, Principle Number 4 titled “Schedules are Realistic and Understood.” It is VMG’s assertion that the primary root cause of the recently identified Construction Quality issues is due to SNC not adhering to this principle. Other factors that have contributed to Construction Quality Issues are noted in footnote 1 below.[[1]](#footnote-1) These issues have then led to re-work having to be added to an already overly compressed and complicated schedule.

More recently, however, the Company has continued to schedule not only early Site Working Schedule Milestone dates but is now also referring to later scheduled dates for these same milestones which are referred to as “Risk Adjusted Dates”, or “Target Dates.” The Site Working Schedule dates as forecast by the Company in late October of this year, and indications of further schedule delays, are provided in Table TS-1 below.

|  |  |  |  |
| --- | --- | --- | --- |
| **Table TS-1: Company's Forecast U-3 Schedule Milestone Dates** | | | |
| **DATA SOURCE: COMPANY'S VOGTLE MANAGEMENT BOARD REPORT DATED OCT 27, 2021** | | | |
| Schedule Milestone | Dates | | Remarks |
| Site Working Schedule as of 10/27/2021 | Site Working Schedule as of 11/10/2021 |
| NRC 103.g. Letter | Dec 6, 2021 | Jan 27, 2022 | In a period of 2 weeks, the Dec 6th date[[2]](#footnote-2) had slipped to Jan 27, 2022. |
| Start of Fuel Load | Jan 11, 2022 | Jan 31, 2022 | In a period of 2 weeks, the Jan 11th date had slipped to Jan 31, 2022.3 |
| Commercial Operations | May 21, 2022 | May 21, 2022 | Only 4 months from Fuel Load to COD is unlikely. |
| NOTE: The 103.g. letter and Start of Fuel have been previously tracked as occurring on the same date, but more recently has been separated, with some work originally required for the singular milestone being pushed into the future as part of the separated and second (Start of Fuel Load) schedule milestone. | | | |

The Company’s Risk Adjusted Dates for the above three milestones, are April 17, 2022 (103.g.), May 23, 2022 (Start of Fuel Load), and September 30, 2022 (COD). VMG views these as much more realistic dates but continues to emphasize that four months (i.e., May 23 – September 30, 2022) between the Start of Fuel Load and Commercial Operations as being too short and VMG considers a 6-month duration to be the best possible case.[[3]](#footnote-3)

**Q: WHAT DOES VMG CONCLUDE FROM THE COMPANY’S FORECAST OF SCHEDULE MILESTONES AS SHOWN IN TABLE TS-1 AND THE RISK ADJUSTED DATES?**

A: From the table, as the time to the forecast Site Working Schedule Milestone date gets closer, that date starts slipping at an ever-faster rate toward the “Risk Adjusted” date; and the “Risk Adjusted” dates (for both the 103. g. letter and the start of Fuel Load schedule milestones) are a much more reliable predictor of the future. VMG also concludes that the time duration of only 4 months from the Start of Fuel Load to Commercial Operations is not realistic and given the status of the Project VMG believes that a more reasonable duration would be 6 months or more. Given all the above, VMG concludes that a U-3 COD of November 2022 is achievable, however it is more probable that the U-3 COD will occur sometime in the November 2022 – February 2023 timeframe.

**Q: WHY DOES VMG BELIEVE THAT A FOUR MONTH DURATION FROM THE START OF FUEL LOAD TO COMMERCIAL OPERATION IS NOT REALISTIC?**

A: The history of prior US Nuclear Plant start-ups indicates that 6 months is the norm. In addition, the Company has continued to defer work into the post Start of Fuel Load period, and (with the NRC’s issuance of the 103.g. letter) this work will have to be completed in an Operations environment which has much greater controls with respect to plant security, and with respect to Technical Specification requirements.[[4]](#footnote-4) Finally, the activities between start of Fuel Load and COD can be largely characterized as “integrated systems tests, at ever increasing power levels”, and the Company’s past poor performance of integrated system tests further supports the VMG position that 4 months is unrealistic.

**Q: IS THERE AN EXAMPLE THAT VMG CAN POINT TO REGARDING THE COMPANY’S PAST PERFORMANCE OF INTEGRATED SYSTEMS TESTS?**

A: Yes, and an example of this is the time duration from when the Hot Functional Test (“HFT”) was started to when it was to be completed. HFT had been reported in our VCM 24 testimony but had not been completed until after our filing of that testimony. HFT involved using heat generated from the Reactor Coolant Pumps to heat the Reactor Coolant System to various temperature plateaus, performing various tests at each temperature plateau, and decreasing the temperature to another set of temperature plateaus at which additional systems integrated types of tests were performed. HFT was reported to have started on April 25, 2021and was to last 45 days but was not declared to be completed until 95 days later on July 28, 2021. The reasons for the delays varied but in large part were due to equipment problems having to be resolved.[[5]](#footnote-5) HFT did not involve taking the reactor critical and increasing reactor power levels up to 100 % rated conditions. In going from the Start of Fuel Load to Commercial Operations, all systems (both the Reactor Plant Systems and the Secondary Steam Plant Systems) will be required for the first time to operate at 100% design conditions. Finally, some of the problems experienced during HFT were the result of equipment and components sitting in the warehouse for extended periods of time (sometimes with not having been properly maintained), and these same types of situations could potentially create the same types of problems (and schedule delays) as were experienced during the HFT phase.

**Q: PLEASE PROVIDE EXAMPLES OF THE EMERGENT WORK SCOPE, WHY IT HAS OCCURRED, AND ITS SCHEDULE CONSEQUENCES.**

A: One added work scope was due to how the Company had checked for leaks that were occurring from the Spent Fuel Pool. This entailed a misguided effort of trouble shooting where air pressure was put into the leakage channels located around and beneath the Spent Fuel Pool. Initially 30 Pounds Per Square Inch (“PSI”) of air was forced into the leakage channels in the hope that the air would bleed through the leaks. The bubbling of air would then indicate the location of any leaks. At this pressure no bubbles were observed. Subsequently, the air pressure was unilaterally doubled to 60 PSI by the ITP engineer performing the test. No time out was called, and no analysis was performed to pre-determine the effects of 60 PSI on the steel plates. This increase of pressure over a large area created forces which then distorted the Spent Fuel Pool and Fuel Transfer Canal steel lined plates on the floor of the pools, thus necessitating the removal and reinstallation of new plates. This is just one example of the emergent work scope but may not even prove to be the most schedule limiting rework issue. Rather, VMG estimates that the emergent work scope which is the primary contributor to the extended U-3 schedule involves the work required to rectify the electrical equipment and cable routing non-compliances to IEEE-384. VMG observes that the Company is starting to complete the emergent work scope for U-3; however, given the continued diversion of critical resources from U-4 to support the higher priority U-3 schedule, it may be more of an open issue for U-4 than it is U-3.

**Q: PLEASE ELABORATE FURTHER ON THE IEEE-384 NON-COMPLIANCES AND WHY VMG BELIEVES ITS REMEDIATION IS A SIGNIFICANT CONTRIBUTOR TO EXTENDING THE SCHEDULE?**

A: As VMG has previously testified, a strategic error in planning the execution of the Project was the premature switching out of bulk installation of electrical commodities and focusing on a more piecemeal approach to the completion of the electrical work where the more limited (more limited when compared to what was previously planned) electrical work was focused on starting nearer term major milestones. The decision to piecemeal electrical commodity installation has contributed to overall schedule slips, and when remedial work must be performed, it further complicates the planning and execution of the remaining Project work. For example, already terminated cables have had to be de-terminated, new cables run and terminated, and previously completed testing has had to be reperformed. Also, with work that was thought to be complete, the running of new cables has in some instances damaged already installed cable, thus adding more to what was thought to be completed work. Further complicating impacts which have then occurred include the following:

* Needing to create additional Work Packages for re-doing work that had already been assumed to be complete. This then further adds to the efforts needed to “close the work packages” and factor the added set of work packages into the turnover (from Construction to ITP) of the system which the additional work packages support.
* Potential changes in when the partial system turnover is to occur, and the resultant change in when the total system turnover is to occur, can complicate and change the schedule by which future component tests, system tests, and pre-operational tests are to occur.
* Electrical work encompasses the powering of equipment, and the monitoring and integrated controls of the equipment comprising the various systems. As such, planning and executing this critical work at this late stage of the Project can often require equipment Lock Outs and Tag Outs (“LOTOs”) which further complicates the planning and execution of this work.
* An additional complication at this late stage of the Project is the need for multiple numbers of various subcontractors to finish their work (referred to in prior VMG testimony as the “stacking of crafts”).

**Q: WHAT COMPANY METRICS SUPPORT THE ASSERTIONS IN THE ABOVE PARAGRAPH?**

A: There are numerous metrics generated by the Company that would indicate that the 103.g. letter and Start of Fuel Load dates are more in line with what the Company is now designating as their “Risk Adjusted” dates. These metrics include the number of work packages to be closed to support each of these two milestones, the separate closure rates required to support the Site Working Schedule, and the Risk Adjusted Schedule, and the actual rate of closures. With respect to metrics such as the number of Work Packages to be closed, due to continual shifts into the future of work that is being required by a particular milestone, combined with Work Packages being added to correct Construction Quality issues, use of a metric such as Work Package closures can be difficult to interpret. One measure that is not subject to change are ITAACs. The submittal of an “ITAAC Completion Notice” (ICN) represents the completion of work and associated tests results that are required to be submitted to the NRC. All ICNs are required to be submitted to, and approved by, the NRC to support NRC’s issuance of the 103.g. letter. Table TS-2 below shows actual versus planned ICN submittal performance.

|  |  |  |
| --- | --- | --- |
| **Table TS-2: Company Submittal of ITAAC Completion Notices (ICNs)** | | |
| Month of | Planned | Actual |
| August | 78 | 6 |
| September | 67 | 8 |
| October | 47 | 21 |
| NOTE: Source of Planned numbers is the July 2021 Monthly Project Review Presentation. Finally, the number remaining to be submitted at the end of this reporting was 147. | | |

Additional metrics that show how the risk adjusted milestones are more realistic than the site working schedule include the numbers of Component Tests required to support the 103g letter and Fuel Load, and the number of System Turnovers to Operations, both expressed separately in terms of the site working schedule, and the risk adjusted dates.

To further illustrate the continued shifts of work into the future (which then complicates using some of these metrices), there are 87 Systems that are required to be turned over to Operations, and as of this writing only two systems (roof drains, and the system required to perform containment leak rate tests) have been turned over to Operations.

Based on a summary analysis of all this data, VMG concludes that the Company’s “Risk Adjusted” dates for the 103.g. letter and for the Start of Fuel Load are much more realistic than the Site Work Plan dates; however, VMG believes the Risk Adjusted Date of September 2022 for the U-3 COD is still unrealistic in that there should be (at the least) a 6 month duration from the Start of Fuel Load to the U-3 COD.

**Q: IS THERE ANYTHING ELSE THAT VMG NEEDS TO ADDRESS BEFORE**

**PROVIDING A SUMMARY ANALYSIS OF THE REMAINING U-3 SCHEDULE?**

A: Even at this late date the Company is continuing to consider deferring of planned work into the future. To illustrate, the Company is further segregating the work currently identified as being required to start Fuel Load, to retain some of the work within this category, and to defer the remainder of this work to after the Start of Fuel Load. And, as was noted previously, there are 87 Systems to Turnover to Operations, and 2 have been turned over. Of the remaining 85 Systems, VMG understands (based on a November site visit) that further efforts are being made to require only 48 systems to be turned over to Operations prior to the Start of Fuel Load. Therefore, when the Company does announce “the start of Fuel Load”, it should be recognized that they are most likely continuing the practice of deferring originally scheduled work into the future, thus adding to, and continuing to further complicate the completion of the remaining work.

**Q: PLEASE SUMMARIZE VMG’S ANALYSIS OF THE REMAINING SCHEDULE BY WHICH U-3 IS TO ACHIEVE COMMERCIAL OPERATIONS.**

A: Based on the currently identified risks and the not yet identifiable future risks, VMG’s summary analysis of the remaining U-3 Schedule is as follows:

* A Start of Fuel Load date by the Company Risk Adjusted May 2022 is possible; however, VMG would point out that for whenever this date is declared, some additional work may have been deferred until a later date, and that there are complications associated with attempting to complete the deferred work in a much more highly restrictive (e.g., from a Security and Plant Technical Specifications) plant operations environment.[[6]](#footnote-6)
* It should be recognized that an assumed 6-month time duration from the Start of Fuel Load to Commercial Operations is most likely the best that one could expect, thus resulting in a more probable VMG Forecast U-3 COD range of November 2022 through February 2023.
* The above is all predicated on the assumption that there will be no additional significant risks, and that if these arise the COD could be even later than February 2023. Examples of these risks include schedule extensions resulting from the increased oversight of construction by the NRC, and long lead times associated with having to replace equipment that does not function properly when exercised at rated power conditions.

**Q: WHEN DOES VMG BELIEVE UNIT FOUR WILL REACH COMMERCIAL OPERATION?**

A: VMG believes that the U-4 COD, at the very best, would occur by November 2023, and perhaps more probably during the 1Q of 2024.

**Q: HOW DID VMG COME TO THIS CONCLUSION?**

A: As a starting point, for some time the U-4 COD had been planned to lag the U-3 COD by 12 months. Comparing the completion status of U-3 12 months ago with the current completion status of U-4 provides a measure of how far behind the rate of completing U-4 is compared to the rate of completing U-3. When applying this measure to the critical electrical area, VMG finds that the U-4 effort now lags the U-3 effort by roughly 16 – 18 months (versus the originally planned 12 months). The next logical question then becomes to what extent can this schedule lag be reduced, and whether reducing it to 12 months is even achievable. For reasons which will follow, VMG has assumed that the U-4 COD range will lag the U-3 COD by 12 months.

**Q: WHEN ASSESSING THE U-4 COD TIME LAG FROM THE U-3 COD, WHAT IS THE REASON FOR VMG HAVING ASSUMED A U-3 SCHEDULE RANGE?**

A: The longer U-3 is delayed, the greater an opportunity exists to further reduce the U-4 COD time lag from the U-3 COD. With a significant extension of the U-3 COD and depending on the extent to which additional resources (above and beyond what had been done on U-3) are effectively employed on U-4, the greater the extent to which the schedule lag between the CODs could be reduced.

**Q: GIVEN YOUR ASSUMPTIONS REGARDING THE U-3 COD SCHEDULE RANGE, WHAT IS YOUR BASIS FOR THEN ASSUMING A 12 MONTH LAG TO THE U-4 COD.**

A: First, there are numerous indeterminate issues at this point, and the analysis is somewhat subjective. There are many performance issues that need improvement on U-4 to reduce the current 16–18-month lag to 12 months, and to date we have not seen objective evidence that U-4 performance is improving. This, even though there are numerous lessons from U-3, which when factored into the planning and execution of U-4, should improve U-4 performance.

**Q: PLEASE PROVIDE EXAMPLES OF HOW PERFORMANCE ISSUES ARE NOT IMPROVING?**

A: First, VMG notes the ever-changing Company forecast for the start of the next U-4 Schedule Milestone, which is the start of Open Vessel Testing (“OVT”). With the major re-baselining effort that was performed in April 2019 the start of OVT was forecast to start in October 2020. In October 2021 it is now forecast to start in December 2021. Therefore, over a period of 2.5 years (30 months), OVT has slipped 14 months. Additional examples of a lack of improvement in U-4 performance are as follows:

* The staffing of the critical electrical craft continues to fall below what has been planned.
* Further exacerbating the issue of electrical craft staffing, U-4 continues to be a lower priority than U-3. Experienced electricians from U-4 continue to be reassigned to U-3 to help finish the remaining U-3 electrical work; and, as noted previously, this U-3 work has been significantly impacted/ increased due to the significant rework required to address IEEE-384 issues.
* Although there had appeared to be a shift in strategic focus away from simply meeting the start of major schedule milestones to completing electrical bulks, it appears as if they are perhaps keeping the primary focus on the piecemeal approach to this work such that they continue to have a greater focus on meeting the start of major milestones. This, despite the fact, that the percent complete for electrical work within the nuclear island is far short of the normal industry benchmarks for when one shifts out of the bulk mode. The normal industry benchmark is to switch out of bulks at roughly 75% to 80% complete, yet for the month ending October 2021 their percentages complete were as follows:
  + Containment Building: Cable Pulls at 15%, Terminations at 2%.
  + Auxiliary Building: Cable Pulls at 22%, Terminations at 14%
* The major metric in measuring schedule performance is the Schedule Performance Index (“SPI”). SPI is a measure of planned work divided by earned work. Therefore, an SPI less than 1.0 is favorable, and greater than 1.0 is unfavorable. As has been explained in past testimony, concurrent with a re-baselining effort, past poor schedule performance is masked by Project to date cumulative measures of the SPI, and one must focus on the SPIs for the future time periods as they are experienced. After each re-baselining the SPI quickly deteriorates. For example, for the six-week period starting with the week ending September 12, 2021, through the week ending October 17, 2021, the SPI varied from 1.16 to 1.91, and averaged 1.54. For every hour of planned construction work, only 0.65 hours of work was completed. In other words, to complete 100 hrs. of work, 154 hours must be planned, which then increases the overall schedule hours by roughly 50%.
* In projecting ahead from September 2021, the time remaining to the aggressive Aug 2022 start of U-4 Fuel Load is 11 months, and assuming a future SPI of 1.54 the time to complete the planned work would be 11 x 1.54 which equals 17 months. This alone results in a risk adjusted U-4 start of Fuel load of February 2023, which is consistent with the Company’s most recent (late October 2021) risk adjusted Start of Fuel Load date. However, this is just a “bulk measure” of work to be accomplished and does not account for the detailed scheduling and integrated planning of an ever-increasing volume of required work, all within an ever-increasing complex work environment.
* From the risk adjusted February 2023 Start of Fuel Load, the Company then assumes only 4 months to a U-4 COD of June 2023. VMG believes this period will take a minimum of six months.
* Finally, due to SPIs experienced to date, in combination with the many other factors discussed thus far, even if there are lessons to be learned from U-3 that will help in the planning and execution of U-4, VMG does not see SNC being able to close the gap between the U-3 and U-4 CODs to less than 12 months.[[7]](#footnote-7)

**Q: WHAT IS VMG’S OPINION REGARDING THE COMPANY’S ASSERTION THAT COVID-19 DELAYED THE OVER-ALL PROJECT SCHEDULE BY 3 TO 4 MONTHS?**

A: This will require more detailed analysis to be done concurrent with the review of prudency issues. However, at this point VMG does not see that there is objective evidence to support this claim. To the contrary, VMG observes that based on measures of the Schedule Performance Indices (SPIs) with staff reductions that occurred during periods of high cases of COVID, SPIs improved by at least 10%. This then indicates that the ratio of the value of the work planned divided by the value of the work completed became less (i.e., schedule performance was more favorable). In addition, there have been many “Company inflicted” problems which in themselves can account for most of (if not the total) delay in Project completion beyond the VCM 17 Regulatory Approved dates of November from 2021/ November 2022. A partial listing of these issues follows:

* Developing and reporting to an unrealistic “Site Work Plan”, and then repeatedly claiming that there was “schedule margin” to the Regulatory Required dates, where in fact that margin never existed.
* With HFT on the critical path, having planned HFT for 45 days, but then taking 95 days, represents another 1.5+ months of delay.
* The damage to the Spent Fuel Pool and Fuel Transfer canal was largely self-inflicted, which (if it were not for the IEEE 384 issues) would have delayed the Project. Further, there is no indication that COVID-19 impacted this repair work.
* The IEEE 384 issues, as will be explained in the cost analyses section, were mostly due to issuing engineering documents for construction that were simply either incomplete or incapable of being properly interpreted by Construction which has then led to the large degree of rework.

**Q: PLEASE SUMMARIZE VMG’S FORECASTS FOR THE U-3 AND U-4 CODS,**

A: This summary is provided in Table TS-3. Also, as is shown in the table, there are the assumed U-3 and U-4 CODs upon which the Company’s forecast TPC EAC is based, and the U-3 and U-4 CODs upon which VMG’s forecast TPC EAC is based. These dates are represented by the table headings “Cost BOE”, where “BOE” stands for “Basis of Estimate” and are important when addressing the Total Project Cost Estimate at Completion (TPC EAC).

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Table TS-3: Summary Schedule Analysis** | | | | | | |
| Forecast By | U-3 COD | | | U-4 COD | | |
| Aggressive | Target | Cost BOE | Aggressive | Target | Cost BOE |
| Company | May 21, 2022 | Sept 30, 2022 | June 2022 | March 2023 | June 2023 | March 2023 |
|  |  |  |  |  |  |  |
| Forecast By | U-3 COD (More Probable Range) | | U-3 Cost BOE | U-4 COD (More Probable Range) | | U-4 Cost BOE |
| From | To | From | To |
| VMG | Nov 2022 | Feb 2023 | Jan 2023 | Nov 2023 | Feb 2024 | Jan 2024 |
| Notes | | | | | | |
| 1. If the scope of work is properly estimated and accounted for, then the main variables that impact the TPC EAC are (a) the actual COD for U-3 and for U-4, and (b) at this point of the Project, U-4 craft productivity (as measured by CPIs). | | | | | | |
| 2. The "probable ranges" provided by VMG reflect some possible degree of previously unidentified risks occurring, but nothing that is "highly significant" | | | | | | |
| 3. Slips of the CODs are estimated to cost roughly $ 100 M/ Month (for an equal slip of both the U-3 and U-4 Scheduled CODs), roughly $ 65 M/ month for a slip of just the U-3 COD, and $ 35 M/ month for a slip of just the U-4 COD. | | | | | | |

**Q: BASED ON TABLE TS-3, PLEASE SUMMARIZE VMG’S ANALYSIS OF THE U-3 AND U-4 CODs VERSUS WHAT THE COMPANY IS FORECASTING?**

A: Whereas the Company is forecasting a U-3 COD of between May 2022 and September 2022, VMG forecasts a U-3 COD schedule range which is 5 months later than this range (i.e., November 2022 to February 2023). Further the basis of VMG’s forecast is based on the following:

* Accepting the company’s risk adjusted U-3 Start of Fuel Load date.
* Not accepting the company’s duration of only 4 months from the Start of Fuel Load to Commercial Operation, but rather considering 6 months as the minimal acceptable duration.
* Including a possible further extension of the 6-month duration to reflect the company’s prior poor performance in successfully completing Integrated Test Type activities (such as was the case for the prior HFT, and as will be the case for the Start-up Testing leading to Commercial Operations).

With respect to the U-4 COD, whereas the company is forecasting a COD of between March 2023 and June 2023, VMG is forecasting a U-4 COD of between November 2023 and February 2024 (i.e., a COD range which is 8 months later than what the company is forecasting). Further, the basis of VMG’s forecast is that due to the many issues previously identified in this testimony, it is simply unrealistic to assume (even with the Lessons Learned from U-3) that the current schedule lag of 16 to 18 months between the U-3 COD and the U-4 COD can be reduced to less than the originally scheduled 12-month lag.

**ANALYSIS OF TOTAL PROJECT COST (TPC)**

**ESTIMATE AT COMPLETION (EAC)**

**Q: PLEASE FIRST DESCRIBE THE COMPANY’S LATEST FORECAST TPC EAC.**

A: The Company’s forecast TPC EAC[[8]](#footnote-8) has increased dramatically in the time-period that VMG has been engaged by the PSC PIA Staff to assist in its independent oversight of the Project. Further, information regarding the latest phase of this large increase was only provided to the PIA Staff, the Construction Monitor and VMG at the October 28, 2021, Vogtle Monthly Project Management Board (“VPMB”) meeting. Finally, these cost increases have in large part been necessitated by the discovery of numerous Construction Quality issues, the amount of rework to fix the issues, and the resultant impact on the Project schedule (where schedule delays have further added to the costs). Recognize that what VMG is reporting may be the subject of further analysis and refinement of information provided by the Company.

Table TC-1 shows the change in the Company’s forecast of the TPC EAC from the time when VMG was first engaged to assist the PIA Staff to the present.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Table TC-1: Company Forecasts of TPC EAC (VCM 19 - VCM 25)** | | | | | |
| Company & VMG VCM Pre-Filed Testimonies | | Co Forecast TPC/ EAC | Company Assumed CODs as Basis of TPC/EAC | | Remarks |
| No | Date Filed | U-3 | U-4 |
| 19 | Fall 2018 | $ 17.1 B | Nov 2021 | Nov 2022 | Dates became new "Regulatory Required" Dates. |
| 25 | Fall 2021 | $ 19.5 B | Sept 2022 | June 2023 | Cost not formally addressed in company VCM 25 Pre-Filed testimony (was under development); Cost from Oct 2021 VPMB |
| Change Summary | | $ 2.4 B, or 14% | 10 Mo Slip | 7 Mo Slip |

**Q: WHAT DOES VMG CONCLUDE FROM TABLE TC-1?**

A: Roughly $ 0.9 B of the cost increase can be attributed to slips of the CODs.[[9]](#footnote-9) With respect to the remaining $ 1.5 B, some may be attributable to prior underestimates of the cost with the balance being attributable to production inefficiencies and scope increases (due primarily to having to correct Construction Quality issues).

**Q: PLEASE SHOW THE TIMING OF COST INCREASES SINCE VMG HAS BEEN ENGAGED IN THIS DOCKET?**

A: This is displayed in Table TC-2 below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Table TC-2: Company Re-Forecasts of TPC EAC ($B's) Broken Down** | | | | |
|  | Date of Re-Forecast | | | |
| Fall 2018 (VCM 19) | Feb 2021 | Aug 2021 | Oct 27, 2021 |
| TPC EAC | 17.1 | 17.8 | 18.9 | 19.5 |
| Increase ($ B's/ %) | $ 0.7 B/ 4.1% | |  |  |
|  | $ 1.1 B/ 6.2 % | |  |
|  | | $ 0.6 B/ 3.2 % | |
| **Increase over 8 months** | | **$ 1.7 B/ 9.6 %** | | |

**Q: AND WHAT DO YOU CONCLUDE FROM TABLES TC-1 AND TC-2?**

A: From table TC-1 VMG concludes that over a roughly 3-year period the TPC EAC increased by $ 2.4 B (i.e., 14%, or roughly **4.5 % per year**), whereas over the past 8 months the TPC EAC increased by 9.6 % (or by **over 14 % per year**)

**Q: YOU ALSO REMARKED THAT THERE IS ADDITIONAL DATA TO SUGGEST**

**THAT THE COMPANY TPC EAC HAS (HISTORICALLY SPEAKING) BEEN AN UNDERESTIMATE. COULD YOU PLEASE PROVIDE THAT DATA?**

A: Table TC-3 provides a monthly update of monthly expenditures starting in January 2021 through September 2021, and the monthly “Estimate to Complete” (ETC) from the same end of the month reporting through project completion.

|  |  |  |  |
| --- | --- | --- | --- |
| **Table TC-3: Company Reforecasting of Project Estimate to Complete (ETC)** | | | |
| Reporting Month | Monthly Costs ($ M's) | ETC | |
| $ M's | Fm End of \_\_\_ To U-4 COD |
| Jan 2021 | 215 | 2,503 | Jan 2021 |
| Feb 2021 | 219 | 2,673 | Feb 2021 |
| Mar 2021 | 227 | 2,454 | Mar 2021 |
| Apr 2021 | 214 | 2,313 | April 2021 |
| May 2021 | 200 | 2,119 | May 2021 |
| June 2021 | 206 | 1,918 | June 2021 |
| July 2021 | 201 | 2,718 | July 2021 |
| Aug 2021 | 220 | 2,517 | Aug 2021 |
| Sept 2021 | 214 | 2,927 | Sept 2021 |
| 9-Month Total | 1,916 | 2,661 | Oct 2021 |

**Q: AND WHAT CAN WE CONCLUDE FROM TABLE TC-3?**

A: As can be seen from the table, over a period of roughly 9 months there were actual

expenditures of $ 1.916 B. At the beginning of this 9-month period the ETC was $ 2.503 B; yet at the end of this 9-month period the ETC (despite having expended a $ 1.916 B)

had increased to $ 2.661 B.

**Q: DOES THIS REVISED ETC OF $ 2.661 B, WHEN ADDED TO THE ACTUAL**

**EXPENSES INCURRED UP THROUGH SEPTEMBER 2021, MATCH THE**

**REVISED COMPANY TPC EAC OF $ 19.5 B, AND IF SO, WHAT DOES THAT, TOGETHER WITH THE DATA OF TABLE TC-3, INDICATE?**

A: The latest ETC of $ 2.661 B (Starting with October 2021 and going through U-4 COD) when

added to the costs prior to October 2021 of $ 16.848 B, does equal the Company’s revised

TPC EAC of $ 19.5 B. When viewing the monthly ETC data of Table TC-3 the monthly minor changes of the ETC would appear to indicate that the amount of work being accomplished was roughly equal to the sum of (a) the amount of work being added (e.g., to address IEEE 384 non-compliances, and other rework such as the Spent Fuel Pool/ Fuel Transfer Canal), and (b) construction inefficiencies (as measured by the CPIs) for already planned and executed work being less favorable than the CPIs used for budgeting purposes.

**Q: DOES VMG CONCUR THAT $ 19.5 B IS NOW A RELIABLE FORECAST OF THE TPC/ EAC?**

A: It is a more accurate representation of the TPC EAC. However, it is contingent on meeting the U-3 and U-4 CODs of September 2022 and June 2023, and without additional significant risks. Also, although efforts have been made to incorporate all scope increases associated with correcting Construction Quality issues, it is not clear to VMG if all these scope increases have been incorporated.

**Q: DOES THE COMPANY TPC EAC OF $ 19.5 B INCLUDE SUFFICIENT COST CONTINGENCIES TO COVER THE POTENTIAL EMERGENCE OF ADDITIONAL COST RISKS?**

A: VMG understands, for the Company assumed CODs presented in Table TC-1, that (a) there is no added schedule related cost contingency to account for further slips beyond the assumed September 2022/ June 2023 CODs, and (b) there is a cost contingency of $ 300 M which is to address potential higher than budgeted construction CPIs and related construction support activities (e.g., support required for inspections and close-out and turnover of Work Packages and Systems). In summary, VMG believes either the CODs used as the basis of the cost estimate need to be established at later dates, or better yet a range of CODs and associated TPC EACs should be developed. With respect to the adequacy of the $ 300 M contingency to cover cost risks other than schedule delay induced costs, it is difficult to make a definitive judgment, but a somewhat qualitative opinion is that it may be adequate.

VMG’s observation is that the most significant cost drivers beyond the company’s $ 19.5 B TPC EAC will continue to be cost increases due to further schedule delays. The most significant potential drivers of further schedule induced cost increases include the increased NRC over-sight of construction activities,[[10]](#footnote-10) and long lead times associated with the potential need to replace equipment that has not yet been required to operate at 100% design rated conditions.

**Q: USING THE COMPANY’S LATEST TPC EAC AS A STARTING POINT, COULD YOU PLEASE PROVIDE A RANGE OF TPC EACS FOR WHAT VMG CONSIDERS TO BE A MORE PROBABLE RANGE OF U-3 AND U-4 CODS?**

A: This information, and how it was derived, are shown within Table TC-4.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Table TC-4: VMG'S Analysis of TPC EAC, Updating for "More Probable COD Schedule Range"** | | | | |
|  | Schedule "Basis of Estimate" CODs | | | Remarks |
| U-3 | U-4 | TPC EAC | See Schedule Table TS-2 for COD data |
| Company | June 2022 | March 2023 | $ 19.5 B | Company CODs & TPC EAC used as starting point; includes company assumed 9 mo lag |
| VMG |
| Jan 2023 | Oct 2023 | + $ 0.7 B | With both units 7 mo slip at $ 100 M/ Mo |
| Jan 2023 | Jan 2024 | + $ 0.1 B | U-4 further slip of 3 months at $ 35 M/ Mo |
| Jan 1, 2023 | Jan 1, 2024 | $ 20.3 B | VMG TPC EAC based on Company TPC EAC, adjusted for later CODs as shown |
| Given VMG "More Probable COD Schedule Ranges" Shown in Table TS-2 | | | | |
|  | U-3 COD | U-4 COD | **VMG TPC EAC Forecast Cost Range** | |
| +/ - 2 months | | **$ 20.1 B - $ 20.5 B** | |

**Q: IN PAST TESTIMONY VMG HAS USED A VARIETY OF MEANS TO INDEPENDENTLY ASSESS THE TPC EAC; HAS VMG DONE SO FOR THIS TESTIMONY?**

A: As is described in VMG prior testimony we had also used a dollars per percent complete method. VMG did not continue use of that method for we have found there are aspects of the percent complete reporting that do not provide a solid basis for continued use of this methodology. To illustrate, the on-going Engineering Budget EAC is $ 258 M, and the Estimate to Complete (ETC) for this budget is $ 57 M, thus (with a properly integrated Earned Value Management System) would indicate a percent complete to go of roughly 22 %. Yet, engineering has been reported at 100% complete for the past 10 months. This will become more obvious as percent complete yet to be reported gets smaller and smaller each month while actual costs continue at about the same $200M per month rate for months to come.

VMG did continue to use another approach wherein we took a closer look at the categories of costs that are the primary drivers of the Estimate to Complete (ETC) and used this method as an independent check.

**Q: COULD YOU PLEASE DESCRIBE THAT METHOD AND ITS RESULTS?**

A: For this method we first looked at the actual CPIs being experienced on both U-3 and U-4 and compared those with what has been used as the basis of estimate CPIs (BOE CPIs) for the going forward construction efforts. This data is provided in Table TC-5.

|  |  |  |  |
| --- | --- | --- | --- |
| Table TC-5: Actual vs Basis of Estimate (BOE) CPIs | | | |
| U-3; Actual Weekly Electrical CPIs (vs Costing BOE CPI of 5.0) | | | |
| Dates (2021) | CPI | Date | CPI |
| Sept 16 | 49.94 | Oct 17 | 15.92 |
| Oct 3 | 43.31 | Oct 24 | 18.01 |
| Oct 10 | 14.86 |  | |
| U-4; Electrical & Mechanical, 4-week Avg CPIs | | | |
| Electrical | | Mechanical | |
| Actual CPI | BOE CPI | Actual CPI | BOE CPI |
| 2.38 | 2.30 | 2.42 | 2.3 |
| NOTE: The actual Mechanical CPI in the most critical (i.e., Containment) Building is 4.9 | | | |

The above data relates to direct construction work. For some of the remaining cost categories such as Indirects, Field Non-Manuals, SNC Labor, and Sub-Contracts VMG has observed that the updated EACs for these categories continues to lag what is happening in the field. An example of the delayed updating of the Project ETC was demonstrated by the discussion of the data presented in Table TC-3. Other examples are the time between updated forecasts and the amount of the increases with each new forecast. In going forward, for these other four major cost categories we continued these trends.

**Q: AND WHAT IS THE TPC EAC FROM USING THIS METHOD OF ANALYSIS?**

A: The resulting TPC EAC in using this method is $ 20.1 B, which is at the low range of the TPC EAC shown in Table TC-4. This latest approach simply trends the company’s latest estimates to complete the defined work within the Company assumed CODs and does not include a cost accounting for what VMG believes will be further schedule delays.

**Q: WHAT DOES VMG CONCLUDE IN ASSESSING THE TPC EAC?**

A: VMG continues to be highly concerned regarding the Project Schedule, especially considering the equipment problems that have been experienced to date, the complicated and time-consuming processes to close out work and turn the plant over to operations, and the fact that both the primary and secondary systems have yet to be operated at 100% rated conditions. For these reasons, VMG asserts that the first method, wherein we took the Company-based estimate, and modified it to reflect a later schedule, is the most reliable indicator of the range within which the final TPC will fall. And that is within the range of $ 20.1 B to $ 20.5 B.

**Q: MR. GRACE, DOES THAT COMPLETE YOUR TESTIMONY?**

A: Yes, it does.

**Exhibit “A”**

**Resume of Donald N. Grace P.E**.

**Donald N. Grace, P.E.**

**President, Grace Management Consulting Services (GMCS, LLC)**

**Serving Vogtle Monitoring Group, & BCN EcoPower, Inc**

**Education, Certifications and Professional Affiliations**

Master of Business Administration, Project Management, Harvard Graduate School of Business (Awarded Fellowship to Attend)

Bachelor of Science in Marine Engineering and Mathematics, United States Naval Academy (Graduated Cum Laude)

Professional Engineer (Pennsylvania), Power Generation

Served as technical lead on Department of Energy (DOE) Reviews and Certifications of major DOE Contractors’ Earned Value Management Systems (EVMS)

Past Chairman of Boiling Water Reactor Owners’ Group, and Past Chairman of the American Nuclear Society Reactor Safety Executive Committee

**Career Highlights**

Over 50 years of hands on technical, management and executive experience with all phases of the Fossil and Nuclear Power Plant Life Cycle (design, licensing & permitting, construction, start-up and testing, commissioning, operations and decommissioning).

Over 20 years of operating power plant experience, with 5 of the years as an officer serving aboard US Naval Nuclear Submarines and 17 years with General Public Utilities.

Development of New Facilities – Seventeen years of experience with a major U.S. Architectural Engineering firm, Burns and Roe Enterprises (BREI), in the positions of Project Engineering Manager, Project Manager, Executive Consultant, and President of a company formed by BREI, AREVA and Duratek. Nearly all these experiences entailed First of a Kind (FOAK) projects which involved new Nuclear Power Plant Projects and FOAK Chemical Process Projects, several of which were DOE Projects.

Directing Major Project, Independent Reviews - As an employee of BREI, contracted by the Department of Energy (DOE) to assemble project review teams which I then directed to provide independent project management reviews of multi-billion-dollar DOE projects. Nearly all the projects were FOAK, and the reviews were total scope reviews (i.e., reviewed ability to achieve technical objectives, within the forecast costs and schedules), and they were performed at major schedule milestones (prior to proceeding to the next project phase).

Currently provide written and oral testimony as an expert witness to state public utility commissions in their prudency reviews of major power plant projects. Included in these reviews have been - and in some cases continue to be - the following: (a) Integrated Gasification Combined Cycle Project (IGCC, at Kemper, Mississippi), (b) Arkansas Nuclear One (a two nuclear unit site), (c) Grand Gulf Nuclear (the largest single unit nuclear plant in the US), (d) Vogtle 3 & 4 Nuclear Project (the only new active nuclear construction project in the US), and (e) the Four Corners Selective Catalytic Project (project was implemented to reduce NOx emissions at this coal fired dual unit site, where each of the still operating units is roughly 750 MW net).

President, BCN EcoPower (Beyond Carbon Neutral, Economical Power Generation) working to develop and deploy a patent pending Cryogenic Regenerative Power Cycle (CRPC) wherein cycle fuel efficiencies for large scale power plants and industrial facilities can be significantly improved with significant reductions of harmful emissions (including CO2).

1. As indicated in past testimonies, other factors that have contributed to Construction Quality issues have included switching too quickly from a “bulk installation” approach to a more piecemeal approach of “do just what is necessary to meet the start of an upcoming intermediate milestone and defer the remaining work.” This has been especially true of bulk electrical commodities, and as an example of the problems this creates, cables were pulled through a raceway in a piecemeal (vs bulk) fashion, and later cable pulls through the same raceway could damage already pulled cables. This, combined with the cable separation issues discovered more recently, have served to greatly complicate the completion of work in that the rework itself often causes further damage to work that was previously considered to be complete. The piecemeal approach also resulted in Systems being broken into sub-systems, allowing for “Partial Releases for Test” prior to completion of the sub-system, and also allowed for “Technical Exceptions” to completion of work that was being turned over to the Integrated Test Program (ITP) Group). All of this has also greatly complicated the work process itself (in that jurisdictional control of the systems is broken into pieces and controlled by different organizations) and has also greatly complicated the process for properly documenting the completion of work. [↑](#footnote-ref-1)
2. The data source for the slipping of the December 6th and January 11th dates has been obtained from the U-3 Plan of the Day (POD) Meetings wherein there is a project reporting of the various Critical Paths and Near Critical Paths. That document, therefore, represents a “live updating” of the Site Working Schedule. [↑](#footnote-ref-2)
3. To further illustrate how unrealistic the company has been in estimating these last remaining time durations, on page 19 of the January 2021 Monthly Project Review (MPR) the company had estimated 114 days (less than 4 months) from the start of HFT to the start of Fuel Load. That duration (as of November 25th) was at 7 months and if start of Fuel Load is achieved by the Company’s current risk adjusted date of May 23, 2022, that actual duration will be 13 months. That same MPR also showed only 110 days (less than 3.5 months) from start of Fuel Load to COD (totally unrealistic). [↑](#footnote-ref-3)
4. With the NRC’s issuance of the 103.g., letter, Operation of the Plant is strictly controlled by the NRC approved “Plant Technical Specifications”. This document provides numerous conditions under which the plant must be operated as it progresses from various states of increased power operations (termed “Modes”), and violation of the requirements can lead to having to file a Licensee Event Report (LER’s) with the NRC. Depending on the reported issue, the potential exists for increased oversight on the part of the NRC, and (depending on the severity of the reported LER(s)) can lead to an order from the NRC to cease operations until various NRC Ordered actions are taken. VMG is not saying that this indeed is likely to happen, but certainly the increased level of controls that must be implemented can further delay the completion of the work required prior to COD. [↑](#footnote-ref-4)
5. During the Southern Company’s 2Q 2020 earnings call, a question was asked regarding our estimate of a 12-month duration from the start of HFT to COD versus the company’s forecast duration of 224 days (i.e., 7.5 months). This 12-month forecast was based on historical experience, with 6 months from the start of HFT to Fuel Load, and another 6 months from the start of Fuel Load to COD. The company response was that our 12-month duration was from the 1970’s era, and that the project can do better. Given, however, the history of the project and the problems which have been manifested, VMG continues to believe that the historical duration of 6 month from the start of Fuel Load to COD is “at best” what the project can hope to achieve. [↑](#footnote-ref-5)
6. In addition to completing added work in a more highly restrictive work environment, see prior footnote 3 on page 7 regarding the example of time duration for what the company had forecast from the Start of HFT to Start of Fuel Load. That was less than 4 months, and the actual time (not yet achieved) may be on the order of 13 months). Then consider the reliability of their current forecast duration from Fuel Load to COD (only roughly 4 months)? [↑](#footnote-ref-6)
7. As mentioned previously, if the U-3 COD were not bounded to roughly November 2022 – February 2023, and it continued to slip, then at some point it should be possible to reduce the COD lag between U-3 and U-4 to less than 12 months. However, that would be possible only with an even greater slip of the U-3 COD. [↑](#footnote-ref-7)
8. The TPC EAC that VMG reports on includes all 100% equity shareable costs and does not include the financing related costs of the various owners and does not include “non-shareable” costs (currently estimated to be $ 570 M) which are incurred only by Georgia Power Company. [↑](#footnote-ref-8)
9. The $ 0.9 B calculation is based on a roughly $ 100 M/ month for both schedules slipping, a roughly $ 65 M/ month for just U-3 slipping, and a roughly $ 0.35 M / months for just U-4 slipping. Given these assumptions, a 7 month slip of both schedules equals $ 0.7 B, plus an additional 3 months slip of the U-3 schedule equals another $ 0.2 B, and when added to $ 0.7 B equals a total of $0.9 B. [↑](#footnote-ref-9)
10. The NRC just recently issued its final “Special Investigation Report” and based on that report they will be providing increased over-sight of construction work. VMG has not had time to assess the extent of this increased over-sight, and its potential impacts on the project schedule, but this is certainly a potential risk to the remaining project schedule which would then also increase the TPC EAC. [↑](#footnote-ref-10)