BEFORE THE

GEORGIA PUBLIC SERVICE COMMISSION

IN THE MATTER OF: GEORGIA POWER COMPANY'S TWENTY-SECOND SEMI-ANNUAL VOGTLE CONSTRUCTION MONITORING ("VCM") REPORT	**DOCKET NO. 29849**

PUBLIC DISCLOSURE

DIRECT TESTIMONY

OF

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ON BEHALF OF THE

GEORGIA PUBLIC SERVICE COMMISSION

PUBLIC INTEREST ADVOCACY STAFF

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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 while meeting the Commission's Regulatory Approved Commercial Operation Dates ("CODs") of November 2021 for Unit 3 ("U-3") and November 2022 for Unit 4 ("U-4"), while also staying within or below SNC's Total Project Cost ("TPC") forecast of $17.1B.[1] Additionally, it involves constructing a plant with high quality allowing full operations with minimal maintenance and repairs moving forward.

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

[1] The TPC represents only capital cost and does not include financing cost. This TPC of $17.1B represents all the equity owners' cost (i.e., represents 100% equity ownership, and not just Georgia Power Company's 45.7% ownership, and as noted excludes all financing related costs). Also, if completed at this cost, then Georgia Power Company's cost share should be consistent with the company's VCM 17 Regulatory Approved cost of $7.3B. Finally, $7.3B does not equal 45.7% of $17.1B, the primary reason being that there are some costs that are borne solely by Georgia Power Company.

A. I have previously provided testimony to the GPSC in Docket 29849 for the Vogtle Unit 3 and Unit 4 Project in December 2018 and December 2019. Also, I have testified before the Mississippi Public Service Commission, the Arizona Corporation Commission, and the Arkansas Attorney General's Office. 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. No. The focus of my testimony today is to analyze data provided by SNC and Georgia Power Company Nuclear Development ("GPCND") through mid-March 2020 with particular emphasis on more recent performance. Based on VMG's analyses of this data, we then opine on the ability of SNC to meet the regulatory approved CODs within the TPC of $17.1B. At this time VMG is unable to accurately assess the cost and schedule impacts associated with the COVID 19 virus that is impacting the Vogtle Project. Any attempt to perform an assessment of COVID 19 impacts would be premature and speculative. Therefore, all analyses and opinions presented in this testimony are based on Project performance pre-COVID 19.

PURPOSE OF TESTIMONY

Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY?

A. The first purpose of my testimony is to describe the process by which SNC has been in a near continuous state of establishing a new Integrated Project Schedule ("IPS") baseline ever since

it took over the Project roughly 3 years ago, and why this continually evolving performance measurement baseline cannot be used as a basis for forecasting that the Project will indeed be completed within the TPC and regulatory approved CODs. Following this, I will then show how VMG has taken historical data provided by SNC and GPCND, trended this data, and analyzed it to support VMG's independent analyses of the forecast CODs and TPC.

Q. PLEASE PROVIDE YOUR SUMMARY CONCLUSIONS.

A. VGM maintains that SNC will not be able to achieve the aggressive target CODs of May 23, 2021 for U-3 and May 23, 2022 for U-4, (i.e., prior to the regulatory required CODs). VGM has also concluded that it is highly unlikely that the Company will meet the Commission Approved CODs of November 2021 for U-3 and November 2022 for U-4. In prior testimony VMG noted that if the then current performance trends continued the $17.1B may be exceeded. Since performance has not materially improved, VMG now concludes that the $17.1B will be exceeded. The degree to which the TPC will be exceeded relies on two primary factors; i.e., (a) poor construction productivity related costs,[2] and (b) schedule delay costs beyond the regulatory approved CODs which, based on SNC's estimate of "schedule contingency costs" are assumed to be roughly $100M per month. Further, VMG is of the opinion that a primary root cause of poor productivity and production is due to SNC's strategy of accelerating testing prior to completion of a greater degree of the bulk construction commodities which then leads to inefficient and costly execution of construction. Further, VMG is of the opinion that SNC's decision to accelerate testing was

[2] As is described later, weekly cost performance indices (CPIs) are published, and the most recent trends indicate an on-going worsening of this measure.

most likely due to the realization that an optimal construction schedule, together with the required durations of testing activities, would not allow SNC to meet the Regulatory Required CODs. SNC erroneously concluded that deviation from normal industry practice would shorten the schedule.

OVERVIEW OF SNC'S PROJECT PLANNING AND REBASELINING

Q. PLEASE DESCRIBE SNC'S PRACTICE OF CONTINUALLY REVISING THE PROJECT IPS BASELINE AND EXPLAIN WHY THIS PRACTICE IMPEDES ACCURATE COST AND SCHEDULE FORECASTING BY SNC.

A. SNC has been in a near continuous state of establishing a new IPS baseline. After having taken over the Project in March 2017, SNC developed its first Schedule Baseline in June 2018 (effective July 1, 2018), issued a revised Schedule Baseline in April 2019, and in late November 2019 initiated another Schedule Re-Baselining termed the February 2020 Refinement. From November 2018 until April 2019 (i.e., over a time period of 17 months) SNC had been working for 9 months to provide a Schedule Baseline whereby it would still meet the aggressive May 2021/2022 CODs. A general description of what transpires during these efforts to Re-baseline the Schedule is as follows:

a. SNC sets an overly aggressive and simply unachievable schedule.
b. It quickly becomes apparent that the workforce cannot meet the unachievable schedule, and there is a subsequent need to again re-baseline.
c. For the cumulative Schedule Performance Index (SPI; which is a measure of the Project to date schedule performance) the re-baselining of the schedule eliminates past unfavorable performance. It does this by setting the value of the previously planned work equal to the value of the actual past earned work. These values are then carried forward into the cumulative reporting of performance, which heavily biases the

cumulative Schedule Performance Index ("SPI")[3] toward a value of 1.0 (which then inaccurately supports representing the Project as performing to meet the Schedule.)

d. The Re-baselining of the Schedule then requires deferral of unachieved work to future periods, building a large backlog of work that must be completed in a compressed time period.

e. As practiced on this Project, realistic weekly (more achievable) goals are initially set, with significant ramped up weekly goals then following; this then continues (for a period of time following Re-baselining) to also bias the cumulative SPI toward 1.0, and thus further masks the inability to perform.

f. In planning schedule durations, taking credit for Productivity Improvement Initiatives (which have yet to achieve the planned results), and as a result, fixing schedule durations to unreasonably short durations to force the schedule logic to work.

g. With the over-all result being that **the IPS performance metrics e.g., SPI and Cost Performance Indices ("CPIs)[4], as measured against each Re-baseline, are of limited value to managing the Project and to forecasting the final CODs and TPC.**

Q. PRIOR TO EXPLAINING THE SCHEDULE AND COST ANALYSES THAT VMG HAS PERFORMED, ARE THERE ANY OTHER ISSUES THAT YOU WANT TO FIRST ADDRESS?

A. Yes. I want to re-iterate a fact that I have pointed to in prior written testimony. Due to an inability of construction to meet planned turnover dates in support of testing -- there is a near continuous on-going effort to further break down partial systems into a multiple number of smaller partial systems. In prior testimony, I also stated that for the remaining partial systems, exceptions[5] are also noted as not being required for turnover (but are picked up later as part of the effort to completely turn over the total system to ITP). Both of these actions then push deferred work into the future thereby creating a large backlog of future work in a compressed time period. Within these smaller partial systems there is then a further effort to

[3] See page 11 for a definition of "Schedule Performance Index" (SPI), and page 12 for a definition of Cost Performance Index (CPI)

[4] As is explained later, cumulative CPIs and cumulative SPIs are handled differently; i.e., with a re-baselining of the schedule, on the cost side the past cost variances continue to be included in the project measure of cumulative CPIs, whereas for cumulative SPIs, past planned values are changed to match the actual earned hours.

[5] An exception is a set of work activities that SNC has deemed unnecessary for ITP to commence initial testing. These work activities will require completion at some future date.

do a partial release for test ("PRT") wherein components are turned over to the Initial Test Program ("ITP") Group for testing. All these actions are addressed in the testimony of Mr. Roetger and Dr. Jacobs, and I mention it only to illustrate the high degree of complexity in attempting to effectively plan and track the progress of the Project. As a further illustration of this complexity, at a reported over-all Project percent complete of 84.9% (as of end of February 2020), it is estimated that there are still over 60,000 activities in the IPS.

Q. PLEASE SUMMARIZE THE EFFECTIVENESS OF SNC'S EFFORTS TO PLAN, TRACK, AND REPORT THE PROGRESS OF THE PROJECT.

A. Normal industry practice is to use a reasonable and achievable resource loaded IPS as one of the major tools in assessing both the forecast CODs and TPC at project completion. However, with SNC management's overuse of hard constraints (i.e., fixed dates) on the logic tied dates of the unreasonably short schedule durations, the ability of the IPS Program (Primavera) to forecast final CODs is significantly compromised. Also, normal industry practice is that the cost and durations of all project required resources be integrated together within the IPS. SNC's cost analyses are largely separate from the IPS. One indicator that the Project is unlikely to meet the regulatory required CODs is that the focus of Project reporting has shifted, in part, toward the reporting of the ability to achieve the start of major milestones. This approach ignores the critical issue of when major milestones are actually *finished* which ultimately drives achieving Project CODs. With SNC's approach, however, caution needs to be exercised in that significant (currently off critical path) work is being deferred in order to concentrate on the effort required to meet the nearer term major schedule start milestones, and it is questionable whether this deferred work plus future

planned work can indeed be completed to meet the CODs. It is for these reasons, therefore, that VMG has chosen to use the same raw unanalyzed performance data that is being generated by SNC and GPCND, but analyzed in a different manner, so as to provide an independent means for assessing the CODs and TPC at Project completion.

VMG APPROACH TO ITS SCHEDULE AND COST ANALYSES

Q. HOW DID VMG DETERMINE FROM ITS SCHEDULE AND COST ANALYSES THAT IT IS HIGHLY UNLIKELY THAT THE PROJECT WOULD ACHIEVE THE NOV 2021/2022 CODS AND WOULD EXCEED A TPC OF 17.1B?

A. VMG has at all times relied solely on raw data provided either by SNC or by GPCND. VMG then analyzed this raw data, and in some cases, has done further trending of the data. Finally, VMG has looked at the sum of these analyses in an integrated manner which has then led to its conclusions.

Q. PLEASE DESCRIBE THE VARIOUS DATA THAT VMG ANALYZED.

A. VMG analyzed the following data elements:

- Schedule Performance Indices (SPIs): This is a measure of the amount, in hours, of construction work that had been planned to be completed within a defined period of time, divided by construction work completed during that same time period. Therefore, an SPI of greater than 1.0 would reflect negative performance vs plan, and an SPI of less than 1.0 would reflect positive performance vs plan. This, however, is simply a gross measure of

performance in that it does not account for whether the most critical work to completing the Project on time (i.e., the "critical path" work) is being completed as planned. VMG used planned and earned data (as measured by construction man-hours) and the resultant SPIs on both a per U-3 and U-4 basis, and also for the most critical U-3 bulk construction activities that remain (i.e., cable pulling and termination of the cables). Finally, VMG then displayed and analyzed this data on a "period basis" (i.e., weekly, and cumulative Project to date basis) which shows how the more recent weekly data is much more indicative of actual Project progress than the cumulative measures, since as discussed earlier, with each re-baseline all past negative schedule performance is eliminated (i.e., SPI is reset to 1.0).

- Cost Performance Indices (CPIs): CPI is a measure of the actual hours spent in performing work divided by the earned hours. Similar to what was done for the SPIs, CPIs, were analyzed for total bulk construction commodities (individually for U-3 and for U-4), and critical remaining construction bulk commodities of cable pulling and terminations (in this case, just for U-3). As is the case with SPIs, a CPI greater than 1.0 indicates cost performance worse than had been planned whereas a CPI of less than 1.0 indicates cost performance better than what had been planned.[6]
- Critical Paths have been reviewed however the majority of the remaining U-3 activities are either critical path or near critical path[7].
- System/ Partial System Turnovers from Construction to ITP: The major activities remaining to U-3 COD include: (a) construction completion of the bulks, Civil, Mechanical and Electrical commodities such as cable pulls and terminations, (b) completing the partial

[6] As is explained later, cumulative CPIs and cumulative SPIs are handled differently; i.e., with a re-baselining of the schedule, on the cost side the past cost variances continue to be included in the project measure of cumulative CPIs, whereas for cumulative SPIs, past planned values are changed to match the actual earned hours.
[7] Near critical path is close in duration to the critical path. For example, something could happen that shortens the critical path, or lengthens the near critical path, to the point where the near critical path becomes critical.

systems (which then roll up to reflect completion of work on a total system basis) and having turned the complete systems over to ITP, (c) ITP completing all of its test activities and turning the systems over to Operations, and (d) Operations then being authorized by the NRC to start loading fuel and completing all plant start up and commissioning activities (e.g., in essence demonstrating that the constructed plant meets its operational and safety performance requirements). Currently, U-3 is focused primarily on completing parts (a), (b) and (c) above. VMG's analysis of the construction SPIs and CPIs addresses Project performance during the construction phase, and what VMG then looked at was the planned, current forecast, and actual turn-over dates for many of these partial systems.

- ITP Performance: ITP's performance of the many partial system tests represents the next phase of work and has therefore been analyzed. However, the ability of ITP to meet the IPS planned start dates are not constrained so much by the performance of ITP but more by the ability of Construction to complete its work in a timely manner so that partial systems can be turned over to ITP. Therefore, what VMG has analyzed is the means by which ITP plans its work, and major challenges it is facing when executing that work.[8]
- Analysis of Performance vs Major Project Milestones: Over the course of the Project SNC has gradually switched emphasis from the traditional (and industry accepted) means of reporting progress (i.e., in terms of SPIs, CPIs and a limited number of Critical Paths and Near Critical Paths[9]), to reporting progress against scheduled major Project milestones. In many cases progress is measured against the start of milestones rather than the finish.

[8] Although not necessarily the fault of ITP, as is explained later ITP's ability to successfully complete testing is being significantly impacted by component test failures, the reasons for which are just starting to be analyzed by ITP.
[9] Near critical path is close in duration to the critical path. For example, something could happen that shortens the critical path, or lengthens the near critical path, to the point where the near critical path becomes critical.

- Monthly Status Reports were reviewed, and data analyzed, including cost details for the various cost categories of Direct, Indirect, Field Non-Manual, Subcontractors performance both in cost and schedule, SNC Labor, Engineering and Procurement related costs.
- Of particular concern to VMG is the cost to go; therefore, the cost per percent complete has been analyzed and considered in VMG's estimate of the cost to go.
- Schedule and Cost Risks, and Contingency Analyses: Although SNC has a well-documented means of identifying and analyzing risks to both the Project IPS and TPC, having a sound program in place does not guarantee the *quality of the program inputs* (i.e., have the identified risks been evaluated in a non-biased manner to yield realistic ranges of schedule and cost impacts and their probability of occurrence). Given the sheer magnitude of the identified risks, this is a very difficult area for an independent monitor to evaluate. What VMG has done, therefore, has been to analyze SNC's identified range of potential cost impacts of these risks over time versus what one should expect for a project of this type, and then used this as a measure of the accuracy of the effort.
- Integrated Analyses of the Project-wide IPS, and Integrated Analyses of the Project-wide TPC: The above described analyses focus on U-3. With respect to U-4, VMG believes it is too early yet to provide a detailed analysis of the U-4 COD and has therefore accepted SNC's current estimate that U-4 will follow U-3 by 12 months. VMG then offers its opinions regarding the final CODs and TPC.

ANALYSES OF PROJECT SCHEDULE

Q. PLEASE DISCUSS THE FIRST ELEMENT OF YOUR ANALYSES OF SCHEDULE PERFORMANCE INDICES (SPIs)

A. SPIs was the first set of raw data that was assembled and analyzed, and it was done for the following subject areas:

- All bulk construction commodities, for U-3 and U-4 individually. These SPIs are displayed in Chart S-1. Following that, Table S-1 provides the average SPIs for U-3 and U-4 over this time period, and it also shows the cumulative SPIs at month's end over this time period.
- For the final construction activities (i.e., cable pulls and terminations), Chart S-2 (later in this testimony) displays the cable pull and termination SPIs on a weekly basis for Unit 3.

Chart S-1: U-3 and U-4 Bulk Commodity Weekly SPI

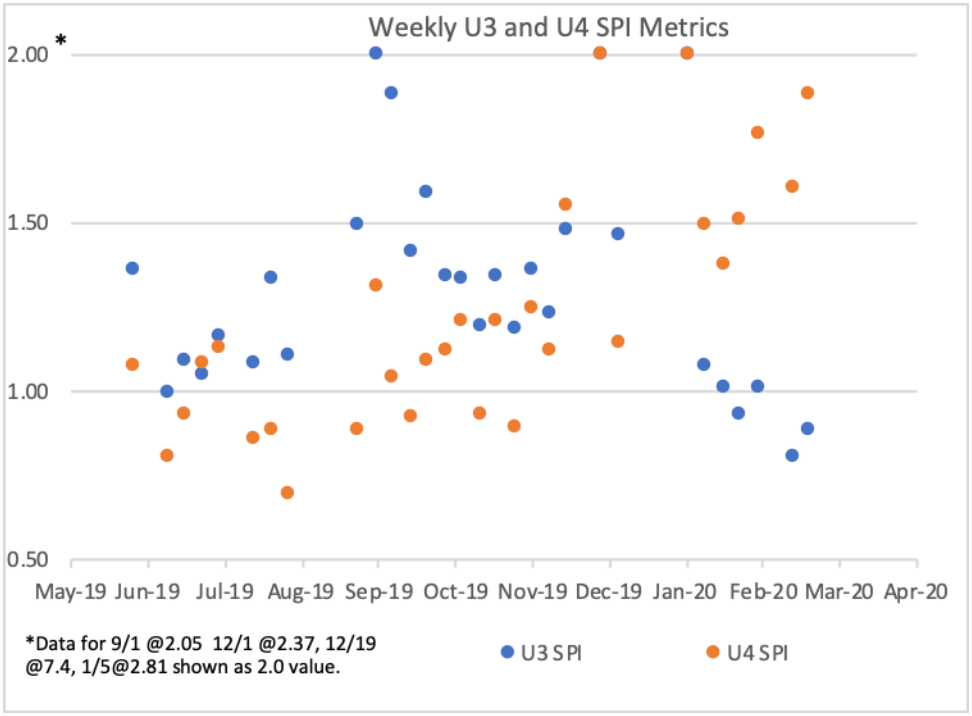


Table S-1: U-3 and U-4 Average and Cumulative SPIs (All Bulks)

Unit	Avg of June 2019 to Mid-March 2020 Weekly Data	Cumulative SPI (all bulks; since October 2017) through end of the listed months										
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
		2019	2019	2019	2019	2019	2019	2019	2019	2019	2020	2020
3	1.42	1.00	1.01	1.03	1.06	1.07	1.10	1.11	1.12	1.14	1.14	1.13
4	1.35	0.98	0.98	0.97	0.96	0.95	0.96	0.97	0.98	1.01	1.04	1.08

Q. WHAT DOES VMG CONCLUDE FROM ITS ANALYSES OF THE SPIs FOR U-3 BULK COMMODITIES AND U-4 BULK COMMODITIES?

A. From Chart S-1, together with Table S-1, VMG provides the following observations:

- From Chart S-1 it can be seen that for a majority of the weeks reported, both for U-3 and for U-4, the SPIs are much higher than 1.0.
- From Table S-1, over the recent time period of June 2019 through mid-March 2020 the arithmetic averages are 1.42 and 1.35 for U-3 and U-4, respectively. This says that the Project fell behind by an average of 42% for U-3 and 35% percent for U-4 during this recent performance period. We believe that further trending of these values will be more indicative of future performance on the Project than historical data from October 2017.
- In addition, from Table S-1 it can be seen that cumulative SPIs for both U-3 and U-4 start equal to or better than plan (i.e., are roughly 1.0, due to having zeroed out prior schedule variances with the re-baselining effort), but then slowly increase to show negative schedule performance. What this data also shows, therefore, is that cumulative SPI (with its prior setting of planned work equal to actual earned work) is heavily biased toward 1.0 and is not a valid measure of recent and current Schedule performance (refer to Chart S-1).

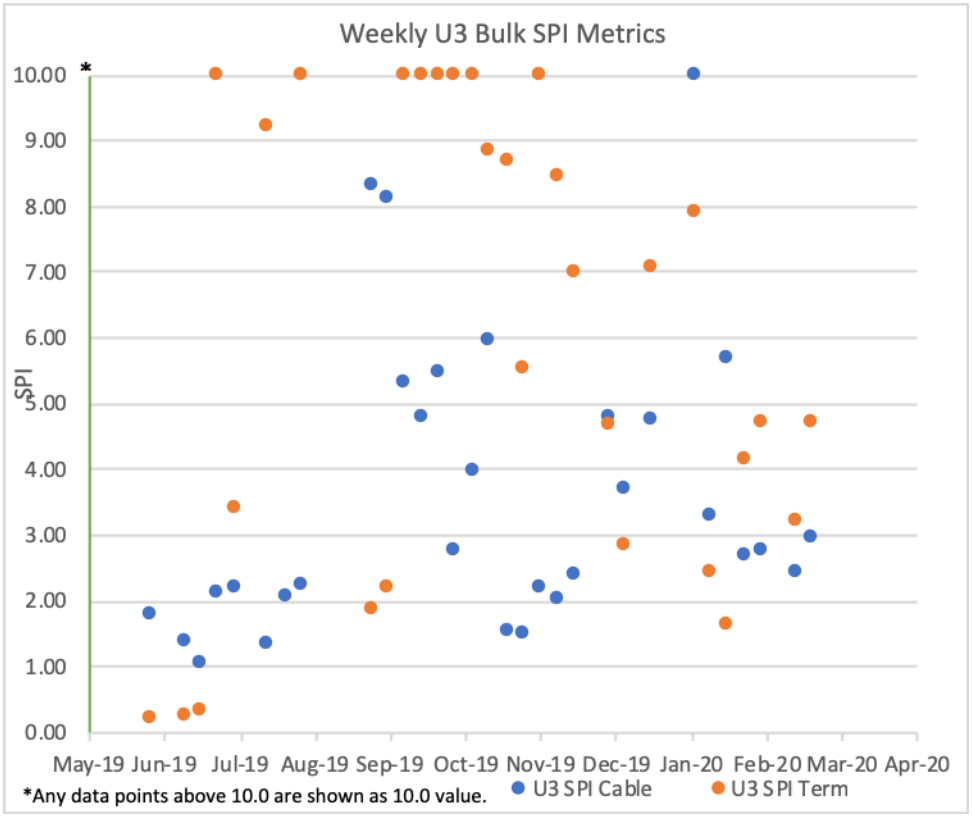
- For all construction bulk commodities (Chart S-1), the weeks reported in 2020 show a complete reversal of performance on U-3 vs U-4. That is, it appears that U-3 performance improved at the expense of U-4; and, as has been verified by the VMG on site construction monitor, this is most likely due to shifting construction resources from U-4 to U-3.
- In Chart S-1, U-3 Weekly SPIs in the January to February 2020 timeframe show the unit performing ahead or on schedule. This is the result of the "interim snap 2020" calibration (and setting non-challenging near-term targets,[10] which then quickly ramp up); so, we expect that unless the near-term targets are reset, or snapped, once again to less challenging levels, these SPIs would again increase rapidly in the remaining weeks of March and April, 2020.

Q. CAN YOU SHOW US THE RAW SPI DATA AND VMG'S ANALYSES FOR CABLE PULLING AND TERMINATIONS?

A. Yes. Chart S-2 plots SPIs for U-3 for these two bulk commodities, and as is shown these SPIs (being more focused and are not balanced out by inclusion of all other bulk commodities), swing much more wildly than the charted SPIs for all bulks.

Chart S-2: Cable and Terminations Weekly SPI's (U-3)

[10] If indeed the work was actually re-planned per these schedule snaps, that would only serve to further delay the required work and thereby contribute to an increasing bow wave of future work.



And, although one would expect some degree of the swing in values to be greater than when compared to the SPIs inclusive of all bulk commodities, these swings are "off the chart" (both figuratively, and actually off the scale of Chart S-1). Further, the arithmetic average SPIs for these IPS critical bulk commodities for this performance monitoring period (i.e., April 2019 through Mid-March 2020) are **3.59 for U-3 Cable, and 5.75 for U-3 Terminations.**

Q. CAN YOU TELL US WHAT VMG HAS CONCLUDED FROM ITS ANALYSES OF THIS DATA?

A. This data clearly illustrates many issues for the remaining critical bulk construction commodities of cable and terminations as follows:

- The Schedule Performance for Bulk Cable and Terminations has been far worse than the Project planned for and is erratic and unpredictable. Clearly, this is a situation which is severely challenged.
- It is becoming increasingly difficult to finish this final cable and termination construction work in a timely manner to support achieving the regulatory CODs, and completing this work is the main (if not most significant) impediment to doing so. This is clearly evidenced by this data, in that **if (as the U-3 cable termination SPI of 5.75 indicates) it could take 57.5 months (i.e., 5.75 x 10 months) to complete the amount of termination effort that had been planned to be completed during this 10-month period, clearly the Regulatory Required CODs of November 2021 and 2022 would not be met.**
- From this same data, it is also clear that SNC has recognized this problem by attempting to move roughly 500,000 hours of direct labor work to beyond the start of the Hot Functional Testing Schedule Milestone. Concurrently, however, as work continues there are increasing numbers of subcontractors attempting to get into the already crowded areas to finish their work (e.g., final HVAC work, painting, etc.). VMG has referred to this "near the end of the job" condition as "the stacking of crafts". And, although spreading out the nearer term remaining work over a longer period of time helps to lessen this issue in the nearer term, without a credible IPS by which a detailed scheduling of the various direct labor craft plus subcontractors can be planned and monitored, it is certainly questionable that this spreading out of the nearer term remaining work will result in productivity improvements which are necessary and sufficient to support meeting the Regulatory Required CODs.

- To further illustrate the seriousness of this problem, what has started as a November 2019 "Schedule Snap" has morphed to a February 2020 "Schedule Refinement." Then, from February until April 26th the reporting did not include planned values, and at that point reporting started again to include updated planned values (with these updated "planned values" still identified as being per the "February 2020 Schedule Refinement").[11] What this then illustrates is that the Project is having difficulty in establishing, and then working to, an achievable plan.
- As a final point, **this data supports VMG's conclusion that the Project is not likely to meet the Regulatory Required CODs.** Further, the additional metrics of system turnovers and slippage of schedule milestones (addressed below) lend additional support to this conclusion.

Q. IN ADDITION TO THE CONSTRUCTION SPIs INDICATING THAT THE REGULATORY REQUIRED CODS MAY NOT BE MET, CAN YOU COMMENT ON CONSTRUCTION TURNING OVER PARTIAL AND COMPLETE SYSTEMS TO THE ITP GROUP SO THAT THEY CAN THEN PERFORM THEIR COMPONENT AND SYSTEM TESTS?

A. The metric of actual turnovers to the ITP group versus the planned turnovers illustrates several issues, as follows: (a) the ability to complete construction work on schedule, (b) the quality of the construction work (since if tests fail, it may require turning back to

[11] As further evidence of the evolving Schedule Baseline (which should really be a "Schedule Performance Measurement Baseline"), there should no reason why the June 2019 U-3 SPIs are so much less than 1.0; i.e., if the April Schedule Baseline had just been implemented, why would the reported June weekly values of earned vs planned be so favorable (ref: Schedule Chart-2, where the June 2019 SPI's are all less than 0.5).

Construction), and (c) the ability of support staff (largely Engineering) to put documentation together (especially for ASME III Nuclear Safety Related Systems) to document that the as-built plant is consistent with all the related design documents. Additional background important to understanding the evolution of how work is planned for turn over, and when it actually turns over is provided as follows:

- Since SNC has taken control of the Project, and as it became clear that a planned turnover date for a system could not be met, the system would be broken down into partial systems. For U-3, the June 2018 Baseline had a listing of 105 systems/partial systems. The April 2019 Baseline had a listing of 114 systems/partial systems, and the February 2020 snap is anticipated to have 151. As it became clear that the planned turnover date for the partial system could not be met, exceptions to that planned work were then defined, and that work also packaged into future planned work. Also, in large part to meet the major schedule milestones and to test components early to identify potential problems, Partial Releases for Test ("PRT") were employed. SNC's ITP Group has compiled data that shows the component test failure rate is at the roughly 80% level, which in VMG's professional opinion is much greater (by at least a factor of 4) of what one should expect.
- All the above greatly increases the complexity of planning work and providing meaningful reports of progress vs plan (as evidenced by there being more than 60,000 remaining activities within the IPS).

Q: ALTHOUGH THIS APPEARS TO BE A HIGHLY COMPLEX SUBJECT AREA, IS THERE A SIMPLE SUMMARY MEASURE YOU COULD PROVIDE TO ILLUSTRATE HOW WORK IS NOT BEING ACCOMPLISHED AS PLANNED?

A. Yes, summary macro level performance data regarding the numbers of planned partial system turnovers (as originally planned by the June 2018 Schedule Baseline, and the April 2019 Schedule Baseline), and performance vs plan, is provided in Table S-2 below:

Table S-2: U-3 Planned and Actual Turnovers

Number of Systems/Partial Systems Planned for T/O by March 2020		
Per June 2018 Schedule Baseline	**Per April 2019 Schedule Baseline**	**Number of Actual Turn Overs Accomplished by March 2020**
94 of 105 Planned for T/O by March 2020 (i.e.: 90%)	**77 of 114 Planned for T/O by March 2020 (i.e.: 68%)**	**17 of 151 (i.e.: 11%)**

Q. WHAT DO YOU CONCLUDE FROM THE ABOVE ANALYSES?

A. The data of Table S-2 simply provides an additional measure of how the aggressive CODs cannot be met and that it is highly unlikely that the regulatory dates will be met.

Q. TURNING NOW TO ITP'S PERFORMANCE OF ITS TESTING ACTIVITIES, WHAT CAN YOU TELL US IN THIS REGARD?

A. First, I will describe the general nature of ITP's activities, and then follow that with summary observations.

ITP's activities consist primarily of performing system (for the most part, "partial system") tests, plus partial release for test (PRT) testing of components. Given the previously described inability of Construction to turn over systems as planned, and the component tests

failing due potentially to problems beyond ITP's control, simply measuring them against unrealistic planned start and finish dates is not a valid measure of performance. Further, ITP's management approach is more akin to what occurs in the management of a production line; i.e., they track incoming system turnovers (and other work, such as PRTs) as they are accepted, the work in process back-log of these items, their production capability in terms of managing the backlog, and the time it takes to process (i.e., complete) testing of the incoming work. This is similar to how the Engineering Department manages their work effort, i.e., to a large extent they cannot control their incoming workload, so they attempt to plan for it so as to be able to process what comes to them in a sufficiently timely manner. With respect to ITP's performance for component tests, as noted previously the component test failure rate is at an unacceptably high rate of roughly 80%. This is an area for which SNC has initiated several analyses to determine the root causes (some of which may be beyond the control of ITP), and until these analyses are completed and VMG has a chance to review them, VMG cannot as of yet comment further.

Based on the nature of ITP's activities as described above, together with VMG's discussions with ITP, summary observations regarding ITP are provided below.

- Measuring ITP performance against an unrealistic IPS baseline would be meaningless because ITP has little control over the timely turnover of systems.
- The component test failure rate is indeed a serious issue; however, it is too early to tell whether the extent of the failures are the result of ITP's performance (e.g., not properly testing the component), or others' performance (e.g., a fabrication failure beyond the scope of what the quality documentation would be able to detect). Further, in going forward, and as the ITP workload starts to increase, this is simply one of the many areas warranting further

review (especially the reasons for high component test failure rates, and the potential implications for items not yet tested).

Q. SNC MANAGEMENT IS PROVIDING INCREASED FOCUS ON ITS ACHIEVEMENT OF MAJOR MILESTONES AS A MAJOR PERFORMANCE MEASURE. WHAT CAN BE SAID IN THIS REGARD?

A. This subject area is addressed in greater detail in the testimony of Mr. Roetger and Dr. Jacobs. As an example of what has happened, the Integrated Flush (IF) Schedule Milestone was established in the June 2018 Schedule Baseline as a "Finish IF" milestone with a completion date of September 24, 2019. Later, this milestone was converted to a more easily attainable "Start IF" milestone. Further, the initial (and subsequently deleted) finish milestone has still not yet been completed (note: as of late April 2020, it is forecast to be complete by August 29, 2020, a slip of nearly one year), yet credit was taken for reaching a Major Milestone of "Start" (vs Finish) IF on August 15, 2019. As another example of Major Milestones continually slipping, Cold Hydro was initially scheduled to be complete by February 2020, then by April 2020, and is now (as of late April) forecast to be completed by June 2020. Similar slippages have also occurred for Open Vessel Testing (OVT) and Hot Functional Testing (HFT). In summary, this is simply an additional measure by which VMG has concluded that the aggressive CODs will certainly not be met, and it is highly unlikely that the regulatory November 2021/ 2022 will be met.

Q. IS THERE ANYTHING ELSE YOU WOULD LIKE TO ADDRESS IN TERMS OF ADDITIONAL MAJOR SCHEDULE ISSUES?

A. Yes, and that is the assumed schedule durations for U-3 to first proceed from the "Start of Hot Functional Testing" to the "Start of Fuel Load". And from there to "Commercial Operations." This is another area addressed in greater detail in the testimony of Mr. Roetger and Dr. Jacobs, and, as they will show, prior experience in the United States demonstrates that the time from the start of the Hot Functional Test to the start of Fuel Load is typically 6 months and from the start of Fuel Load to Commercial Operations is typically another 6 months. As has already been indicated in this testimony, significant work has already been deferred to after the start of HFT, thereby putting timely completion of post HFT work at risk. In addition, for the second of these two phases (i.e., Fuel Load to Commercial Operations) SNC is claiming that these roughly 182 days can be reduced to 105 days thus creating 72 days as "schedule margin."

Q. GIVEN SNC'S APPROACH TO PROJECT PLANNING AND THE SCHEDULE PERFORMANCE TO DATE, HOW WOULD YOU CHARACTERIZE THESE EFFORTS?

A. Simply stated, it is to develop an unachievable plan, fail relatively quickly, and repeat the process to develop a new (and still unachievable) plan. When first creating the unrealistic plan, this is usually accompanied with, and based upon, a "Productivity Improvement Plan" wherein improvements in productivity are assumed within both the newly established Schedule Baseline and in the going forward cost estimates, but performance then falls far short of these assumed improvements.

Q. PLEASE DISCUSS VMG'S ANALYSIS OF SCHEDULE RISKS AND THEIR POTENTIAL IMPACTS?

A. In terms of identifying risks and evaluating potential ranges of outcomes, the SNC risk analysis focus is on cost in that it identifies and quantifies high, low, and mean dollar values for identified project risks, and then addresses the cost of schedule delays by assuming a roughly $100 M per month cost for schedule delays from the aggressive May 23, 2021/ 2022 CODs to the Regulatory Approved November 2021/ 2022 CODs (for a total schedule delay cost contingency of $540 M). Further, SNC management continues to maintain that the Regulatory Required CODs will not be exceeded, and their risk analyses therefore do not address schedule delays beyond that point.

With respect to "risk mitigation" activities, and as an example, SNC with its "partial release for test" approach to performing component tests as early as possible helps to some extent in mitigating schedule risks (although the component test failure rate is very high, at 80%, and much higher than one should expect and have to plan for). In addition, there is always the potential for a schedule risk – that may be currently identified as a low probability risk – to manifest itself (such as a problem with a Reactor Coolant Pump, as was experienced in China). It appears as if SNC may be doing all that it can in these regards (e.g., SNC has ordered a spare Reactor Coolant Pump from the now cancelled Summer 2 Project); however, as VMG has concluded, it is highly unlikely that these risk mitigation measures will be enough to meet the Regulatory Required CODs.

SUMMARY CONCLUSIONS - PROJECT SCHEDULE

Q. BASED ON THE VARIOUS ANALYSES YOU HAVE PERFORMED REGARDING THE PROJECT SCHEDULE, WHAT ARE VMG'S FINAL CONCLUSIONS?

A. Based on raw data (all of which has been derived from SNC or GPCND reports), and VMG's trending and analyses of that data, we conclude the following with respect to a forecast of the Vogtle 3 & 4 CODs:

- As previously testified, the aggressive May 23, 2021/2022 CODs are not achievable, and have not been achievable for some time prior to this reporting period.
- **With respect to the Regulatory Required November 2021/2022 CODs, it is highly unlikely that these dates will be achieved.** Further, based on the lack of realistic planning (via a credible IPS) and monitoring of performance versus a potentially achievable plan, it is difficult to ascertain the extent to which these dates will be exceeded.

ANALYSES OF TOTAL PROJECT COST (TPC)

Q. WITH RESPECT TO VMG'S ANALYSIS OF THE TPC, COULD YOU PROVIDE A BRIEF DESCRIPTION OF HOW VMG APPROACHED, AND THEN INTEGRATED, THE VARIOUS PARTS OF THE ANALYSES?

A. VMG first analyzed the direct construction labor CPI's to validate what we believe will be a range of CPI's within which the overall Project will fall. We then analyzed the cost that is being expended to complete each additional percentage of the Project, and then trended that to provide a separate independent estimate of the TPC at 100%. We also did a high-level review of the Risk Management Program and the associated range of potential cost impacts for the identified risks. We then did an update of the cost analyses we had performed for the VCM 20/21 Testimony and when completed, checked the results for consistency with the other macro level analyses provided within this testimony. All of this was done with an assumption of the CODs occurring per the regulatory approved dates of November 2021/2022. With that we completed this section of VMG's Cost Analysis, and in the next section of VMG's testimony we provide an integrated range of estimates based on both a range of CPIs and a range of schedule delays beyond the regulatory approved CODs.

Q. CAN YOU DESCRIBE WHAT VMG DID IN ANALYZING THE CONSTRUCTION COST PERFORMANCE INDICES (CPIs)?

A. VMG plotted the weekly CPIs starting in May 2019 just after establishment of the April 2019 Schedule Baseline and ending in mid-March 2020. This was done for all construction bulk commodities and was done separately for U-3 and U-4; these weekly plots are shown on Cost Chart C-1. VMG then calculated the arithmetic average of these weekly CPIs, separately for U-3 and for U-4, and the cumulative CPIs through the last week of each reporting month. These data are displayed in Table C-1. The cumulative CPIs includes all past actuals and past earned direct craft hours (starting in October 2017 to the present); therefore, the heavy weighting of the prior values results in the cumulative CPI not changing very quickly.

Focusing on cumulative CPI's is important, for part of VMG's cost analyses uses various cumulative CPI's to obtain a range of the TPC at Project completion. Finally, since the cumulative CPI's do not change very rapidly, in order to obtain a measure of how quickly the cumulative CPI may be increasing, one needs to focus on the more recent CPI's.

Chart C-1: U3 and U4 Bulk Commodity Weekly CPI's

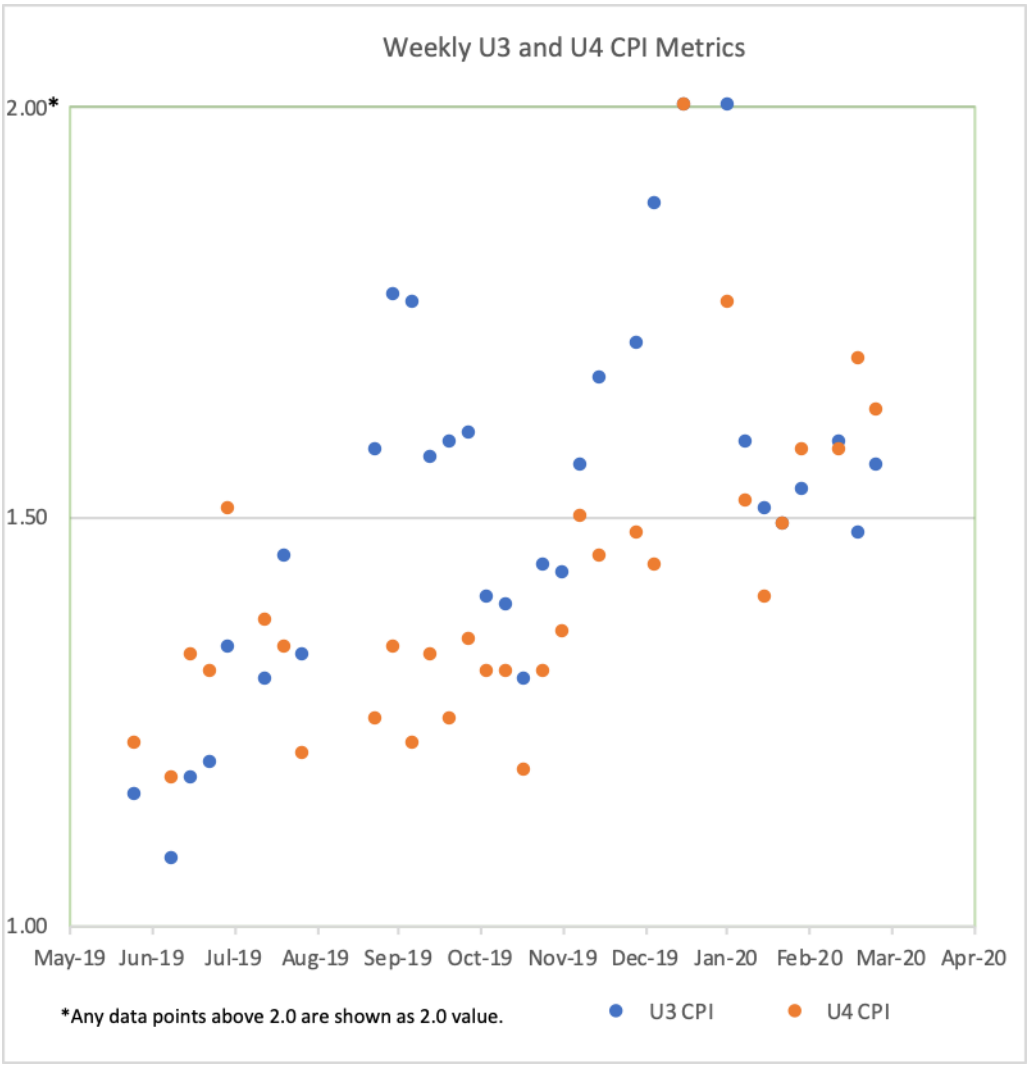


Table C-1: U-3 and U-4 Average and Cumulative CPI's (All Bulks)

Unit	Avg of June 2019 to Mid-March 2020 Weekly Data	Cumulative CPI (all bulks since October 2017) through end of listed months											
		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
		2019	2019	2019	2019	2019	2019	2019	2019	2019	2020	2020	2020
3	1.51	1.21	1.21	1.24	1.25	1.27	1.29	1.29	1.30	1.32	1.33	1.34	1.35
4	1.41	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.27	1.29	1.30	1.31	1.32

Q. WILL YOU PLEASE DESCRIBE WHAT VMG CONCLUDES BASED ON ITS ANALYSES OF CHART C-1 AND TABLE C-1?

A. Based on our analysis of the chart and table, VMG concludes the following:

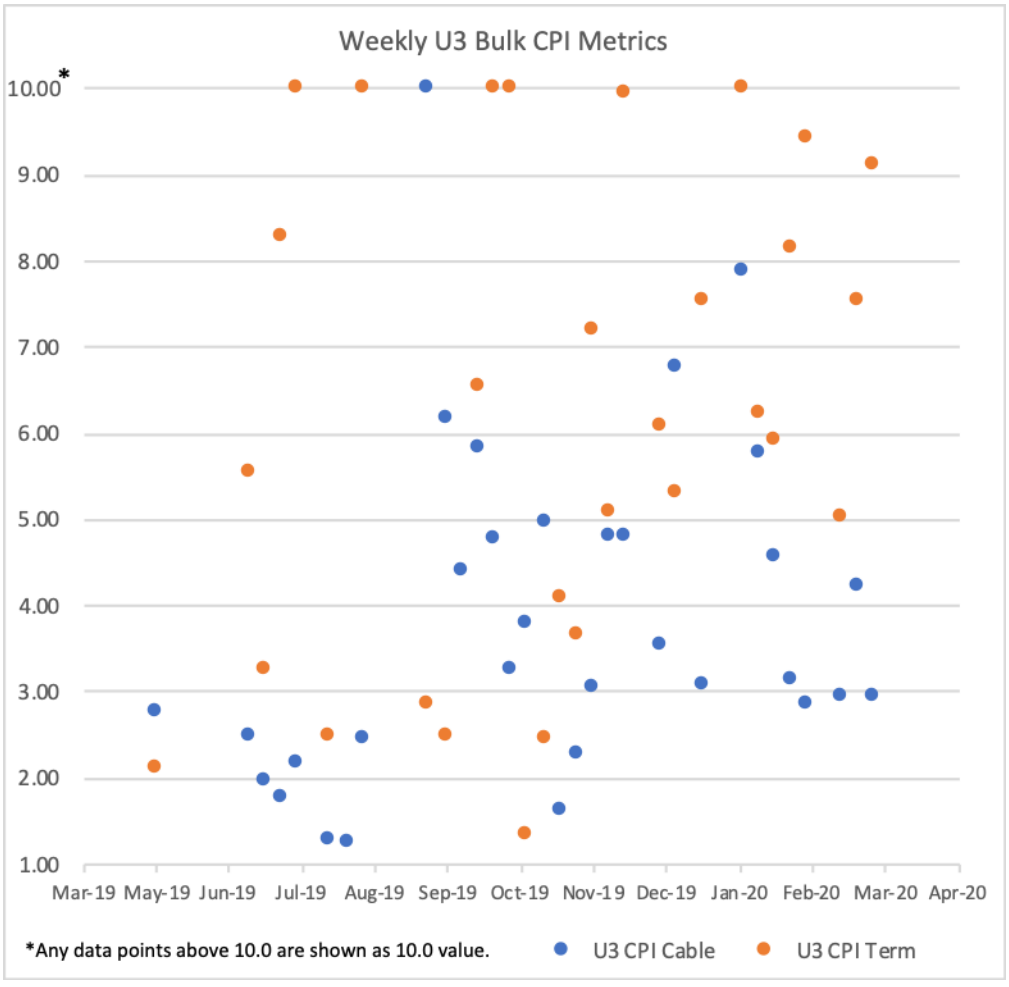
- For these recently reported weeks, both for U-3 and for U-4, the weekly CPIs are much higher than 1.0, and for the time periods shown the arithmetic averages are 1.51 and 1.41 for U-3 and U-4, respectively. This means the cost of performing work during this recent performance period is 40% to 50% more than the cost at which it was planned to be performed.
- The over-all trend (except for a spike, and return from the spike, during the Christmas / New Year time period) has been getting progressively worse for both units. Further, as work areas continue to become more crowded with construction workers, plus ITP workers and sub-contractors all involved toward the finishing stages of their work, it is likely the CPIs would become even worse.

Q. PLEASE PROVIDE VMG'S ANALYSES OF THE U-3 CPIs FOR THE

CRITICAL BULK CONSTRUCTION COMMODITIES OF CABLE AND TERMINATIONS.

A. The weekly CPIs for U-3 cable-pulling and terminations are plotted in Chart C-2 for the same time period as the prior SPI and CPI charts. Also, the arithmetic averages over this time period have been calculated to be 3.87 (for cable) and 6.49 (for cable).

Chart C-2: Cable and Terminations Weekly CPI's (U-3)



Q. WHAT DOES VMG CONCLUDE BASED ON VMG'S ANALYSES OF THIS DATA?

A. With such wide swings in the weekly CPIs and the highly adverse average CPIs, it should be obvious that management's current work plan is very inefficient and may need to be modified.

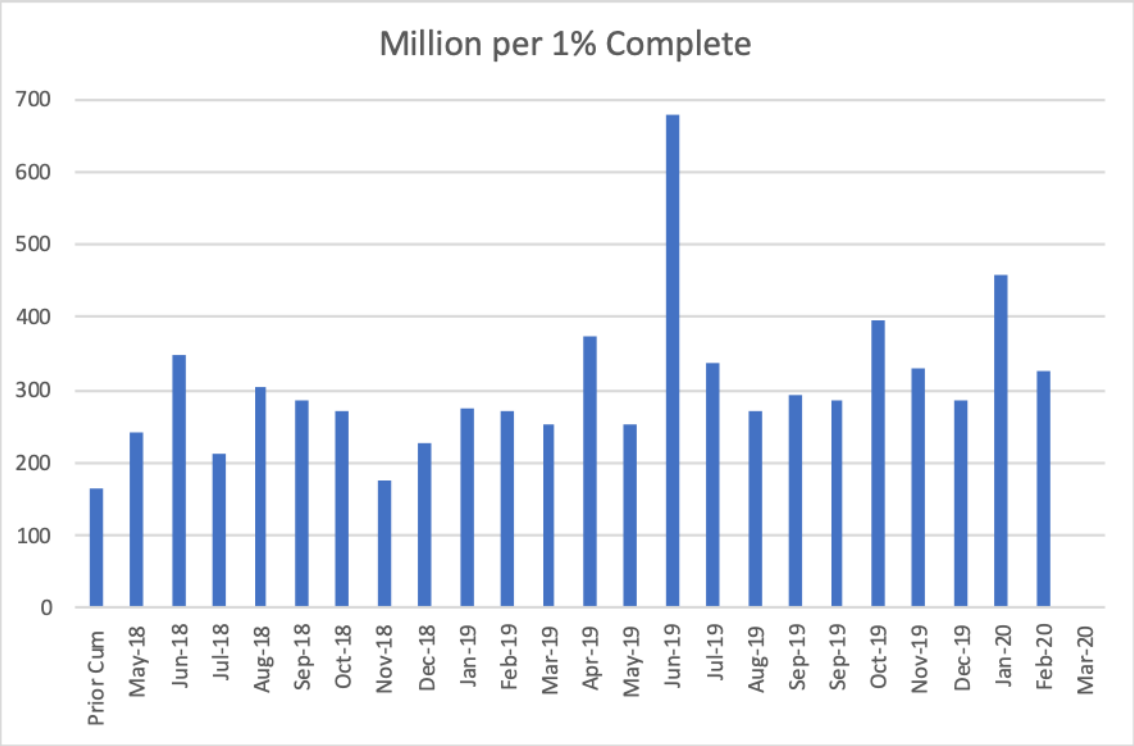
Q. WHAT DOES YOUR ANALYSIS OF THE TPC SHOW IN LIGHT OF THE DOLLARS REQUIRED TO ACHIEVE 100 PERCENT PROJECT COMPLETE?

A. First, I will describe the methodology for this analysis, and then what the results of the analysis indicates with regard to a final TPC. For this analysis we took SNC, GPCND, and Bechtel reports of both the total Project percent complete, and of the dollars spent, for three different time periods; i.e., (a) all charges up to the point of establishing the June 2018 Schedule Baseline, (b) from the June 2018 Schedule Baseline to the establishment of the April 2019 Schedule Baseline, and (c) from the April 2019 Schedule Baseline through February 2020. In addition, Chart C-3 takes the monthly charges and the additional percent complete reported for the month, and then shows (based on that performance) the expenditures that would have been required to achieve a 1% performance value. (NOTE: In looking at the chart, June 2019 may appear as an anomaly, but reflects a low earned percent complete of only 0.3% and is measured against a relatively constant month to month actual cost).

Apart from Chart C-3, VMG took the total dollars charged against each of the three time periods and divided that by the credited percent complete taken for that same time period, thereby obtaining a dollar per percent complete for each of these three periods. These values are $166M, $223.9M, and $357.7M, with each dollar then representing (over the associated time period) the average expenditures required to yield an additional 1% of Project percent complete. As can be seen from these figures, the trend is increasing dramatically, and in light

of the "stacking of crafts" issue together with intensifying ITP activities proceeding in parallel with construction, VMG sees no reason as to why this trend should start to decrease as the Project progresses further to completion. If one then multiplies the "remaining percentage to be complete" (which at the end of February 2020, with an over-all project reported 84.9%, would be 15.1%) times the latest (and probably conservatively low $357.7M), this yields a "to go" cost of $5.4B.

Chart C-3: Cost per Project Percent Complete



This, when added to the reported TPC through February 2020 of $12.53B, yields a $17.93B TPC (i.e., is nearly $1B in excess of the Regulatory Approved $17.1B). Finally, SNC's latest Project Cost Contingency Analysis assumes a much more favorable cumulative CPI through Project completion (which then erroneously supports a need for less cost contingency), thus

further validating that the TPC Estimate at Completion is indeed growing beyond the Regulatory Approved $17.1B.

Q. IN ANALYZING THIS DATA, WHAT DO YOU CONCLUDE?

A. With a properly integrated cost and schedule baseline one would expect the cumulative dollars spent over time (as a percentage of the total TPC) to roughly match (within plus or minus several percentage points) the reported total project percent complete. This would also indicate that there should be a relatively constant (within several +/ - percentage points) dollars per percent complete. Yet for this Project the dollars spent per percent complete credit taken has first increased by 41% (i.e., by ($233.9M /$166M) -1)), and then by an additional 53% (i.e., by ($357.7M/$233.9M) – 1). This analysis by itself brings into question SNC's methods by which it updates the TPC Estimate At Completion, and (when considered in light of VMG's additional cost analyses, which follow) shows that SNC's TPC EACs are consistently and unrealistically low (on the order of $1B in excess of the Regulatory Approved $17.1B).

Q. WHAT CAN YOU TELL US ABOUT THE RISK ANALYSES RELATED TO CONTINGENCY USAGE?

A. For risk analyses to produce meaningful results one must be sure that the inputs to the process are realistic and accurately predict a range of cost and schedule outcomes and their probability of occurrence. As an example, VMG as Independent Monitor on another recently cancelled project, reviewed the extensive and highly documented risk analysis of a critical

portion of a power plant that was attempting to achieve Commercial Operations, and the analyses concluded that there were essentially minimal to no risks. In the final analyses, however, the failure of this portion of the system led to cancelling the project and the company writing off billions of dollars of expenses. Here, the CPIs that are assumed in SNC's latest risk analyses are based on much lower numbers than recent experience would indicate, and this therefore represents an example of unrealistic inputs to SNC's risk analysis process.

Q. ARE YOU SAYING THAT SNC's RISK ANALYSES ARE FLAWED?

A. With regard to specifics, their level of documentation was so immense that it was beyond our capability to review in detail. However, there is a specific summary measure which would lead one to question its validity. More specifically, as a project proceeds towards completion one would expect already realized risks to have been incorporated into the forecast TPC, and the range of potential cost impacts (from low to high) to lessen. However, in reviewing this data since establishment of the April 2019 Schedule Baseline through mid-March 2020 the low end has not varied that much ([redacted]), yet the higher end started off at only $[redacted] in May 2019 and is roughly $[redacted] in the January through March 2020 time period (an increase of nearly $[redacted]). This increase in the upper bound at this late stage of the Project then suggests that certain of the identified risks have already been realized but have not yet been processed by the allocating of contingency funds as an increase to the budgeted TPC. Further, and as acknowledged by SNC, most likely all of the remaining cost contingency will have already been used up by the time U-3 achieves COD thereby leaving no contingency for risks as they will be realized in finishing U-4.

Q. FOR VCM 20/21, VMG PROVIDED A MACRO LEVEL ANALYSIS OF WHAT THE TPC EAC COULD BE BASED ON VARIOUS CPI'S. COULD YOU PLEASE PROVIDE AN UPDATE OF THAT ANALYSIS?

A. Yes, and in the interest of brevity I will not repeat the details of that analysis in this part of my testimony, but rather provide a general overview of the process and then will provide the results of our analyses in Table C-2. Further, the analysis performed for this VCM 22 was very similar (but differed slightly with respect to some details) to what was done in the TPC EAC analysis done for VCM 20/21, so the results of the prior analysis are also included in Table C-2.

The starting point for this VCM 22 analysis consists of both (a) the going forward Project Cost estimates for all items (less construction and contingency)[12], and (b) the going forward Project Cost estimate for Construction (assuming a CPI of 1.0).[13] For this VCM 22 cost estimate, VMG has accepted all cost line items except for Construction and Contingency. For the Construction line item (which is based on an assumed over-all project CPI of 1.0), VMG then multiplied this value by 1.4, and by 1.45,[14] to yield Construction Cost Estimates based on each of these CPIs, respectively. Then, for the contingency line item, VMG took 10% of all remaining costs (less Construction, since the CPIs of 1.4 and 1.45 already reflect inclusion of construction risks). These "going forward" values were then summed for the CPI = 1.4 scenario, and the CPI=1.45 scenario. For each of these scenarios, the prior costs

[12] This is based on the February 2020 Project Management Board Meeting.
[13] That Construction Cost Estimate was provided in the October 2019 Project Management Board Meeting.
[14] These values were based on VMG's forecast range of where the cumulative Project wide CPI will be at completion and is supported by the previous statements within this testimony regarding the increasing ITP work being performed concurrently with construction and the "stacking of crafts".

(inclusive of the Toshiba Warranty Credit) was added to yield a TPC estimate at completion for each of the scenarios. Further, the results of this process, and the equivalent process as it was done in the VCM 20/21 testimony, are presented in Table C-2, below; and, although the details of the VCM 20/21 analysis and the VCM 22 analyses differ slightly, the over-all results are relatively consistent and communicate the same message.

Table C-2: TPC/EAC ($ B's) for Various CPI's

Analysis For:	CPI = 1.25	CPI = 1.35	CPI = 1.40	CPI = 1.45	CPI = 1.50
VCM 20/21	$17.5B	$17.8B			$18.2B
VCM 22			$18.2B	$18.4B	
NOTE: All the above analyses assume COD's of November 2021 (U-3) and November 2022 (U-4), and therefore assume usage of all the currently budgeted $540M "schedule contingency". This is basically the "base case" TPC EAC, from which the cost impacts of the highly likely schedule slippage beyond these COD's can be added to yield a "total integrated cost range analysis" (provided later in Table C-3)					

Q. AND WHAT DOES VMG CONCLUDE FROM THE RESULTS OF THIS ANALYSIS?

A. Given that the final project cumulative CPI will most likely equal or exceed 1.40 (ref: footnote 14), the results of this analysis shows that even if the Regulatory Required CODs were achieved (which VMG believes is highly unlikely), the TPC would still exceed the Regulatory Approved TPC of $17.1B by roughly $1B. And, beyond this, costs above that level would be determined by the degree of schedule slip beyond November 2021/2022.

SUMMARY ANALYSIS

Q. HAVING ANALYZED THE SCHEDULE, AND THE COST, SEPARATELY, CAN YOU NOW PROVIDE AN INTEGRATED SUMMARY OF VMG'S RESULTS OF WHAT THE RANGE OF TPCs COULD BE AT PROJECT COMPLETION BASED ON DIFFERENT ASSUMED CODs?

A. Yes, and that is provided in Table C-3, below.

Table C-3: VMG Forecast Ranges of TPC's and CODs

COD's	Forecast TPC - for each CPI shown below:	
	1.4	1.45
Nov 2021/2022	$18.2B	$18.4B
March 2022/2023	$18.6B	$18.8B
June 2022/2023	$18.9B	$19.1B
Sept 2022/2023	$19.2B	$19.4B
TPC's beyond Nov 2021/2022 derived by adding $100M for each Month of schedule delay		

Q. COULD YOU NOW PROVIDE AN OVER-ALL SUMMARY OF EVERYTHING THAT VMG HAS ANALYZED?

A. Yes, the summary of what VMG has analyzed is provided below.

- SNC's methods of providing updated forecasts of the Project CODs and TPC at Project completion are based on a flawed process of "develop an unachievable plan, fail relatively quickly, and repeat the process to develop a new (and still unachievable) plan." It should not

be relied on to provide meaningful measures of the Project TPC and CODs at completion of the Project.

- VMG's independent means of assessing the TPC and CODs has relied on using raw (unanalyzed) data from both SNC and GPCND, and then trending and analyzing that data to provide a forecast estimate range of both the CODs and TPC at Project completion.
- With respect to the Regulatory Required CODs of November 2021 (U-3) and November 2022 (U-4), it is highly unlikely that they will be achieved; and, with respect to the TPC, even if the regulatory approved November 2021 / 2022 CODs were achieved, VMG forecasts that the TPC would be roughly $1B over the regulatory approved $17.1B.
- SNC's estimate of schedule delay related costs is roughly $100M per month, and the potential impacts of these schedule delay related costs on the forecast TPC at project completion have been provided in Cost Table C-3. Further, this analysis is based on where the Project was heading up to roughly Mid-March 2020 prior to the Project being impacted by the COVID-19 virus.

VMG also points to the fact that SNC has been significantly challenged since taking over the Project in March 2017. However, Southern Company as a whole has been responsible for the Project since its inception and must therefore be held accountable for where it currently stands and the final cost. Further, VMG has been concerned about the extent to which both personnel safety and the safety of the final as-built plant, could potentially be compromised due to SNC's aggressive, highly complex, and unrealistic scheduling practices.[15] In spite of these concerns, however, the personnel safety record (a fundamental requirement for

[15] The basis of this concern can be found in an Institute of Nuclear Power Operations (INPO) Construction Principle that states, "Unrealistic, uncoordinated, or obsolete schedules or insufficient resources can have a negative effect on construction quality and personnel safety, especially when inappropriate actions are taken to accelerate construction or reduce cost."

construction work in the United States) to date has been more than acceptable, and – due largely to its disciplined approach to the conduct of operations -- VMG is reasonably confident that when completed both Vogtle 3 & 4 will meet or exceed the already exceptional safety and operational performance of its six, currently operating nuclear power plants.

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.
Vice President, Engineering; Vogtle Monitoring Group

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
(Expanded Details Available on Request)

- Over 50 years of hands on technical, management and executive experience with all phases of the Fossil and Nuclear Power Plant Life Cycle (design, permitting & licensing, construction, testing, start-up and 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 with an 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. Most experiences were for First of a Kind (FOAK) 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 of 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).
- As President, BCN EcoPower (**B**eyond **C**arbon **N**eutral, **Eco**nomical **Power** Generation) working to further develop and deploy a patent pending Cryogenic Regenerative Power Cycle (CRPC) wherein cycle thermal efficiencies for large and small scale power plants and industrial facilities can be improved to over 80% with harmful emissions (including CO_2) significantly reduced or eliminated.