Constellation

200 Exelon Way
Kennett Square, PA 19348
www.exeloncorp.com

10 CFR 50.82(a)(3)

CCN-24-24

May 13, 2024

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Peach Bottom Atomic Power Station, Unit 1
Facility Operating License No. DPR-12
NRC Docket No. 50-171

Subject: Supplemental Information in Support of Request for Alternative Schedule to Complete Decommissioning Beyond 60 Years of Permanent Cessation of Operations

References:

1. Letter from David P. Helker, Constellation Energy Generation, LLC, to the U.S. Nuclear Regulatory Commission - "Request for Alternative Schedule to Complete Decommissioning Beyond 60 Years of Permanent Cessation of Operations," dated October 20, 2023 (ADAMS) Accession No. ML23293A305

2. Electronic Mail Message to Richard Gropp, Constellation Energy Generation, LLC, from Tanya Hood, U.S. Nuclear Regulatory Commission, "Audit Plan Associated with Peach Bottom, Unit 1 - 10 CFR 50.82(a)(3) Alternate Decommissioning Schedule Request," dated March 28, 2024 (ADAMS) Accession No. ML24088A319

By letter dated October 20, 2023 (Reference 1), Constellation Energy Generation, LLC (CEG) requested an alternative from the decommissioning schedule requirements specified in 10 CFR 50.82(a)(3) to allow the completion of decommissioning for Peach Bottom Atomic Power Station (PBAPS), Unit 1, beyond 60 years of permanent cessation of operations. This request is to allow CEG to complete the decommissioning of PBAPS, Unit 1, in a time frame more suitable with the decommissioning of PBAPS, Units 2 and 3, in order to reduce the overall risk and increase the margin to public health and safety, as further discussed in the attachment to this letter.

In an electronic mail message dated March 28, 2024 (Reference 2), the U.S. Nuclear Regulatory Commission (NRC) notified CEG of their intent to conduct a regulatory audit on April 11, 2024, with CEG staff in support of the Reference 1 licensing action. The electronic mail message included a regulatory audit plan that included requests for information (RFIs) and related audit questions.

This letter provides supplemental information in support of the Reference 1 licensing action. The attachment to this letter provides a response to the audit questions posed by the NRC staff during the April 11, 2024, regulatory audit that occurred at the PBAPS, Unit 1, facility.

There are no regulatory commitments contained in this supplement.

Should you have any questions concerning this submittal, please contact Richard Gropp at 1-267-533-5642.

Respectfully,

David P. Helker
Sr. Manager, Licensing
Constellation Energy Generation, LLC

Attachment: Supplemental Information for Alternative Decommissioning Schedule Request

cc: w/ Attachment
Regional Administrator - NRC Region I
NRC Decommissioning Project Manager, NMSS/DUWP/RDB - Peach Bottom Atomic Power Station, Unit 1
NRC Senior Resident Inspector - Peach Bottom Atomic Power Station, Units 2 and 3
Director, Bureau of Radiation Protection - PA Department of Environmental Protection
S. Seaman - State of Maryland

ATTACHMENT

Supplement to Request Alternative Schedule to Complete Decommissioning Beyond 60 Years of Permanent Cessation of Operations

Peach Bottom Atomic Power Station, Unit 1
Docket Nos. 50-171

Supplemental Information for Alternate Decommissioning Schedule Request

Attachment

Supplemental Information for Alternate Decommissioning Schedule Request

Background

By letter dated October 20, 2023 (ML23293A305), Constellation Energy Generation, LLC (CEG) requested an alternative from the decommissioning schedule requirements specified in 10 CFR 50.82(a)(3) to allow for the completion of decommissioning for Peach Bottom Atomic Power Station, Unit 1 (PBAPS-1), beyond 60 years of permanent cessation of operations.

In an electronic mail message dated March 28, 2024 (ML24088A319), the U.S. Nuclear Regulatory Commission (NRC) notified CEG of their intent to conduct a regulatory audit on April 11, 2024, at the PBAPS-1 facility in support of their continued review of CEG's October 20, 2024, submittal. The purpose of the audit was to obtain further clarification regarding CEG's request and to review requests for information (RFIs) and questions posed by the NRC in support of their continued review of the licensing action.

This submittal supplements the October 20, 2023, letter and provides responses to requests for information (RFIs) related to audit questions identified in the NRC's March 28, 2024, audit plan. The audit questions are reiterated below followed by CEG's responses, and other supporting information necessary to address RFIs is also included.

PBAPS-1 permanently shut down on October 31, 1974. Based on the 10CFR50.82(a)(3) requirement for decommissioning to be complete within 60 years of permanent cessation of operations, PBAPS-1 decommissioning is currently required to be complete and the PBAPS-1 license terminated by October 31, 2034. Completion of decommissioning beyond this date is requested because of the concerns related to the unique considerations/characteristics of the PBAPS-1 reactor type as detailed below (i.e., refer to Question 8 response), and the potential risks associated with operation of PBAPS, Units 2 (PBAPS-2) and 3 (PBAPS-3) if PBAPS-1 is decommissioned while PBAPS-2 and PBAPS-3 are operating (i.e., refer to responses for Questions 01, 02, 05, 06, 07, 08, and 09).

Accordingly, CEG is requesting that decommissioning of PBAPS-1 be completed no later than 20 years following the permanent shutdown of PBAPS-2 and PBAPS-3 as further discussed in response to Question 3 below. The latest year currently projected to complete decommissioning and terminate the license for PBAPS-1 is 2074.

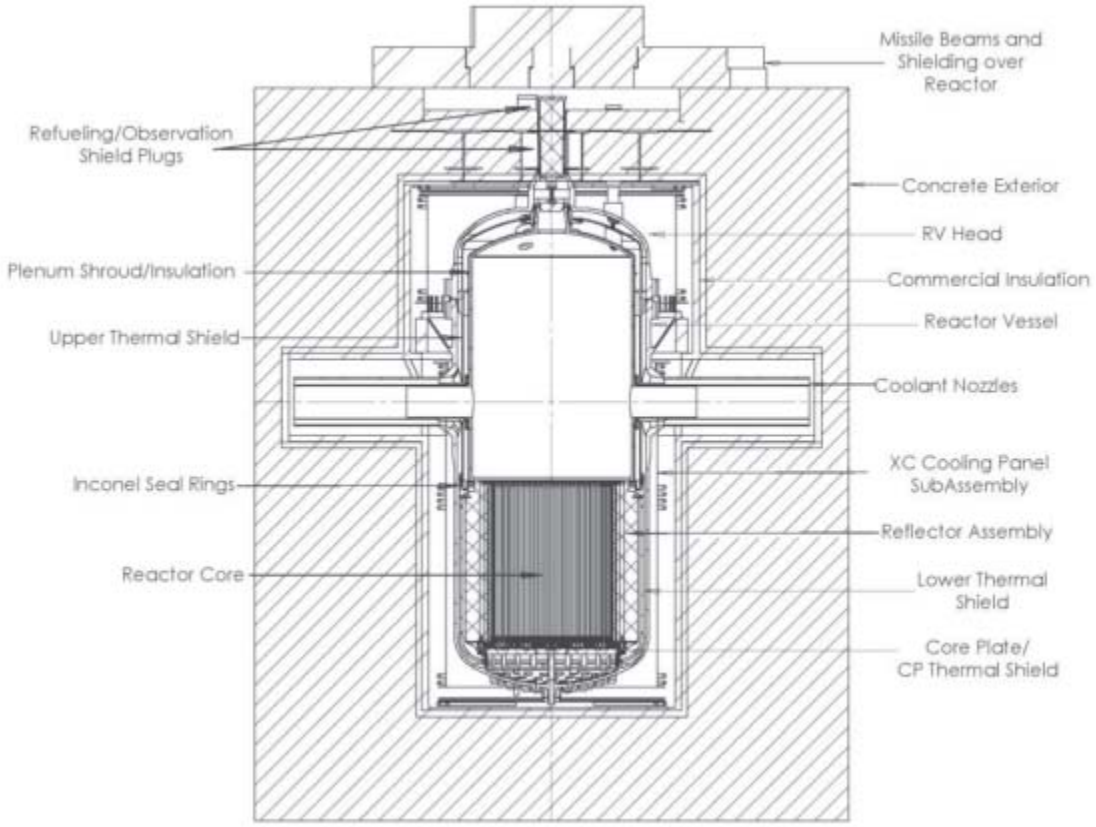
Reactor Design Details

PBAPS-1 was the first prototype installation of a High-Temperature Gas-Cooled Reactor (HTGR) in the United States under the Atomic Energy Commission's Atoms for Peace program and the second HTGR prototype in the world. PBAPS-1 became critical on March 3, 1966 (Core 1). Power operation began in January 1967, began commercial operation on June 1, 1967, and operated through October 31, 1974 (end-of-life, Core 2). PBAPS-1 was 40 MWe and 115 MWt. The NSSS system was helium-cooled, and the core was graphite moderated.

The prototype design of PBAPS-1 differs significantly from the designs used for commercial operation in the United States. As shown in Figures 1 and 3, the reactor consists of the reactor

pressure vessel, both solid and removable graphite reflectors, reflector seals, fuel element stand-off pins, core support plate, thermal shield, and the plenum shroud. The normal and emergency operation control rods and drives insert from under vessel.

Figure 1: PBAPS-1 Major Reactor Components



The reactor used homogeneous solid fuel consisting of uranium 235 and thorium 232 in the form of carbides enclosed in graphite cladding referred to herein as the graphite sleeve. The reactor core (active fuel region) consisted of 804 vertical cylindrical graphite sleeves, each of which contained 30 graphite fuel compacts, and vertically supported the remaining components, as depicted in Figures 2 and 3. There are 342 removable graphite reflector sleeves that surround the active core region, shown in Figure 3. The graphite sleeves are 3.5 inches in diameter and twelve feet long, arranged in a hexagonal array, and are oriented vertically in a closely packed circular pattern within the vessel. The fuel compacts were in essence the fuel elements, which were contained within the graphite sleeve and were removed when the reactor was de-fueled.

Solid graphite reflector blocks surround the vertical graphite reflector sleeves along the full length of the graphite sleeves and are two feet thick. The vessel also contains 55 control rods (normal and emergency operation) that remain fully inserted into the core including 55 control rod guide tubes that project from the bottom of the vessel.

The following graphite components remain in the vessel: active core region graphite sleeves, removable reflector graphite sleeves, permanent graphite reflector blocks, reflector block brackets, control rod guide tubes, and irradiated control rods (normal and emergency operation).

Figure 2: PBAPS-1 Graphite Fuel Sleeve

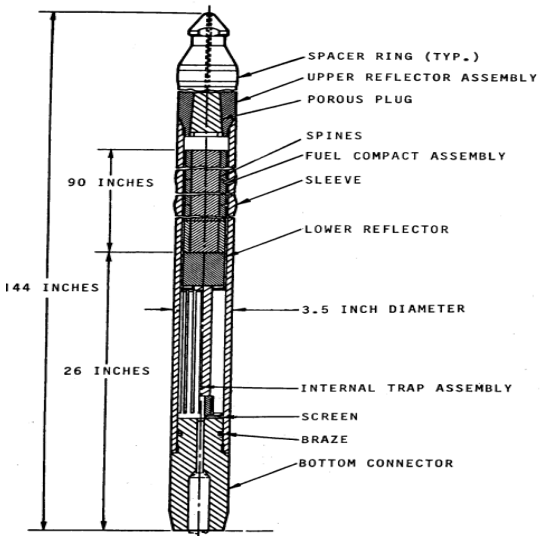
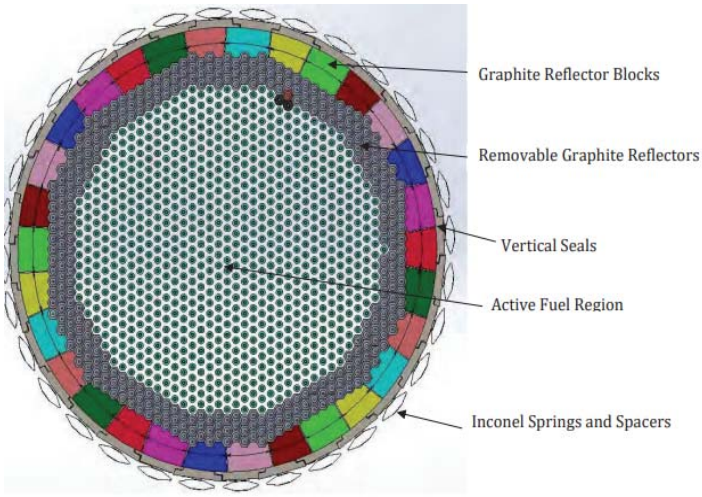


Figure 3: PBAPS-1 Top View of Vessel Internals



Question 01 – Protective Relay

Discuss the following regarding the protective relay scheme housed in Peach Bottom Unit 1 that is credited as offsite sources for Peach Bottom Units 2 and 3.

a. *Protective relay functions and the enclosure (i.e., relay house)*
b. *Costs or effort required to move the Peach Bottom Unit 1 protective relay scheme and the impact to Peach Bottom Units 2 and 3 if the relay scheme has to be moved.*
c. *Discuss the interconnection of the protective relay scheme housed on Peach Bottom Unit 1 and if it is required for GDC 17 and 18 compliance for Peach Bottom Units 2 and 3.*
d. *Provide the applicable North American Electric Reliability Corporation standards that pertain.*
e. *The radiological status of the Peach Bottom Unit 1 facility and the subsurface area(s) that houses the protective relay scheme.*

Question 01 a. - Protective relay functions and the enclosure (i.e., relay house)

a. Protective relay functions and the enclosure (i.e., relay house)

Response

The PBAPS-1 electrical distribution system, as originally designed, has mostly been abandoned during initial decommissioning activities, including all generation-related and reactor-related systems, structures, and components (SSC) or modified to support current functions.

PBAPS-1 was originally equipped with two 2400V load centers, which have both been abandoned, that provided power to two (2) essential (diesel-backed power) 480V load centers, 1-1 and 2-1. When PBAPS-1 was shut down, 480V load centers 1-1 and 2-1 were re-named 10B014 (14 bus) and 10B024 (24 bus). The former feeds from the PBAPS-1 2400V system were replaced with feeds from the Peach Bottom 361 Line and the PBAPS-2 and PBAPS-3 Station Blackout (SBO) Line.

The Peach Bottom 361 Line is supplied by the #4 Step-down (230kV to 33kV) Transformer located in Peach Bottom North Substation/Switch yard. The SBO 34.5 kV Bus #10 (00R010) is supplied by the 191-00 Line which is powered by Conowingo Hydroelectric Generating Station.

The Peach Bottom 361 Line (33kV) is stepped down to 480V via Light and Power (L&P) Pad Mount Transformer #1 (10X014) to supply power to the 480V 10B014 load center 1-1. The SBO 34.5 kV Bus #10 (00R010) is stepped down to 480V via L&P Pad Mount Transformer #9 (10X024) to supply power to the 480V 10B024 Load Center 2-1. The Peach Bottom 361 Line and SBO Line provide power to PBAPS-1 480V Essential and Non-Essential Load Centers.

The former common connection between the PBAPS-1 emergency diesel generator and the two (2) 480V load centers was re-purposed as a tie line between the 1-1 and 2-1 480V load centers which provides power to eight 480V motor control centers (MCCs). PBAPS-1 is equipped with various distribution panels for lighting, receptacles, HVAC and other purposes which are fed from MCCs located throughout various areas in PBAPS-1.

PBAPS-1 is currently equipped with a 125VDC battery, 10D465, which is the former PBAPS-1 station battery. The associated DC distribution panels are 10D001 (DC panel A) and 10D002 (DC panel B). The loads on these two panels include circuit breaker control power and protective relaying. The PBAPS-1 battery is a 58-cell lead-calcium battery. The cells are EnerSys EC-9M. Maintenance and testing of the PBAPS-1 battery is performed in accordance with station procedures and in compliance with North American Reliability Corporation (NERC) standards.

The Technical Support Center (TSC), located in the former PBAPS-1 Control Room, is also equipped with a communication battery (10D040). This battery is used only for the TSC.

The 220-08 Line was originally the grid connection for PBAPS-1 commercial operation. The protective relaying associated with this line was located in a relay room within the PBAPS-1 Turbine Building, near the north end of the building on the 128' elevation. The configuration was an assortment of electromechanical protective relays and a transfer trip system linked to the nearest switchyards on PECO's 220-08 230kV Line.

When PBAPS-1 ceased operation in 1974, the 220-08 Line became an offsite source for PBAPS-2 and PBAPS-3. Some electromechanical protective relays and the transfer trip system were left in place at PBAPS-1, in the same relay room. The transfer trip system was upgraded from an analog system to a digital system in 2010. The remaining 220-08 Line protective functions include transfer trips from remote PECO switchyards, undervoltage protection, zero-sequence overvoltage protection and Containment Building (CB) start-up (SU) 25 breaker failure.

The 220-08 Line protective relaying located at PBAPS-1 includes:

- Four digital transfer trip system modules, linked by fiber optic to similar transfer trip modules in the Cooper and Nottingham substations on the 220-08 line.
- Two auxiliary relays associated with the digital transfer trip system.
- 2-51C-427-2SU, 220-08 Line Undervoltage Relay, GE 12IAV54E1A (electromechanical).
- 2-51C-459-2SU, 220-08 Line Zero-Sequence Overvoltage Relay, GE 12IAV51A1A (electromechanical).
- 2-51C-450-2SU, CB SU25 Breaker Failure Fault Detector, GE NHC (electromechanical).
- 2-51C-462BF-2SU, CB SU25 Breaker Failure Timer, GE RPM (electromechanical).
- 2-51C-86/CBSU25F (breaker failure scheme) lockout relay, GE type HEA.

Separately, a cathodic protection (CP) system is not required for PBAPS-1, as documented in the License Amendment Request and associated approval for License Amendment 7 (dated April 25, 1990). The CP system was left in place after initial decommissioning, but as documented in a letter dated July 12, 1989, the environment surrounding the steel liner is such that CP is not required. This letter, which was included in the Amendment 7 approval letter from the NRC, indicates that if the CP system were to fail, there were no plans to return it to operation. This conclusion was based on the facts that: 1) excavation for the containment was made to clean rock, after which concrete was poured; 2) the underground portion of the steel liner is surrounded by concrete; 3) CP systems are not normally required for this environment and was added to PBAPS-1 as a precaution based on material knowledge at the time; 4) a ground-level moat was installed to minimize water accumulation; 5) soil and water studies showed that the soil present is not aggressively corrosive; 6) Inspections of the containment drain sump will detect any collection of water; and 7) readings are obtained from the CP system during the periodic surveillance.

Question 01 b.

b. Costs or effort required to move the Peach Bottom Unit 1 protective relay scheme and the impact to Peach Bottom Units 2 and 3 if the relay scheme has to be moved.

Response

Decommissioning of PBAPS-1 while PBAPS-2 and PBAPS-3 are operating would require the relocation of the PBAPS 220-08 Line (Qualified Off-Site Source) Protective Relay scheme equipment as a mitigative measure, although not located within a radiologically controlled area, because of the proximity to the radiologically controlled areas and risk to the operating units.

Relocation of the 220-08 Back-Up Relaying equipment would necessitate the temporary removal (de-energization) of the 220-08 Line. The removal of the 220-08 Line would necessitate PBAPS-2 and PBAPS-3 to realign the 4KV Emergency Distribution System to the 3SU Qualified Offsite Source. While the 3SU Qualified Offsite Source is able to supply the required loads for a PBAPS Design Basis Accident (i.e., Design Basis Accident Loss of Coolant Accident (DBA-LOCA)), the 3SU Qualified Offsite Source is not a credited source within the 10 CFR 50, Appendix R, Fire Safe Shutdown Analysis. The 220-08 Line supports the 2SU Qualified Offsite Source, which is the only credited source of AC power in several fire scenarios. An extended outage of the 220-08 Line would impact Appendix R Fire Safe Shutdown requirements and would require a review for additional compensatory measures.

Currently, estimated costs and the full scope of the efforts required to move the PBAPS-1 protective relay scheme, and to determine the impact to PBAPS-2 and PBAPS-3 if the relay scheme had to be moved, have not been developed.

The removal of the 220-08 Line (with subsequent realignment of PBAPS-2 and PBAPS-3 to the 3SU Offsite Source) will result in the following:

- Entry of a Potential Technical Specification Action (PTSA).
- Entry into Technical Specifications 3.8.1, Limiting Conditions for Operation, if a failure of either the 3SU Offsite Source, the 343SU Offsite Source, or a failure of any of the Emergency Diesel Generators (EDGs) occurred.
- Impacts to both the station's work control process (on EDGs and Start-Up Buses – Transformers) and the Grid work control process (on PBAPS North 220 Substation Yard equipment) based on Probabilistic Risk Analysis (PRA) insights, thereby reducing both the station and the grid reliability and flexibility.

Question 01 c.

c. Discuss the interconnection of the protective relay scheme housed on Peach Bottom Unit 1 and if it is required for GDC 17 and 18 compliance for Peach Bottom Units 2 and 3.

Response

PBAPS-1, PBAPS-2, and PBAPS-3 were designed and constructed prior to issuance of the General Design Criteria (GDC) as specified in 10 CFR 50, Appendix A. The units were instead designed and licensed to Atomic Energy Commission (AEC) criteria. General Design Criterion 5 discusses the sharing of structures, systems, and components and is similar to AEC Criterion 4, which is discussed in the PBAPS-2 and PBAPS-3 Updated Final Safety Analysis Report (UFSAR). Appendix F of the UFSAR states, in part, "…Units 2 and 3 are situated adjacent to Unit 1, an HTGR plant. PBAPS-1 is now in a SAFSTOR status that allows it to be safely stored and subsequently decontaminated to levels that permit release of the facility for unrestricted use. There is no direct connection between PBAPS-1 and Units 2 and 3. The office complex of Unit 1 has been converted to a Technical Support Center (TSC) for Units 2 and 3." Criterion 17 of the GDC has no corresponding criteria within the AEC. The topic of offsite electric power is discussed in Chapter 8 of the PBAPS-2 and PBAPS-3 UFSAR. This section states, in part, "Normal auxiliary power for the station is supplied from unit auxiliary power transformers connected to the generator leads. Startup auxiliary power is provided from any of the three offsite sources." Protective relaying for one (1) of the three (3) offsite sources is routed through the non-radiological areas of PBAPS-1. Criterion 18 of the GDC has no corresponding criteria within the AEC; however, the offsite power sources are inspected and tested to meet NERC standards.

Question 01 d.

d. Provide the applicable North American Electric Reliability Corporation standards that pertain.

Response

NERC standards are utilized at PBAPS, including the PBAPS-1 electrical system. The 220-08 Line protective scheme affects the Bulk Electric System (BES) and, therefore, are within the scope of PRC-005-6, "Protection System, Automatic Reclosing, and Sudden Pressure Relaying Maintenance." The applicable 220-08 Protection System components such as the protective relays, communication systems, sensing devices, DC supply and control circuitry are required to meet the maintenance activities required by PRC-005-6. The Peach Bottom Nuclear Plant Interface Requirements (NPIRS) includes the Peach Bottom tap on the Cooper-Nottingham (220-08) 230kV Line supplying the 230/13 kV regulating transformer as one of the three independent sources of offsite power for startup and shutdown of the station. PBAPS is required to inform the applicable Transmission Entities of actual or proposed changes to nuclear plant design (e.g., protective relay setpoints), configuration, operations, limits, or capabilities that may impact the ability of the electric system to meet the NPIRs and satisfy NUC-001-4, "Nuclear Plant Interface Coordination."

Question 01 e.

e. The radiological status of the Peach Bottom Unit 1 facility and the subsurface area(s) that houses the protective relay scheme.

Response

The electrical SSCs important to PBAPS-2 and PBAPS-3, the 220-08 protective relaying equipment and TSC battery, are located in non-radiologically controlled areas of PBAPS-1. However, the locations in the former Turbine Building are immediately adjacent to the radiologically controlled area(s) of the containment building. Refer to responses for Questions 05 and 06 for additional details on concerns related to radiological decommissioning activities and existing adjacent areas.

Question 02 – Security Measures

Peach Bottom Unit 1 is within the Peach Bottom Owner Controlled Area. The Physical Security Plan is inclusive of all three units and the adjacent Independent Spent Fuel Storage Installation (ISFSI). The submittal does not describe which site security measures are associated with, or credited for, the security of Peach Bottom Unit 1.

Describe the security measures for Peach Bottom Unit 1 during the proposed extended period for decommissioning and provide the rationale for why these security measures are adequate for Peach Bottom Unit 1 during safe storage (SAFSTOR) prior to dismantlement. Confirm that the security measures for Peach Bottom Unit 1 during the proposed extended period of decommissioning would not adversely impact the physical protection of Peach Bottom Units 2 and 3 and the associated ISFSI.

Describe whether there would be any impacts to the implementation of physical security for Peach Bottom Units 2 and 3 that could not be reasonably mitigated during the partial or full decommissioning of Peach Bottom Unit 1, if it were to be conducted as scheduled (i.e., without an exemption for an alternative schedule). If so, describe those impacts and why reasonable mitigation wouldn't be possible.

Response

In a letter dated August 1, 2011 (ML103410383), the NRC granted an exemption from the requirements of 10 CFR 50.54(p) and the fixed site physical protection requirements of 10 CFR Part 73, including the requirements of 10 CFR 73.67, for PBAPS-1. This exemption was granted based on factors that will remain unchanged in an extended SAFSTOR condition. As stated in the exemption approval, the purpose of the subject requirements is to prescribe requirements for a facility that possesses and utilizes special nuclear material. With the completion of the transfer of fuel to an offsite facility in 1977, there is no longer any special nuclear material located within PBAPS-1 other than that contained in plant systems as residual contamination. The remaining radioactive material is in a form that does not pose a risk of removal and, therefore, the application of 10 CFR Part 73 requirements to PBAPS-1 is no longer required.

While it is in the SAFSTOR condition, PBAPS-1 is not subject to the requirements of 10 CFR Part 37. The residual radioactive material within Unit 1 is contained in the reactor structure as residual contamination. As stated in NUREG-2155, “Implementation Guidance for 10 CFR 37, 'Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material,’” activation products contained in the reactor structure are not subject to 10 CFR Part 37 as long as these materials remain an integral component of the reactor. Additionally, task time analyses have demonstrated that the size and location of radioactive material are such that additional security measures are not required.

While in an extended SAFSTOR condition, the existing security measures described above will remain in place and are satisfactory for this condition. The basis for the existing security requirements is unchanged because the Unit 1 structure and components with residual radiation will not be altered. Therefore, during extended SAFSTOR, there would be no adverse impact to the physical protection of PBAPS-2 and PBAPS-3 nor the site Independent Spent Fuel Storage Installation (ISFSI).

At the time that dismantlement in pursuit of license termination is anticipated, the site Security Plan will be reviewed and could require additional licensing actions to account for the physical changes to the site, such as the construction of material staging areas and large equipment located in close proximity to the Protected Area boundary. Planning for decommissioning evolutions would require consideration of the site Security Plan protective strategies and development of additional compensatory measures to ensure that effectiveness of the Security Plan is maintained as required by 10 CFR 73. This would likely result in restrictions on material and equipment staging for decommissioning evolutions and may require adjustments to the assumed responses in the site Security Plan. The additional complexity of managing the dismantling activities and their impact on the site Security Plan presents additional risk to the station. Although this risk could be mitigated with additional compensatory measures and licensing actions, the health and safety of the public would be best served if this was accomplished after PBAPS-2 and PBAPS-3 are shut down and overall site risk is minimized.

Question 03 – Decommissioning Measures

Peach Bottom Unit 1 has been monitored and controlled in SAFSTOR in accordance with the Facility Operating License, Technical Specifications as amended, and Decommissioning Plan. Explain how decommissioning the remainder of Peach Bottom Unit 1 would differ from the activities that occurred in the past with respect to safety of Peach Bottom Units 2 and 3 and the licensee’s ability to maintain public health and safety? Include a discussion about why decommissioning of Peach Bottom Unit 1 on schedule creates site-specific conditions that impact Peach Bottom Units 2 and 3 resulting in an increased risk to public health and safety that would not allow the licensee to maintain safety requirements without an alternative schedule necessary to protect public health and safety.

The application requested that the alternative decommissioning schedule for Peach Bottom Unit 1 coincide with the schedule for Peach Bottom Units 2 and 3, whichever is the first to transition to permanent cessation of operations. Clarify the additional period of required surveillance and maintenance that would result from the alternative decommissioning schedule for Peach Bottom Unit 1.

Response

The decommissioning activities performed at PBAPS-1, beyond monitoring and maintenance activities for SAFSTOR, occurred between 1976 and 1978. The focus of the activities during this time was spent fuel removal from the facility and radiological decontamination. Radiologically contaminated equipment was removed primarily from the spent fuel pool and the radwaste areas of the plant. No contaminated building demolition or large component removal occurred. To complete decommissioning of PBAPS-1, several large components, including the reactor vessel and steam generators, must be removed, and disposed of. Additionally, the reactor vessel and reactor vessel internals, including the site-specific graphite components in the core region, must be removed, packaged, and disposed of. Decommissioning activities also must address and remove structural material in the spent fuel pool and radwaste areas of the plant.

Removal of the remaining large components, core components, and structural material while minimizing the spread of radioactive contamination within the plant and to the environment must occur within the spatial constraints/confines imposed by the Training Building (built in the early 1990s) and the ISFSI Heavy Haul Path (poured in the late 1990s), and without impacting the operation of the PBAPS-2 and PBAPS-3 Control Room Simulator and Emergency Planning TSC (in 1990 the PBAPS-1 Administration Building was converted into a PBAPS-2 and PBAPS-3 Training Center). Refer to the response to Question 06 for discussion of the space constraints, the response to Question 07 for concerns related to the ISFSI Heavy Haul Path, and Question 09 for impacts to the Control Room Simulator and TSC.

Additionally, the removal of the remaining large components, core components, and structural material must occur without impacting the SSCs associated with the NERC required protective relay scheme for one of the credited offsite power sources necessary for PBAPS-2 and PBAPS-3 that are housed in the PBAPS-1 facilities (220-08 Line). The 220-08 Line has been a credited offsite power source since PBAPS-2 began commercial operation in 1974. Consequently, it existed when the initial PBAPS-1 decommissioning activities occurred, and protection of this line is not a new decommissioning concern. However, the scope of the activities required to complete PBAPS-1 decommissioning increases the risk of impacting the protective relay scheme for this offsite power source. Refer to the response to Question 01 for concerns related to the protective relay scheme.

PBAPS-1 operated from initial criticality on March 3, 1966, until permanent shut down on October 31, 1974. Operation of PBAPS-1 coincided with construction of PBAPS Units 2 (began operation in July 1974) and 3 (began operation in December 1974). Because PBAPS-2 and PBAPS-3 are North of PBAPS-1, not physically connected to PBAPS-1[1], and PBAPS-2 and PBAPS-3 were primarily accessed from the North via Lay Road, the impact of the construction of PBAPS-2 and PBAPS-3 on PBAPS-1 operation was minimal. However, over the course of operation of PBAPS-2 and PBAPS-3, facilities supporting the operation of the two units have been added adjacent to (Training Building, Simulator, TSC, and ISFSI Heavy Haul Path) and southeast of PBAPS-1 (ISFSI) increasing the interconnectedness of the three units. Thus, PBAPS-1 decommissioning will impact the operation of PBAPS-2 and PBAPS-3 even though these units were constructed without impacting PBAPS-1 operation as detailed in the responses to Questions 01, 02, 05, 06, 07, and 09.

[1] Physically connected as used here refers to adjoining and adjacent structures. SSCs associated with the protective relay scheme for the 220-08 offsite power line were shared between Units 1, 2, and 3 at the time of PBAPS-1 operation and PBAPS-2 and PBAPS-3 construction.

PBAPS-1 permanently shut down on October 31, 1974. Based on the 10 CFR 50.82(a)(3) requirement for decommissioning to be complete within 60 years of permanent cessation of operations, PBAPS-1 decommissioning is currently required to be complete and the PBAPS 1 license terminated by October 31, 2034. Completion of decommissioning beyond this date is requested because of the concerns relative to the considerations/characteristics unique to this HTGR type reactor as detailed in the response to Question 08 and the risks to operation of PBAPS-2 and PBAPS-3 if PBAPS-1 is decommissioned while PBAPS-2 and PBAPS-3 are operating (see responses to Questions 01, 02, 05, 06, 07, and 09).

Once PBAPS-2 and PBAPS-3 are permanently shut down, decommissioning of PBAPS-1 is expected to be completed within 20 years such that license termination criteria can be achieved. This estimate assumes the graphite handling and disposal concerns are resolved through industry initiatives and innovative technological advancements prior to PBAPS-2 and PBAPS-3 shutting down.

PBAPS-2 and PBAPS-3 are located on the same site as PBAPS-1 and were previously authorized to operate until August 2053 and July 2054, respectively, upon issuance of the Subsequent Renewed Facility Operating Licenses (SRFOL) issued on March 5, 2020.

However, the NRC published a final plant-specific supplement, Supplement 10, Second Renewal, to the Generic Environmental Impact Statement (GEIS) in 2020 as part of its environmental review of the PBAPS-2 and PBAPS-3, subsequent license renewal application (NUREG-1437, Supplement 10, Second Renewal, NRC 2020). As a result of external legal challenges to the NRC's review, the Commission subsequently issued Order CLI-22-04 on February 24, 2022, to address its concerns with the National Environmental Policy Act (NEPA) analysis. In CLI-22-04, the Commission held that the License Renewal GEIS (which the NRC previously found to be applicable to subsequent license renewal) did not apply to subsequent license renewal. Therefore, the Commission's Order directed the NRC staff to modify the expiration dates for the SRFOLs for PBAPS-2 and PBAPS-3. As a result, on March 25, 2022, the NRC staff reverted the expiration dates to reflect the end dates associated with the issuance of the Renewed Facility Operating Licenses (RFOLs) of August 8, 2033, and July 2, 2034, respectively, issued on May 7, 2003. The NRC has undertaken an effort to revise its regulations and the license renewal GEIS to address the Commission's concerns by 2024. A draft Final Rule revising Part 51 and the GEIS was presented to the Commission on February 21, 2024 (SECY-24-0017) and CEG understands that a Staff Requirements Memorandum (SRM) approving issuance of the Final Rule and GEIS is imminent. CEG expects that the generic environmental impact discrepancies are expected to be appropriately resolved and the PBAPS-2 and PBAPS-3, expiration dates will be restored well in advance of the beginning of SRFOL period. Therefore, restoring the SRFOLs expiration dates of August 2053 and July 2054 for PBAPS-2 and PBAPS-3, respectively, will result in PBAPS-2 and PBAPS-3 operating past the PBAPS-1 decommissioning period currently required by 10 CFR 50.82(a)(3).

The table below details the range of possible PBAPS-1 license termination dates based on currently known information.

PBAPS 2/3 Shutdown Date (Year)	PBAPS 1 License Termination Date (Year)	Basis
2033/2034 (renewed license expiration)	2054	20 additional years (beyond 2034) for development and resolutions for HTGR concerns
Prior to License Expiration	Last unit to shutdown plus 20 years	20 years after PBAPS-2 and PBAPS-3 permanently shut down
2053/2054 (subsequent license renewal expiration)	2074	20 years after PBAPS-2 and PBAPS-3 permanently shut down after SLR

Based on this table, the latest year currently projected to complete decommissioning and terminate the license for PBAPS-1 is 2074. Consequently, CEG is requesting extension of the PBAPS-1 decommissioning completion and license termination requirement to December 31, 2074.

While CEG has not yet developed the plan to achieve license termination for PBAPS-1, the preliminary decommissioning planning has identified categories of activities necessary to complete the project. The categories of tasks have been grouped into:

- Organization – Identification and development of the project organization structure and staffing. Implementation is likely to include a phased approach commensurate with the work schedule. A project of decommissioning PBAPS-1 may involve contractor support and incorporation into the project organization. The duration for performing these activities is anticipated to be approximately one (1) to four (4) years.

- Planning – Preparation activities to address details necessary to transition from SAFSTOR, through active Decommissioning, and achieve license termination. Evaluations and/or surveys/inspections, for engineering, radiological, and environmental concerns, would be developed to ensure safety and successful project execution. The duration for performing these activities is anticipated to be approximately two (2) to five (5) years.

- Decontamination and Demolition (D&D) Preparations – Implementation of any necessary activities to ensure no adverse impact on PBAPS-2 or PBAPS-3; activities to prepare for D&D to include tooling design and fabrication, material handling solutions, infrastructure, packaging and processing accommodations, and offsite transportation solutions. The duration for performing these activities is anticipated to be approximately two (2) to six (6) years.

- D&D Execution – Removal of radiological source(s) and residual activity to satisfy the license termination requirements. The duration for performing these activities is anticipated to be approximately three (3) to seven (7) years.

- License Termination Resolution – All final restoration activities necessary to satisfy license termination, including Final Status Survey(s) and site remediation, as necessary. The duration for performing these activities is anticipated to be approximately two (2) to five (5) years.

Question 04 – Mitigative Measures

The 1996 Decommissioning Cost Estimate (DCE) assumes that the decommissioning will be conducted concurrent with Peach Bottom Units 2 and 3. In Section 3.2 of the 1996 DCE, the estimate provides a detailed list of activities needed to conduct decommissioning. This list identifies the need for improving roads, building temporary structures for decommissioning, but does not mention any contingencies or mitigative measures needed for decommissioning of Peach Bottom Unit 1 in the presence of Peach Bottom Units 2 and 3. The cost estimate does identify that if the units were not decommissioning concurrently, more resources and time would be needed. Please explain if there are any site-specific factors due to the presence of Peach Bottom Units 2 and or 3 that would prohibit the maintenance of public health and safety.

For SSCs not related to safety, discuss the SSC impact to safe operations of the other nuclear facilities during decommissioning. Share what reasonable mitigative measures may be applied to all or any of the components related to the presence of other nuclear facilities that would result in not needing an alternative schedule for the purpose of maintaining public health and safety.

Response

At the time the 1996 Decommissioning Cost Estimate (DCE) was prepared for PBAPS-1, the PBAPS-2 and PBAPS-3 licenses were slated to expire in 2013 and 2014, respectively. If PBAPS-2 and PBAPS-3 shut down in 2013 and 2014 as originally licensed, there was time to complete concurrent decommissioning of all three units before the 10CFR50.82(a)(3) 60-year license termination requirement based on PBAPS-1 permanent shut down (October 2034) was reached. Additionally, it was unknown in 1996 whether the PBAPS-2 and PBAPS-3 licenses would be renewed. The first license renewal application for the industry was submitted in April of 1998 and was approved in March 2000. The PBAPS-2 and PBAPS-3 license renewal applications were submitted in July 2001 and approved in May 2003. Consequently, the PBAPS-1 1996 DCE only discusses concurrent decommissioning of the three units and does not describe or contemplate contingencies or mitigative measures needed for decommissioning PBAPS-1 while PBAPS-2 and PBAPS-3 continue to operate.

Colocation of PBAPS-1 at the same site as two (2) operating units supports the maintenance of public health and safety in relation to PBAPS-1 because of the consistent availability and presence of human resources and station programs. PBAPS-2 and PBAPS-3 individuals are routinely in the areas adjacent to PBAPS-1, and often in the PBAPS-1 areas exclusive of PBAPS-1 containment. The presence of these individuals supports increased informal monitoring and observations of material condition concerns impacting PBAPS-1 between scheduled inspections. Additionally, personnel from PBAPS-2 and PBAPS-3 qualified to the station programs, as applicable, are used to perform the monitoring and scheduled inspections of PBAPS-1. These individuals are subject matter experts with site-specific knowledge, both site history and site process knowledge. Using the PBAPS-2 and PBAPS-3 individuals and station program guidance enhances the quality of the inspections, monitoring, and effectiveness of the site Corrective Action Program (CAP). The presence of PBAPS-2 and PBAPS-3 reduces the risk to public health and safety of PBAPS-1 remaining in SAFSTOR.

Decommissioning PBAPS-1 on a schedule resulting in license termination by October 2034 increases the risk to maintaining public health and safety due to the site-specific factors discussed in the responses to Questions 01, 02, 05, 06, 07, 08, and 09. In contrast, delaying PBAPS-1 decommissioning on an alternative schedule create no additional risk to public health and safety given the extremely low levels of remaining radioactivity and the integrity of existing structures. Further, PBAPS-1 is located well within the PBAPS-2 and 3 licensed site and Exclusion Area Boundary, thus CEG will continue to maintain complete control over all activities on that property, including access by the public, in accordance with 10 CFR 50.2. Even if PBAPS-1 were to be decommissioned by 2034, the property would remain within the Units 2 and 3 licensed site and Exclusion Area Boundary and CEG would have no intention to divest itself of that property or permit access by members of the public. Therefore, advancing the PBAPS-1 decommissioning by 2034 would likely not improve public health and safety as envisioned by the Part 50 regulations or NRC's general mission under the Atomic Energy Act of 1954. This said, CEG is committed to conducting all decommissioning activities in a manner that shall not adversely impact public health and safety, regardless of schedule. The request recognizes the impacts associated with PBAPS-1 final decommissioning activities as it relates to the overall operations of PBAPS-2 and PBAPS-3, and that decommissioning PBAPS-1 while PBAPS-2 and PBAPS-3 continue to operate will likely result in an increased risk to public health and safety. Implementing the alternate schedule as proposed provides for the risk to public health and safety to be minimized and, therefore, is being pursued in accordance with the guidance in the regulations.

A future Post-Shutdown Decommissioning Activities Report (PSDAR) will be developed for PBAPS-1 which will determine the appropriate mitigative measures based on the anticipated schedule for decommissioning.

Question 05 – Shared Structures, Systems, and Components (SSCs)

Provide an assessment of the connection between physical, functional, and spatial interaction between any operating unit as related to the components identified in the October 20, 2023, request that it asserts merit an alternative schedule.

Provide or reference the document(s) containing the potential risk to health and safety of the public on the operating units due to decommissioning one or more units. Also, provide or reference your assessment of risk from potential decommissioning accidents that could affect the safe-operation of the other nuclear facilities to ensure appropriate treatment of important insights related to operation of the other nuclear facilities present such as the ability to:

- *Control the power*
- *Cool the fuel and*
- *Maintain containment (defense in depth).*

Describe any impacts that decommissioning activities for Peach Bottom Unit 1 following the current decommissioning schedule would have on the structural integrity or intended safety functions of any SSCs important to the safety of Peach Bottom Units 2 and 3. If any structural impacts are identified, discuss whether they could be reasonably prevented or mitigated.

Describe the current structural material condition of and any degradations and/or aging effects on Peach Bottom Unit 1 SSCs that are important to safety. Describe the sources of residual radioactivity including the reactor vessel, reactor coolant system, containment, the spent fuel pool and spent fuel pool building, piping, tanks, and storage containers as applicable and how they would be controlled and contained over the proposed extended period of decommissioning.

Response

A formal risk assessment has not been completed for PBAPS-1 decommissioning and license termination and its impact on PBAPS-2 and PBAPS-3.

Decommissioning PBAPS-1 on a schedule resulting in license termination by October 2034 increases the risk to maintaining public health and safety due to the site-specific factors discussed in the responses to Questions 01, 02, 05, 06, 07, 08, and 09. However, CEG is committed to conducting all decommissioning activities in a manner that shall not prohibit the maintenance of public health and safety, regardless of schedule. The request recognizes the impacts associated with PBAPS-1 final decommissioning activities as it relates to the overall operations of PBAPS-2 and PBAPS-3, and that decommissioning PBAPS-1 while PBAPS-2 and PBAPS-3 continue to operate will likely result in an increased risk to public health and safety. Implementing the alternate schedule as proposed provides for the risk to public health and safety to be minimized and, therefore, is being pursued in accordance with the guidance in the regulations.

SSCs are not shared between PBAPS-1 and PBAPS-2 and PBAPS-3, although some PBAPS-2 and PBAPS-3 SSCs are housed in PBAPS-1 facilities. As stated in the PBAPS-2 and PBAPS-3 UFSAR, Appendix F, Section F.1, Summary Description, in part the following:

> "Units 2 and 3 are situated adjacent to Unit 1, an HTGR plant.
>
> Unit 1 is now in a SAFSTOR status that allows it to be safely stored and subsequently decontaminated to levels that permit release of the facility for unrestricted use. There is no direct connection between Unit 1 and Units 2 and 3. The office complex of Unit 1 has been converted to a Technical Support Center (TSC) for Units 2 and 3…"

From PBAPS-2 and PBAPS-3 UFSAR, Section 1.8.4, which states in part: "…There is no [radiological] interaction between Unit 1 and Units 2 and 3, except Unit 1's liquid waste may be moved [by portable tank] to the radwaste facility between Units 2 and 3 for processing and discharge."

The decommissioning activities would not have an adverse impact on the structural integrity or safety functions of any SSCs important to safety for the operating PBAPS-2 and PBAPS-3. The physical location of PBAPS-1 is outside of the protected area with sufficient geographic separation between the two operating units. There are no PBAPS-1 SSCs that are important to safety.

PBAPS-1 was constructed in a manner that supports extended SAFSTOR and was erected on solid bedrock and lean concrete was placed on top of the bedrock. The steel containment shell was set, and concrete was placed between the liner and the bedrock with the depth in most places being approximately 3-feet. Water stops are located at concrete construction joints above elevation 110'-6" to prevent water intrusion. Concrete was also placed inside the curved liner bottom to create a bottom floor. The drainage sump is located in the interior concrete floor.

As part of the semi-annual inspection that is performed in accordance with PBAPS-1 Technical Specifications, a qualified engineer performs a structural inspection of accessible areas within containment, focused on structure health and potential sources of water intrusion. This inspection has resulted in no indications of significant corrosion, cracks, or structural integrity concerns. The moisture barrier has been identified as showing degradation, which has been mitigated by maintenance activities to control ground water intrusion. The moisture barrier will continue to be monitored by this inspection. The scope of this inspection is sufficient to identify containment liner corrosion and potential sources of water intrusion over an extended period of decommissioning.

The PBAPS-1 licensing documents do not establish a requirement for an Aging Management Program specifically for PBAPS-1 containment; however, the semi-annual inspection performed in accordance with the Technical Specifications is performed in a manner consistent with program inspections performed for PBAPS-2 and PBAPS-3 as required by the Maintenance Rule, including qualified personnel.

PBAPS-1 UFSAR Section 3.11, Inventory of Radioactive Materials Left On-Site, states in part the following as it relates to SSCs remaining with radiological contamination.

> "The only significant Source of radioactive materials left in the Unit-1 facility will be the neutron activation products contained in the reactor vessel. Some fission products left on the internal surfaces of the primary coolant system and some fission product activity in the annulus of the Spent Fuel Pool…."
>
> Although there is residual activity in systems other than the primary coolant system in the containment, the total activity in such systems (once the traps and delay beds are removed) is expected to be less than ten percent of the activity in the primary coolant system."

Current accessible areas for personnel have low radiation levels and are controlled per the station Radiation Protection Program as a Radiologically Controlled Area. Areas, currently accessible or otherwise, that are potentially radiological are evaluated and controlled in accordance with station Radiation Protection processes and procedures as required by the PBAPS-1 Technical Specification.

Question 06 – Limitations

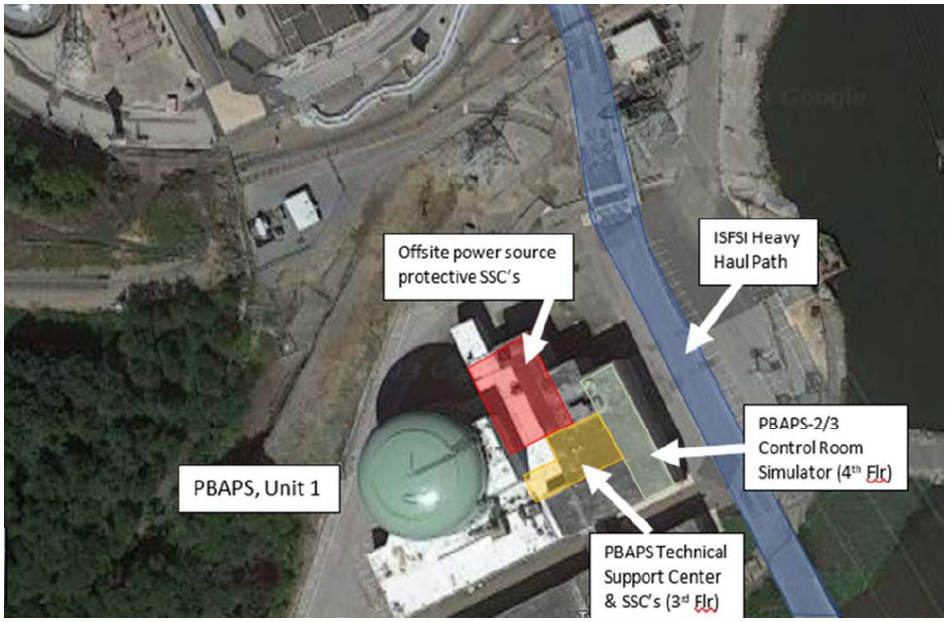
Attachment 1 of the request, states:

> *"Limitations on available physical space due to configuration of the site and functional facilities adjacent to PBAPS [Peach Bottom], Unit 1, increase the risk of performing decommissioning activities. The facilities in the vicinity of PBAPS [Peach Bottom], Unit 1, support operation of PBAPS [Peach Bottom], Units 2 and 3, and therefore there will not be limitations following cessation of operations of the adjacent units on site."*

Please characterize the limitations based on common decommissioning techniques used in industry today or the ones planned to be use and the degree of increased risk from Peach Bottom Unit 1 decommissioning activities. Indicate whether this increased risk of performing decommissioning prohibit the ability to protect public health and safety.

Response

Both existing structures and geographic features surround PBAPS-1 which physically limit decommissioning activities as depicted in the figure below. Physical space is limited by a steep hillside which spans the southwest to north-northeast of the facility, within approximately 25-ft from the Containment Building. The site is of course bounded by the Susquehanna River on the East side. Both the east and south portions of the PBAPS-1 facility are connected to adjacent buildings and structures which support PBAPS-2 and PBAPS-3 operations, emergency response facilities and ISFSI Heavy Haul Path (HHP).



The preliminary plan for decommissioning PBAPS-1 considers utilizing common methods and techniques from the decommissioning industry. The approach is anticipated to include a new suitably sized and located opening in the containment building necessary for dismantlement/disposal of large components, due to limitations (i.e., size/orientation/elevation) associated with original PBAPS-1 containment access pathways. Additionally, it would be expected that adjacent to containment, a confinement structure would be erected outside and immediately adjacent to containment and the new opening to maintain the necessary radiological controls, including monitoring and engineered features for segmentation, packaging, and transportation preparation activities, as applicable. Concerns unique to PBAPS-1 for the handling and disposal of the graphite components from the core of this HTGR type reactor are detailed in response to Question 08.

The radiologically controlled areas of PBAPS-1 include the Containment (reactor) building, Spent Fuel Pool area, and Radwaste area. While the adjacent administrative/training buildings to the east and south are not radiologically controlled or within the scope of decommissioning for license termination, elimination of these interfacing interferences following PBAPS-2 and PBAPS-3 operations would improve the access and ability to perform safe decommissioning of the containment building and internal SSCs. Physical space for an adequate confinement structure and associated engineered controls, including ventilation and radiological monitoring, are critical aspects of performing decommissioning activities related to the graphite components within the reactor vessel of this HTGR.

Decommissioning PBAPS-1 on a schedule resulting in license termination by October 2034 increases the risk to maintaining public health and safety due to the site-specific factors discussed in the responses to Questions 01, 02, 05, 06, 07, 08, and 09. However, CEG is committed to conducting all decommissioning activities in a manner that shall not prohibit the maintenance of public health and safety, regardless of schedule. The request recognizes the impacts associated with PBAPS-1 final decommissioning activities as it relates to the overall operations of PBAPS-2 and PBAPS-3, and that decommissioning PBAPS-1 while PBAPS-2 and PBAPS-3 continue to operate will likely result in an increased risk to public health and safety. Implementing the alternate schedule as proposed provides for the risk to public health and safety to be minimized and, therefore, is being pursued in accordance with the guidance in the regulations.

Question 07 – Heavy Haul Path

The Heavy Haul Path is designed to handle traffic with fully loaded casks.

1. *What type of inadvertent damage to the Heavy Haul Path due to decommissioning is envisioned that could not be reasonably mitigated?*

2. *How often will the heavy haul path be used for Peach Bottom Units 2 and 3 in relation to or concurrent with the proposed Peach Bottom Unit 1 demolition and waste removal decommissioning activities?*

3. *Can decommissioning and fuel transfer campaigns in the portion of the heavy haul path be coordinated or addressed in some other manner so that public health and safety can be maintained? If not, please explain.*

Response

Significant inadvertent damage to the ISFSI HHP due to PBAPS-1 decommissioning activities is not anticipated but is an increased risk during decommissioning during PBAPS-2 and PBAPS-3 power operations. Additional wear and tear of the haul path from PBAPS-1 decommissioning activities would be expected due to space limitations likely requiring crossing over the HHP to access the laydown area.

PBAPS-2 and PBAPS-3 dry cask loading strategy generally plans to load approximately seven (7) casks every other year (odd years are loading years). Each cask takes approximately one week, so the duration of the loading campaign is at least seven (7) consecutive weeks in duration where casks are being transported on the heavy haul path. During this time, combustible material along the travel path is regulated (i.e., no parking in PBAPS-1 parking lot) to ensure compliance with the cask design and licensing bases.

Additionally, TN-68 casks stored at the PBAPS ISFSI contain a helium overpressure system that maintains interseal pressure of at least 3 atm absolute. In the event that a leak causes the pressure to decay, and it cannot be restored, the cask would be required to be returned to the spent fuel unloading facility within 30 days (TN-68 Technical Specifications LCO 3.1.5) and therefore requires the haul path be maintained or capable to be restored within the LCO window in accordance with the current provisions of the cask license.

Decommissioning and fuel transfer campaigns can be coordinated to the extent practical. Crane activities and other abnormal configurations of the PBAPS-1 area would have to be evaluated against the design basis of the cask system. However, during ISFSI loading campaigns, certain decommissioning activities may need to be suspended, which may adversely affect the decommissioning project and the decommissioning trust fund.

Question 08 – Cumulative Damage or Duration

Attachment 1 of the request discusses the cumulative duration of demolition and dismantling activities.

1. *Explain why the cumulative duration of demolition and dismantling activities would be less if all three units were decommissioning together.*

2. *Explain how the factors stated apply to the criterion in 10 CFR 50.82(a) about the need for an extended decommissioning schedule and would be necessary to protect public health and safety.*

3. *Explain how waiting beyond 60 years would provide appreciable safety benefits in dose rate or source term reduction by completing decommissioning past the regulatory timeline. Additionally, the unrestricted release criteria under the current regulations are the same for each individual site, regardless of the timeline. How would site-specific factors prevent meeting public health and safety standards?*

4. *Explain what "intensive demolition and dismantling activities" will be used for the decommissioning of Peach Bottom Unit 1 and whether they are needed due to the unique site-specific factors present. Would there also be significant impacts to the environment due to these intensive activities?*

Responses for 08.1 through 08.4

The cumulative duration of decommissioning all three (3) PBAPS units concurrently would be reduced based on numerous factors, including: 1) mitigative measures due to operating unit(s) onsite are significantly reduced or eliminated; 2) removal of interferences can be performed as needed to perform decommissioning activities without adverse impact on operating units; 3) mobilization and demobilization activities are coordinated for the site; 4) equipment and resource sharing and leveraging supports improved efficiencies in performing tasks; 5) specialized equipment and/or tooling necessary for station decommissioning is shared across the units; 6) waste decontamination, packaging, and transport offsite is coordinated between units and maximized; and 7) optimal transportation methods and routes can be implemented as needed without adverse impact on operating units.

Decommissioning PBAPS-1 on a schedule resulting in license termination by October 2034 increases the risk to maintaining public health and safety due to the site-specific factors discussed in the responses to Questions 01, 02, 05, 06, 07, 08, and 09. However, CEG is committed to conducting all decommissioning activities in a manner that shall not prohibit the maintenance of public health and safety, regardless of schedule. The request recognizes the impacts associated with PBAPS-1 final decommissioning activities as it relates to the overall operations of PBAPS-2 and PBAPS-3, and that decommissioning PBAPS-1 while PBAPS-2 and

PBAPS-3 continue to operate will likely result in an increased risk to public health and safety. Implementing the alternate schedule as proposed provides for the risk to public health and safety to be minimized and, therefore, is being pursued in accordance with the guidance in the regulations.

The impact on ALARA and dose rate and source term reduction is influenced by the unique aspects of the HTGR associated attributes. Decommissioning of PBAPS-1 is complicated by site-specific nuances that are unique to PBAPS-1. These nuances are discussed in more detail below.

1. **Fuel Failures -** The first core (Core 1) of PBAPS-1 experienced severe fuel failure which resulted in fission product poisoning and potential transuranics through the core during the first cycle of operation. The first cycle operated for 450 effective full power days (EFPD) before shutting down to remove the failed fuel and reload the second core (Core 2). Core 2 operated for 900 EFPD before shutting down permanently on October 31, 1974, with no additional indications of failed fuel.

   While the fuel elements themselves were replaced, all other core components contained within the vessel during operation of Cycle 1 remain in the vessel to present day. Current reactor operational practices include core reloads on a recurring frequency that remove fuel components that may retain fission products from fuel failures, but this was not done for PBAPS-1. PBAPS-1 operated 450 EFPDs without failed fuel suppression before shutting down and removing the failed fuel. Modern industry practices would promptly perform suppression procedures to limit the release of fission products. Additionally, current cores do not see the high percentage rate of fuel failure observed during PBAPS-1's first core. Because PBAPS-1 was an experimental test reactor, these abnormal operating conditions were deemed acceptable for testing purposes. However, this operational history combined with early material impurities causes great uncertainty in neutron activation results. Aforementioned fuel failures could also result in potential alpha contamination posing an internal exposure risk.

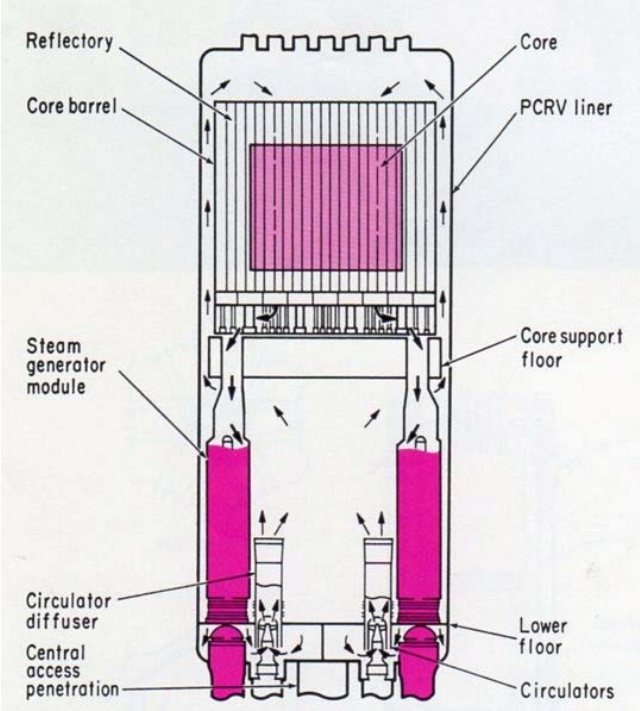
2. **Core Flood-Up Capability** – PBAPS-1 was a gas cooled reactor and as such was not designed with the expectation that the vessel would require flooding with water as a method for decommissioning. It is standard decommissioning practice for reactor vessel internals (RVI) disassembly and segmentation to be performed under water for both dose rate concerns and contamination control.

   The only other graphite HTGR in the United States with which to compare is Fort St. Vrain (FSV) which was the next generation experimental HTGR after PBAPS-1. FSV operated from 1979-1989 and was immediately decommissioned upon shutdown. Based on initial neutron activation analyses performed it was believed a dry decommissioning process would be acceptable. During dismantlement, it was identified that actual radiological conditions were grossly higher than expected values. Because actual radiological conditions were not favorable for a dry demolition the utility was forced to revise all plans and emergently develop a plan to flood the vessel to ensure worker safety. Because FSV was the next generation experimental HTGR design, the reactor vessel and Nuclear Steam Supply System design, and construction were vastly different and improved from PBAPS-1, which ultimately supported the need to flood the vessel for safe decommissioning as shown in Figure 4. PBAPS-1 was not designed to support vessel flooding and requires a unique approach to be developed to accomplish dismantlement.

Additionally, most light water reactors have adjacent fuel pool and equipment pit which can be flooded to allow for dose and contamination control to protect worker safety during decommissioning activities. PBAPS-1 does not have an adjacent fuel pool, or equipment pit, or room within the containment to construct such a structure.

Therefore, the PBAPS-1 HTGR vessel and lack of design to support flooding will complicate the approach to vessel segmentation and will require development of a new approach to reduce radiation protection concerns.

Figure 4: FSV Vessel and Nuclear Steam Supply (NSSS) System



3. **Trace Elements** – To produce an accurate radioactive inventory in PBAPS-1, the composition of materials used within the influence of the neutron flux need to be well understood. Particular attention needs to be paid to the trace elements which could produce significant quantities of long lived, neutron induced radioactivity. As operating experience has shown us, it is those trace elements (i.e., those which were not necessary for the purpose of material properties and hence were uncontrolled at the stage of material production) which dominate the total inventory. Trace elements are a particular concern for PBAPS-1 because the early material manufacturing processes that were in place at the time which differ from the current nuclear grade material requirements. Expansive sampling will be required to ensure vessel material composition is clearly understood to account for trace elements during the neutron activation analysis which is exacerbated due to the vessel design not supporting flooding for dose and contamination control.

4. **Graphite Material Specific Risks/Concerns**. As noted, there is a significant volume of graphite in PBAPS-1 which introduce challenges during the decommissioning process and are discussed in more detail below.

    a. **Graphite Impurities** - Irradiated nuclear graphite represents a challenging issue for decommissioning graphite moderated reactors. The graphite used in the PBAPS-1 reactor was not procured to modern quality standards. Consequently, the grade of graphite used in the PBAPS-1 core is identified as "virgin" graphite in the industry which includes impurities. These impurities introduce uncertainties in the radiological characterization of the graphite implemented in the PBAPS-1 core. The International Atomic Energy Agency (IAEA) has been promoting research in early graphite impurities to obtain accurate radiological characterization of irradiated graphite with the hope of accurately characterizing activity for subsequent dismantling and disposal procedures. Because PBAPS-1 contains early manufactured graphite it is understood that there is a large degree of uncertainty when performing a neutron activation analysis using the assumptions and methods available to date. As noted, with the support of the IAEA, improved methods should become available at a later date to support accurate activation analyses of irradiated graphite.

    b. **Graphite Combustibility** –The safety of the PBAPS-1 graphite was evaluated for SAFSTOR during the initial decommissioning process. As part of the safety considerations, it was noted that the graphite reflector blocks which were left in place are combustible but have an ignition temperature of 1200°F. While this is not a safety concern for SAFSTOR it must be re-evaluated during the decommissioning process and potentially require special processes to ensure the health and safety of workers and the public.

    c. **Graphite Composition** – The PBAPS-1 graphite was considered "virgin" material and the irradiation behavior of graphite is strongly dependent on its virgin microstructure, which is determined by the manufacturing. As previously mentioned, the graphite components in PBAPS-1 were not replaced along with the failed fuel when refueling PBAPS-1 for Core 2 operation. Because the graphite was irradiated through both cycles of operation and the graphite material was "virgin," there is uncertainty as to the physical condition of the graphite components.

    d. **Chlorine 36** – Chlorine is introduced into graphite during the manufacturing process and through reactor operation is activated to chlorine-36. This isotope is long-lived and poorly blocked by geological barriers and is therefore a key radionuclide with respect to post-closure disposal facilities acceptance as well as processes used during graphite removal from the vessel. Irradiated graphite is a unique material from this type of HTGR that presents special challenges during the decommissioning process that will require innovation and specialized processes.

5. **Analytical Methods** – As discussed above, there is significant uncertainty associated with analytical activation analyses because of the unique factors associated with the design, construction, and operation of PBAPS-1. In the case of FSV, the large divergence between the neutron activation results and actual conditions was caused by incorrect assumptions.

   Because PBAPS-1 was a first-generation experimental reactor, the analytical shortfalls associated with FSV have the potential to be applicable to PBAPS-1. Specifically, material composition will require additional sampling and analysis to ensure the true material compositions are understood. These nuances associated with PBAPS-1 introduce more uncertainty into required analytical analyses. Due to the early age of construction and documentation processes, and the fact that PBAPS-1 was an experimental reactor, it is a challenge to ensure the information provided in support of a neutron activation analyses is accurate. With the support of the IAEA research it is believed, at a minimum, that neutron activation methods will improve to support more accurate analyses of the “virgin” graphite contained in PBAPS-1.

6. **Nuclear Decommissioning Trust Fund** – As noted above, FSV was required to revise their decommissioning plan upon discovery of unexpected conditions and implement invasive efforts to ensure a safe and successful decommissioning process. This resulted in large financial impact that was not planned or expected. Furthermore, the uncertainties described above could lead to additional expense during decommissioning. Allowing more time to resolve these uncertainties would result in less risk of increased expenditures. It should be noted that the DCE, on which funding assurance is based, does not include any explicit costs associated with the mitigation actions described elsewhere in this submittal.

7. **European Experience** – As part of the early efforts to develop nuclear power there were two (2) HTGRs built in Europe (Dragon and Arbeitsgemeinschaft Versuchsreaktor GmbH (AVR)) along with PBAPS-1 in the United States. The Dragon and AVR reactors were HTGRs, each with a very different design, but were graphite moderated, like PBAPS-1. The Dragon reactor vessel continues to remain in SAFSTOR until the utility develops new processes and tooling to successfully disassemble the vessel and internals. The AVR reactor site has also begun decommissioning processes surrounding the vessel but because of the challenges related to decommissioning graphite, the vessel was entombed in concrete temporarily and remains onsite until plans are developed for disposal of the reactor vessel and internals.

   As for decommissioning the next generation graphite moderated HTGR in Europe, Électricité de France SA is a French multinational electric utility company owned by the government of France which has multiple HTGRs in SAFSTOR and is currently developing the technology and processes required to safely decommission a graphite moderated HTGR. Électricité de France SA has recognized that decommissioning of their graphite moderated HTGRs will require new technology, tooling, and processes to perform this work in a dry environment, meaning not under water although while still under rad controls. Électricité de France SA has partnered with Veolia, an environmental firm, to create Graphitech a business entity that is responsible for the technological development and engineering studies required in preparation for decommissioning

nuclear reactors that use graphite technology. EPRI Europe plans to capture the results of Électricité de France SA research program as well as Graphitech with the goal of utilizing the results of all the research and development completed to share with the decommissioning industry.

In summary, PBAPS-1 is a one-of-a-kind reactor, a stand-alone design unlike any other in the United States, and the world, that results in site-specific factors that challenge decommissioning and license termination. Specifically, the special characteristics of irradiated graphite which are multi-faceted, the lack of vessel design that would support flooding to provide the standard dose and contamination protective barrier, the original materials and manufacturing methods that introduce unknown trace elements and required updates to analytical methods to support "virgin" graphite analysis all must be addressed to ensure the health and safety of the public is maintained.

These nuances of PBAPS-1 present increased risk for decommissioning activities to achieve license termination. In fact, the most closely related and only other graphite moderated HTGR in the United States, FSV, encountered radiological conditions beyond what was predicted despite following all the normal decommissioning processes and was forced emergently to re-design the plan and ultimately flood up the reactor vessel. The PBAPS-1 vessel was not designed to support flooding the cavity. The only other two experimental reactors built along with PBAPS-1 are either temporarily entombed or continue in SAFSTOR operation as their owners in Europe work to find a suitable process to manage dry decommissioning for their graphite moderated HTGRs.

Europe's desire to start decommissioning their graphite moderated HTGRs has initiated research, currently in progress, focused on a dry decommissioning process using new materials, newly developed robot technology and procedures. CEG will continue to gain insights and operating experience from EPRI Europe and ultimately utilize the processes that are currently under development to complete a safe and successful decommissioning and license termination for PBAPS-1.

The use of industry standard decommissioning techniques is anticipated, except as required to address the concerns unique to PBAPS-1 for the handling and disposal of the graphite components from the core of this HTGR type reactor. Refer to Question 06 for details related to the decommissioning approach and methods.

CEG anticipates that all PBAPS-1 decommissioning activities will remain within current environmental impact evaluations and statements. CEG is committed to protection of the environment and would maintain and/or implement the necessary environmental controls for decommissioning activities to ensure there are no significant environmental impacts as a result of decommissioning PBAPS-1.

Question 09 – Radiological Status of Buildings

Attachment 1 of the request discusses the cumulative duration of demolition and dismantling activities. Does the location (building or subsurface) of the Emergency Operation Center (EOC), TSC, and Peach Bottom Units 2 and 3 Control Room Simulator need to be decommissioned because of the radiological status? If they do not need to be decommissioning, then how would their presence impact decommissioning on the current decommissioning schedule or an

alternative decommissioning schedule. Explain how would decommissioning surrounding them prohibit maintaining public health and safety?

Explain how decommissioning of Peach Bottom Unit 1 would cause major disruptions to the EOC, TSC, and Peach Bottom Units 2 and 3 Control Room Simulator which are located at Peach Bottom Unit 1. Explain the types of major disruptions and if they could be avoided. Would these disruptions prohibit maintaining public health and safety because mitigative measures would be unreasonable?

Response

The PBAPS Technical Support Center (TSC) and Control Room Simulator support regulatory required functions for the site for Emergency Planning and Operations Training, respectively. They are located in the former PBAPS-1 turbine and administration building which are not radiological areas of PBAPS-1, but the building which houses these facilities is physically attached to the containment structure which is a radiologically controlled area boundary. The ventilation equipment for the TSC is designed to ensure that personnel occupying the TSC during an accident will receive an exposure less than the 10 CFR 50.67 limit and is primarily located immediately adjacent to the PBAPS-1 containment structure. Decommissioning activities such as removing the graphite components located within the reactor vessel or dismantling of the containment structure could compromise this ventilation system. PBAPS does not currently have an approved alternate TSC facility that could be used to maintain compliance with NRC EP requirements, if the current TSC were compromised due to decommissioning activities.

Training of plant personnel, which includes plant operators and other plant personnel (e.g., engineering, maintenance, radiation protection, etc.), is required pursuant to the requirements and guidance specified 10 CFR 55, “Operators’ Licenses,” ANSI/ANS-3.1-2014, “Selection, Qualification, and Training of Personnel for Nuclear Power Plants,” Regulatory Guide (RG) 1.8, “Qualification and Training of Personnel for Nuclear Power Plants.” Additionally, training for station personnel is performed in laboratories within PBAPS-1 adjacent to the containment structure, as well as the Training facility located adjacent to PBAPS-1. Integral to protecting public health and safety is the training program excellence, which is key to maintaining staff qualification, proficiency and continuous improvement. Training conducted in the control room simulator which is governed under the provisions of 10 CFR 55.46, “Simulation facilities,” and technical labs which utilize former PBAPS-1 equipment cannot be relocated without unreasonable impact and mitigative measures.

As detailed in Question 06, concerns with radiological decommissioning of PBAPS-1 include the space limitations for activities to be performed. PBAPS-1 is surrounded on all sides by natural and man-made obstacles, leaving very little room for equipment staging, crane operations, and laydown areas. Anticipated major disruptions to TSC and simulator functions include power outages, heavy lifts above or adjacent to the buildings, disruptive noise, and impacts to the TSC ventilation filtration. Interruptions to the TSC ventilation are reportable and a loss of function for the TSC would adversely impact the station’s Emergency Plan response.

The alternate schedule for PBAPS-1 radiological decommissioning would eliminate the adverse impacts associated with the emergency planning and training programs/facilities that are needed to support the continued operation of PBAPS-2 and PBAPS-3 since these facilities are

currently at PBAPS-1. Additionally, when training and emergency planning functions are eliminated, the PBAPS-1 buildings used for these purposes can be dismantled to provide better access to the PBAPS-1 containment structure.

Question 10 – Decommissioning Conducted

Attachment 1 of the request states that Peach Bottom Unit 1 facilities have been integrated into the support infrastructure and are actively utilized by Peach Bottom Units 2 and 3. Please clarify what decommissioning activities would be conducted, if the proposed amendment to allow Peach Bottom Unit 1 decommissioning were approved, and their duration if an exemption from 10 CFR 50.82(a)(3) to completion of decommissioning within 60 years were granted.

Response

The PBAPS-1 License Amendment Request dated September 22, 2023 (ML23265A150), to modify the Technical Specifications and follow the PSDAR process as governed by 10 CFR 50.82, “Termination of license,” and the guidance stipulated in Regulatory Guide 1.185, "Standard Format and Content for Post-Shutdown Decommissioning Activities Report," is separate from the alternate decommissioning schedule request. The PSDAR process and guidance as described in the regulations will ensure activities performed during current and extended SAFSTOR maintain compliance with the regulations.

Since PBAPS-1 currently has a Decommissioning Plan/PSDAR from 1978, an updated PSDAR will be developed and utilized as the process to describe and control the associated decommissioning strategy. An extended SAFSTOR condition would be managed consistently with the current SAFSTOR structure and requirements. Activities related to or in support of future decommissioning planning, e.g., characterization surveys, data collection, etc., would be evaluated against the updated PSDAR, once submitted, and conducted only within the provisions of the plan and regulations.

Question 11 – Hazards Assessment

In the 2022 Peach Bottom Unit 1 Decommissioning Status Report, dated March 23, 2023 (ML23090A048) it was reported that:

> *“The inspection of the upper portion of the moisture barrier between the containment shell and the concrete foundation was identified as degraded in December, 2022. At the time of the most recent inspection, the ring trench was dry as past ground water intrusion mitigation efforts have resulted in limited amounts of water from entering containment. Repair of this barrier has been proactively scheduled for 2023 to be completed to ensure the prevention of water intrusion into the Unit 1 containment.*
>
> *All remaining structural inspections performed in accessible areas showed no indication of significant corrosion, cracks, or structural integrity concerns. The water intrusion has remained at a low level.”*

Provide a hazards assessment of the containment structure that is inclusive of the proposed extended decommissioning schedule to ensure that the radioactive material would remain contained and that underground contamination through the groundwater pathway remain contained.

Also, identify whether there would be significant construction hazards during demolition of the radiologically contaminated buildings that require decommissioning due to the physical presence of other nuclear facilities that could not be reasonably mitigated.

Response

A hazards assessment is not currently required, and no new radiological hazards have been introduced since the construction of PBAPS-2 and PBAPS-3. The numerous physical barriers associated with the PBAPS-1 containment structure(s) surrounding the residual radioactive material remain structurally sound and adequately sealed to protect the health and safety of the public. The PBAPS-1 containment structure remains enclosed and has not experienced any structural integrity issues during the past 50 years (1973-2024), during operations, decommissioning, or SAFSTOR plant conditions.

As required by the Technical Specification Section 2.3.b.4, the PBAPS-1 containment building sump water collection is monitored on a semi-annual frequency. Any identified water collection is sampled and evaluated in accordance with the site Radiological Protection program. Collection of water intrusion volumes has not challenged the Technical Specification Section 2.1.b.9 limits and has significantly improved following implementation of ground water intrusion improvements, identified by the monitoring program and driven by the CAP.

Refer to Question 08 for additional discussion regarding radiological decommissioning hazards associated with PBAPS-1 demolition.

Question 12 – Environmental

The NRC staff will prepare an environmental assessment (EA) pursuant to 10 CFR 51.21 and 51.30. To support a complete description in the EA of the proposed action, provide a written description of activities that would be conducted under the proposed action, such as maintenance, monitoring, and any planned physical changes (e.g., to structures or other features) related to Peach Bottom Unit 1. Include a timeline for the activities from the present to the proposed decommissioning completion date.

Provide a written description of the no action alternative along with a timeline. This includes activities to be conducted if the NRC denies the request for an alternative schedule, including (but not limited to) license termination plan submittal, infrastructure changes (e.g., new roads or structures) to accommodate decommissioning, any intensive decommissioning and demolition techniques, radioactive waste generation and disposal (estimate of rates and quantities), and plans for consultation with the State Historic Preservation Office regarding historic properties.

Several factors may change for residual radioactivity in the groundwater system beyond 60 years, including changes to the groundwater system from changes in climatic conditions since the latest license renewal, cessation of pumping, or from partial decommissioning activities that alter surficial characteristics. These changes may lead to changes in flow direction and

magnitude that may lead to new or additional mobilization or acceleration of migration of radionuclides offsite. These potential changes may be offset by reductions in groundwater contamination due to radionuclide decay and additional dilution associated with groundwater flushing and dispersion. How does climate change impact erosion and containment of the radioactivity at Peach Bottom Unit 1 over the proposed alternative decommissioning schedule? Describe any effects of potential changes to the groundwater system beyond 60 years and whether those changes may lead to increased magnitude and spreading of groundwater residual radioactivity.

Response

With approval of the alternate decommissioning schedule, Constellation intends to continue to maintain PBAPS-1 in SAFSTOR in accordance with the Technical Specifications, including monitoring activities and frequencies (e.g., radiological surveys, monitoring wells, groundwater in-leakage, facility conditions). No planned physical facility changes are currently planned for the extended SAFSTOR condition.

The current decommissioning plans for PBAPS-1 do not include any activities or actions that would have impact on features of historical significance that merit consultation with SHPO. Future evaluation of decommissioning activities will include consideration of SHPO to ensure all appropriate preservation considerations are factored into decommissioning planning.

Refer to Question 03 for details related to PBAPS-1 decommissioning activities and associated timeline(s).

PBAPS is controlled by a site-wide Radiological Groundwater Protection Program (RGPP) that encompasses the area surrounding PBAPS-1. This program meets the objectives of the voluntary Groundwater Protection Initiative as set forth in NEI 07-07, “Industry Groundwater Protection Initiative – Final Guidance Document,” which also meets recommendations from our insurers (American Nuclear Insures (ANI)).

Four wells located near PBAPS-1, and distributed around the perimeter of the containment, are sampled quarterly. A fifth idle well can be utilized to diagnose any issues that may arise. This program will be continued through an extended SAFSTOR period.

Additionally, the PBAPS facility predominantly uses surface water so there is little groundwater use at the station. Due to the low volume, there are no measures of groundwater withdrawals. The alternative decommissioning schedule for PBAPS-1, to include extended SAFSTOR, is not anticipated to have any impact on the groundwater system. There have been no inadvertent reportable releases of radiological or non-radiological materials from PBAPS-1 that impacted soil or groundwater since 1976. The station’s RGPP governs and includes the Annual Radiological Environmental Operating Reports (AREORs) which provide the documentation of groundwater monitoring. The AREORs are submitted to the NRC at the required frequency, which will continue through extended SAFSTOR.

Question 13 – Structural

Describe any maintenance, surveillance, inspection, or aging management performed to ensure the structural integrity are maintained for Peach Bottom Unit 1. Justify their adequacy to minimize the introduction of residual radioactivity into the site if the decommissioning schedule were extended. In particular, discuss the visual inspections of SSCs described in section 6.4.g of the updated final safety analysis report including the frequency, acceptance criteria, any findings of significance, and how findings are addressed.

Response

PBAPS-1 inspections are performed semi-annually as required by Technical Specifications Section 2.3.b. The governing inspection procedure provides the written guidance and acceptance criteria for the inspections. Inspection includes visual inspection of the containment structure and spent fuel pool building for damage, corrosion, structural degradation or any abnormal conditions. This surveillance is designed to ensure that issues are identified and entered into the CAP.

10 CFR 54.21(a)(1)(i) requires an aging management review of containment structures for plants requesting renewal of operating licenses. Since PBAPS-1 does not maintain a renewed license and is SAFSTOR with all fuel removed and shipped off site, the requirements of 10 CFR 54.21(a)(1)(i) would not apply. As a result, there is no requirement to establish an Aging Management Program specifically for PBAPS-1 containment; however, the semi-annual inspection is performed in a manner similar to the inspections performed for PBAPS-2 and PBAPS-3 as required by Maintenance Rule, by the same personnel. The inspection is performed by an engineer with the Constellation Structures Monitoring qualification and the General Structural Activities qualification.

The SAFSTOR monitoring program and inspections, along with the CAP, have effectively managed and implemented groundwater intrusion mitigation projects and containment coating applications over the lifespan of the PBAPS-1 facility. The current conditions of the PBAPS-1 containment structure and radiological areas are appropriately monitored and maintained to ensure the SAFSTOR condition meets all design and licensing bases. Therefore, it can be concluded that the existing SAFSTOR controls are appropriate and adequate for PBAPS-1 and no new hazards are anticipated that would prevent the site from protecting the health and safety of the public from a radioactive release for the extended SAFSTOR period associated with the alternate decommissioning schedule.

As detailed in the PBAPS-1 UFSAR, Section 4.2.3, which states in part: "…The containment vessel is a 100 foot diameter thin shell steel cylindrical structure. The shell near grade elevation is 15/32 inch thick and is reinforced by stiffening rings at elevations 115'-6", 130'-6" and 143'-9". A stress analysis was made of the ability of the containment vessel above grade level to withstand an extended flood loading without buckling and it was concluded that the vessel could satisfactorily withstand flood elevations to 122.8 ft."

Additionally, the containment building is equipped with a lightning rod, approximately 32 feet tall, located at the top center of the steel containment shell. The PBAPS-1 containment building is an all-steel building which is securely connected to the PBAPS-1 ground grid. PBAPS-1 is equipped with a grounding system which is connected to the ground grid common to PBAPS-2 and PBAPS-3.