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**Project Number:** 2009-35

## SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT

# **SEQUOYAH NUCLEAR PLANT UNIT 2 STEAM GENERATOR REPLACEMENTS**

**Hamilton County, Tennessee**

**PREPARED BY:**  
TENNESSEE VALLEY AUTHORITY

MAY 2011

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## SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT

### SEQUOYAH NUCLEAR PLANT UNIT 2 STEAM GENERATOR REPLACEMENTS HAMILTON COUNTY, TENNESSEE

TENNESSEE VALLEY AUTHORITY

MAY 2011

#### **The Proposed Action and Need**

The Tennessee Valley Authority (TVA) plans to replace the four Unit 2 steam generators at the Sequoyah Nuclear Plant (SQN) during an outage scheduled for October 2012. Steam generators are large, upright cylindrical pieces of equipment that use heat from the nuclear reactor to produce a continuous supply of steam. This steam is then used to propel turbines, which spin the generators to produce electric power. The Unit 2 steam generators have been in operation since 1982, and their performance has degraded over time. Replacement of the four Unit 2 steam generators would improve the long-term efficiency and reliability of Unit 2.

#### **Background**

TVA prepared an environmental assessment (EA) entitled *Sequoyah Nuclear Plant Unit 2 Steam Generator Replacements, Hamilton County, Tennessee* (TVA 2009) in November 2009. That EA documented the potential effects of implementing the proposed action on various environmental resources, including potential effects to floodplain functions and values.

The Nuclear Regulatory Commission regulation General Design Criterion 2 (GDC-2), i.e., “Design Basis for Protection Against Natural Phenomena” of Appendix A (General Design Criteria for Nuclear Power Plants) to 10 CFR part 50, requires that nuclear facilities in the United States be designed to ensure safe operation under the most severe of the natural phenomena that have been historically reported for the site and surrounding area. Such phenomena include the probable maximum flood<sup>1</sup> (PMF) or floods following the probable maximum precipitation<sup>2</sup> (PMP) event.

Potential effects from a PMF on the Tennessee River or an on-site PMP event were not documented in the 2009 environmental review because the final locations of ancillary structures and facilities were not known at that time. TVA prepared this supplemental EA to address PMF and PMP concerns associated with the placement of ancillary structures and facilities during the proposed steam generator replacements project. Potential effects to all other relevant environmental resources associated with the steam generator replacements project were documented in the 2009 EA.

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<sup>1</sup> The probable maximum flood is defined as the most severe flood that can reasonably be predicted to occur at a site as a result of extreme weather conditions. It assumes an occurrence of probable maximum precipitation critically centered on the watershed and a sequence of related meteorologic and hydrologic factors typical of extreme storms.

<sup>2</sup> The probable maximum precipitation is defined as the theoretically greatest depth of precipitation for a given duration that is physically possible over a particular drainage area at a certain time of year. Because of the limited knowledge of the complicated processes and interrelationships in storms, PMP values are identified as estimates.

## **Alternatives**

Two alternatives were considered in the 2009 EA. These were Alternative A (the No Action Alternative) and Alternative B (the Action Alternative, i.e., install four new Unit 2 steam generators). Under the No Action Alternative, TVA would not replace the four Unit 2 steam generators. Because the performance of the existing steam generators will continue to degrade over time, a gradual derating<sup>3</sup> of Unit 2, which would lead to reduced power generation, is likely. Likewise, expensive repairs to replace components of the steam generators could be required to forestall derating Unit 2. Over the long term, Unit 2 could be shut down if repairs prove ineffective or if such repairs become economically infeasible.

Under Alternative B, the Action Alternative, TVA would replace the four Unit 2 steam generators during a scheduled outage in 2012. These replacements would allow Unit 2 to function at full capacity and provide a reliable supply of electric power. As part of the Action Alternative, various temporary ancillary buildings and structures would be erected or placed on site to support the steam generator replacements project. The various actions proposed under the Action Alternative are described in the 2009 EA.

## **Affected Environment and Evaluation of Impacts**

### Site Description

SQN is located on the shoreline of Chickamauga Reservoir approximately 18 miles northeast of downtown Chattanooga, Tennessee, between Tennessee River Mile (TRM) 483 and TRM 485. The normal operating elevation of Chickamauga Reservoir at Chickamauga Dam ranges from 675.0 feet in the winter to 682.5 feet in the summer. The 100-year flood elevation at TRM 483 is 686.8 feet mean sea level (msl), while the 500-year flood elevation is 688.3 feet msl. The flood risk profile<sup>4</sup> elevation at SQN is 689 feet msl. Based on the 2009 flood analysis reverification, the flood elevation associated with the PMF on the Tennessee River at the SQN site with the current lock configuration at Chickamauga Dam would be 722 feet msl. In addition to the PMF, SQN could be subject to flooding from the on-site PMP. PMP flood elevations within the SQN protected area<sup>5</sup> vary due to drainage patterns caused by the presence of permanent structures and other obstructions to the flow.

### Impacts Evaluated

All ancillary structures and facilities associated with the project would be located within the Tennessee River PMF inundation area, and some of these structures could possibly be damaged by the PMF. However, flooding of these structures and facilities during the PMF would not jeopardize the operation of SQN and would not result in a shutdown of the plant. Thus, the steam generator replacements project would satisfy the conditions of GDC-2 with respect to the PMF.

An analysis of potential restrictions and obstructions of on-site overland flow and drainage patterns from the PMP event was also conducted. This analysis included the following four major areas at SQN:

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<sup>3</sup> Derating is the deliberate reduction of the power output of the generating unit below its designed capacity.

<sup>4</sup> The flood risk profile is the elevation of the 500-year flood that has been adjusted for surcharge at the dam. Surcharge is the ability to raise the water level behind the dam above the top-of-gates elevation (when in closed position) without causing damage to the dam.

<sup>5</sup> The protected area is the secure portion of the plant site containing the nuclear reactors and associated power generation equipment.

- The area on the eastern side of SQN, outside of the SQN protected area, where the replacement steam generators are being stored temporarily.
- The area of the SQN site within the protected area around Unit 2 and in the vicinity of the existing Multipurpose Building. This area was identified as Area 2 in Calculation SCG1S503 (TVA 2011). Temporary structures would be located in this area.
- The area east of the Turbine Building and the Service Building in the vicinity of the Field Services Building and the ISFSI (Independent Spent Fuel Storage Installation) Pad (i.e., Area 1 as identified in Calculation SCG1S503). This area would provide the location for laydown areas and support structures.
- The area south of the Turbine Building adjacent to the Unit 2 Reactor Building (Area 1 as identified in Calculation SCG1S503). This area would provide the location for the crane and laydown areas.

Detailed topographic analysis indicated that the new (i.e., the replacement) steam generators are currently stored in an area at approximate elevation 700 feet. This area is outside the 100-year floodplain (i.e., 687.0 feet at TRM 485) and above the flood risk profile elevation (689 feet). The replacement steam generator storage pads are located outside the PMP site drainage. These actions are consistent with the requirements of Executive Order 11988 (Floodplain Management). Thus, potential effects to floodplains relative to offloading the replacement steam generators from barges and the temporary storage of these new steam generators as described in the 2009 EA were addressed adequately in that document.

The project area is situated outside the 100-year floodplain and above the flood risk profile elevation. Thus, the proposed actions associated with the steam generator replacements project in this area would comply with the requirements of Executive Order 11988. A PMP drainage analysis of locations within the protected area indicated that the placement of temporary structures as indicated in a preliminary site plan could affect site drainage following the PMP event. Consequently, a revised site plan (Attachment A) for the placement of temporary facilities and structures was developed. Analysis indicated that location of ancillary temporary structures within the SQN protected area during the steam generator replacements project according to the revised site plan (Attachment A), in conjunction with the implementation of the mitigation measures listed below, would ensure that potential adverse effects to on-site drainage following the PMP event would be avoided or minimized.

Lighting under elevated temporary structures for security purposes would not affect flood flow or drainage. Similarly, security cabling under structures would not affect flood flow or drainage.

### **Cumulative Impacts**

Activities associated with the replacement of the steam generators are confined to the SQN plant site. Minimal, if any, cumulative impacts to drainage patterns or capacity or to other environmental resources are expected under either alternative.

## **Mitigation Measures**

No specific nonroutine environmental commitments or mitigation measures were identified in the 2009 EA to reduce the potential for adverse environmental effects. However, the routine measures such as implementation of construction best management practices stated in the 2009 EA remain valid. To ensure unobstructed drainage of floodwaters from areas subject to the PMP, TVA would implement the following nonroutine measures during the Unit 2 steam generator replacements project.

1. All temporary facilities or structures to be located in an area subject to the PMP drainage would be located on piers to prevent obstructing flood drainage. These structures would be elevated at least 18 inches above the existing ground level.
2. Any solid skirting placed on temporary structures or facilities to be located in an area subject to the PMP drainage would be placed such that the bottom of the skirting is at least 18 inches above the existing ground level. Lattice or open mesh wire fence-type skirting installed for security purposes may extend to the ground elevation.
3. Buried utility crossings of roads (e.g., for cables, water lines, etc.) associated with the steam generator replacements project would be installed such that the elevation of the crossing is no higher than the existing road surface.
4. All sidewalks associated with temporary facilities or structures and located on existing ground below elevation 706 feet msl would be constructed so that the top of the sidewalk is no higher than the existing ground level.
5. All spoil material would be placed outside the PMP site drainage areas.
6. At the completion of the Unit 2 steam generator replacements project, all temporary structures and facilities associated with the project would be removed, and the sites where these structures and facilities were located would be returned to preproject conditions.
7. Modifications to the placement of temporary structures or ancillary facilities as shown in Attachment A are permissible, provided TVA River Operations staff has reviewed the proposed modifications and determined that such changes would not adversely affect site drainage following the PMP event.

## **TVA Preparers**

The following individuals assisted in the preparation of this supplement:

- Karen Tidwell Ford, P.E.  
PMP and PMF Analysis
- Roger A. Milstead, P.E.  
Floodplain Analysis
- James F. Williamson Jr., PhD.  
Document Preparation

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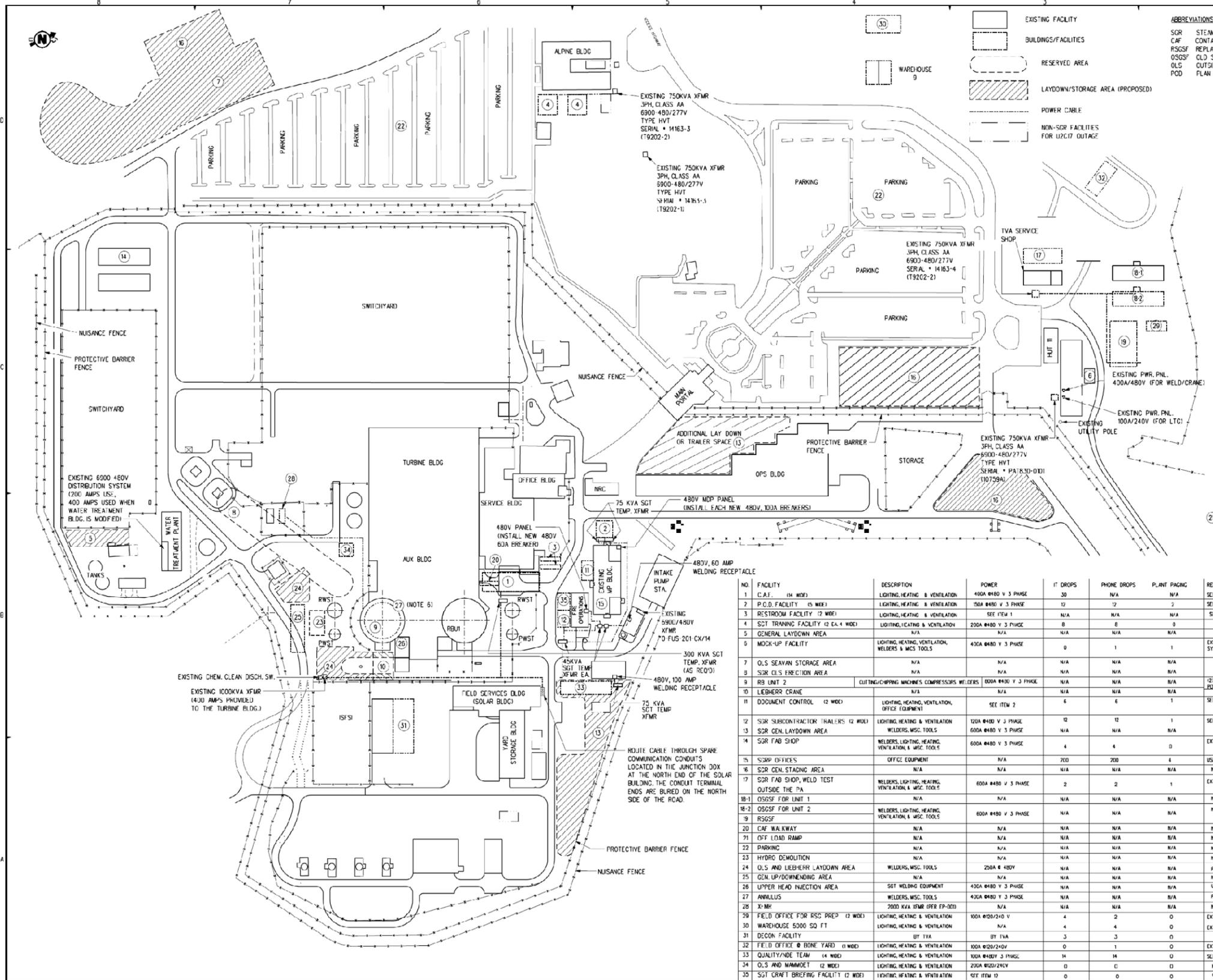
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**Attachment**

- A. Location of Facilities Associated With the Unit 2 Steam Generator Replacements Project

Attachment A. Locations of Facilities Associated With the Unit 2 Steam Generator Replacements Project



- ABBREVIATIONS:**
- SGR STEAM GENERATOR REPLACEMENT
  - CAF CONTAINMENT ACCESS FACILITY
  - RSGSF REPLACEMENT STEAM GENERATOR STORAGE FACILITY
  - OSGSF OLD STEAM GENERATOR STORAGE FACILITY
  - OLS OUTSIDE LIFT SYSTEM
  - POD PLAN OF THE DAY
- NOTES:**
1. THIS SKETCH IS (GENERAL) TO INDICATE THE (APPROXIMATE) LOCATIONS OF THE CONTAINMENT AND THE GENERAL ELECTRICAL UTILITIES TO SUPPORT THE SGR. THE LOCATION OF THESE FACILITIES IS APPROXIMATE AND IS SUBJECT TO CHANGE.
  2. CONNECTION TO EXISTING POWER AND COMMUNICATIONS WILL BE COORDINATED WITH TVA.
  3. TEMPORARY POWER AND COMMUNICATION LINES WILL BE INSTALLED AT GRADE LEVEL AND PROTECTED WHERE REQUIRED. OVERHEAD UTILITY POLES WILL BE INSTALLED IF REQUIRED WITH TVA ENGINEERING CONCURRENCE.
  4. POWER FOR TEMPORARY FACILITIES MAY BE PROVIDED FROM DIFFERENT SOURCES. TWO SOURCES ARE THE EXISTING 1000 KVA XFMR (0-XFA-42-CY/20) OR EXISTING POWER PANELS IN THE MULTI-PURPOSE BUILDING AND FFE OPS BUILDING. REFER TO SK EP005-003 FOR A POWER DISTRIBUTION BLOCK DIAGRAM.
  5. POWER TO BE PROVIDED IN THE ANNULUS PRIOR TO SGR. CABLES ARE TO BE ROUTED VIA PENETRATION WK72 FROM SGT TEMPORARY TRANSFORMER (ITEM 28). REFER TO 39866-EP-C-001 AND DCN D2256A FOR DETAILS.
  6. SGT TEMPORARY TRANSFORMER (2000KVA, 6900/480-277V) WILL PROVIDE POWER FOR FACILITIES NO. 9, UNIT 2 REACTOR BLDG., AND NO.27 (ANNULUS). REFER TO 39866-EP-C-001 AND TACS 2-10-315-303 FOR DETAILS.
  7. TEMPORARY FACILITY NO. 1 (CAF) WILL BE PROVIDED WITH A WET PIPE SPRINKLER SYSTEM AND IS TO BE CONNECTED TO THE SGN FIRE SYSTEM HEADER. REFER TO SK-EP005-002 FOR DETAILS.
  8. TEMPORARY FACILITIES NO. 2, NO. 3, NO. 10, NO. 12, NO. 33, NO. 34 & NO. 35 ARE TO BE EQUIPPED WITH A DRY PIPE SPRINKLER SYSTEM AND A FIRE HOSE STAGED FOR CONNECTION TO A FIRE HYDRANT OR VALVE STATION.
  9. ALL TEMPORARY FACILITIES ARE TO BE INSTALLED RASSED OFF GRADE. ELEVATION AREA BELOW FACILITIES IS TO REMAIN OPEN AND PROVIDED WITH SECURITY LIGHTING. SKIRTING MAY BE INSTALLED TO WITHIN 12" OF GROUND IF DESIRED.
  10. ALL TRAILER FENCE REMOVAL HELD UP TO SUPPLY ALL ALIUM CH TEMPORARY FACILITIES IS TO BE COORDINATED WITH SECURITY PRIOR TO REMOVAL AND IS TO BE PERFORMED IN ACCORDANCE WITH DCN D22470A.
  11. FLUSH WATER AND WASTE WATER STORAGE TANKS ARE TO BE PROVIDED BY THE FACILITY VENDOR AND SHALL BE EQUIPPED WITH FREEZE PROTECTION.
  12. ALL TEMPORARY FACILITIES ARE TO BE ANCHORED IN ACCORDANCE WITH VENDOR RECOMMENDATIONS AND LOCAL CODES.
  13. ALL CABLE TO BE 67°C OR EQUAL. CABLE SIZES TO BE PER NATIONAL ELECTRICAL CODE.
  14. CONSTRUCTION HAS THE OPTION TO ALTER CABLE ROUTE AND ELECTRICAL EQUIPMENT, (E.G. XFMR'S) LOCATION TO SUITE FIELD CONDITIONS.

- REMARKS NOTES:**
- NO. 1 POWERED BY SGT 300 KVA/120-208V XFMR FED FROM 600A BREAKER IN 1000KVA XFMR 0-XFA-42-CY/20
  - NO. 2 POWERED BY TWO SGT 75 KVA/120-208V XFMR FED FROM NEW 200A/600V W/100A FED IN W/100A
  - NO. 3 POWERED BY TWO SGT 420KVA 480/120-208V XFMR FED FROM A NEW 400A BREAKER INSTALLED IN THE OPS BUILDING AND 480V 60A WELDING RECEPTACLE OUTSIDE 300A FACILITY.
  - NO. 4 POWERED FROM SGT 75 KVA 480/120-208V XFMR FED FROM 100A WELDING RECEPTACLE IN DRY CAST STORAGE BLDG.

| NO.  | FACILITY                               | DESCRIPTION   | POWER               | FT DROPS | PHONE DROPS | PLANT PACING | REMARKS  |
|------|--|---|---------------------|----------|-------------|--------------|--|
| 1    | CAF (14 WIDE)                          | LIGHTING, HEATING & VENTILATION                       | 400A @480 V 3 PHASE | 30       | N/A         | N/A          | SEE REMARKS NOTE NO. 1   |
| 2    | P.C.D. FACILITY (5 WIDE)               | LIGHTING, HEATING & VENTILATION                       | 150A @480 V 3 PHASE | 12       | 12          | 2            | SEE REMARKS NOTE NO. 2   |
| 3    | RESTROOM FACILITY (2 WIDE)             | LIGHTING, HEATING & VENTILATION                       | SEE ITEM 1          | 8        | N/A         | N/A          | SEE ITEM 1   |
| 4    | SGT TRAINING FACILITY (2 EA 4 WIDE)    | LIGHTING, HEATING & VENTILATION                       | 200A @480 V 3 PHASE | 8        | 8           | 0            | N/A  |
| 5    | GENERAL LAYDOWN AREA                   | LIGHTING, HEATING & VENTILATION                       | N/A                 | N/A      | N/A         | N/A          | N/A  |
| 6    | MOCK-UP FACILITY                       | LIGHTING, HEATING, VENTILATION, WELDERS & MCS TOOLS   | 400A @480 V 3 PHASE | 0        | 1           | 1            | EXTEND PLANT COMMUNICATION SYSTEM TO FACILITY  |
| 7    | OLS SEAVAN STORAGE AREA                | N/A   | N/A                 | N/A      | N/A         | N/A          | N/A  |
| 8    | SGR OLS ERECTION AREA                  | N/A   | N/A                 | N/A      | N/A         | N/A          | N/A  |
| 9    | RB UNIT 2                              | CUTTING/CHIPPING MACHINES, COMPRESSORS, WELDERS       | 100A @480 V 3 PHASE | N/A      | N/A         | N/A          | 12: 400A/480V POWER PANELS ON CONTAINMENT DOME POWERED BY SGT 2000KVA XFMR (ITEM 28) |
| 10   | LIEBHERR CRANE                         | N/A   | N/A                 | N/A      | N/A         | N/A          | N/A  |
| 11   | DOCUMENT CONTROL (2 WIDE)              | LIGHTING, HEATING, VENTILATION, OFFICE EQUIPMENT      | SEE ITEM 2          | 6        | 6           | 1            | SEE ITEM 2   |
| 12   | SGR SUBCONTRACTOR TRAILERS (2 WIDE)    | LIGHTING, HEATING & VENTILATION                       | 100A @480 V 3 PHASE | 12       | 12          | 1            | SEE REMARKS NOTE NO. 3   |
| 13   | SGR GEN. LAYDOWN AREA                  | WELDERS, MISC. TOOLS                                  | 600A @480 V 3 PHASE | N/A      | N/A         | N/A          | N/A  |
| 14   | SGR FAB SHOP                           | WELDERS, LIGHTING, HEATING, VENTILATION & MISC. TOOLS | 600A @480 V 3 PHASE | 4        | 4           | 0            | EXTEND PLANT COMMUNICATION SYSTEM TO NEW FACILITY                                    |
| 15   | SGR OFFICES                            | OFFICE EQUIPMENT                                      | N/A                 | 200      | 200         | 4            | USE 75 OF EXISTING BUILDING  |
| 16   | SGR GEN. STAGING AREA                  | N/A   | N/A                 | N/A      | N/A         | N/A          | N/A  |
| 17   | SGR FAB SHOP, WELD TEST OUTSIDE THE PA | WELDERS, LIGHTING, HEATING, VENTILATION & MISC. TOOLS | 600A @480 V 3 PHASE | 2        | 2           | 1            | EXTEND PLANT COMMUNICATION SYSTEM TO NEW FACILITY                                    |
| 18-1 | OSGSF FOR UNIT 1                       | N/A   | N/A                 | N/A      | N/A         | N/A          | N/A  |
| 18-2 | OSGSF FOR UNIT 2                       | WELDERS, LIGHTING, HEATING, VENTILATION & MISC. TOOLS | 600A @480 V 3 PHASE | N/A      | N/A         | N/A          | N/A  |
| 19   | RSGSF                                  | N/A   | N/A                 | N/A      | N/A         | N/A          | N/A  |
| 20   | CAF WALKWAY                            | N/A   | N/A                 | N/A      | N/A         | N/A          | N/A  |
| 21   | OFF LOAD RAMP                          | N/A   | N/A                 | N/A      | N/A         | N/A          | N/A  |
| 22   | PARKING                                | N/A   | N/A                 | N/A      | N/A         | N/A          | N/A  |
| 23   | HYDRO DEMOLITION                       | N/A   | N/A                 | N/A      | N/A         | N/A          | N/A  |
| 24   | OLS AND LIEBHERR LAYDOWN AREA          | WELDERS, MISC. TOOLS                                  | 250A @ 480V         | N/A      | N/A         | N/A          | POWERED FROM 1000KVA XFMR 0-XFA-42-CY/20   |
| 25   | GEN. UP/DOWNENDING AREA                | N/A   | N/A                 | N/A      | N/A         | N/A          | N/A  |
| 26   | UPPER HEAD INJECTION AREA              | SGT WELDING EQUIPMENT                                 | 400A @480 V 3 PHASE | N/A      | N/A         | N/A          | UTILIZE EXISTING EQUIPMENT   |
| 27   | ANNULUS                                | WELDERS, MISC. TOOLS                                  | 400A @480 V 3 PHASE | N/A      | N/A         | N/A          | POWER SUPPLY REQUIRED BEFORE START OF SGR  |
| 28   | X-MR                                   | 2000 KVA XFMR (PER EP-001)                            | N/A                 | N/A      | N/A         | N/A          | N/A  |
| 29   | FIELD OFFICE FOR RSC PREP (2 WIDE)     | LIGHTING, HEATING & VENTILATION                       | 100A @20/240V       | 4        | 2           | 0            | EXTEND PLANT COMMUNICATION SYSTEM TO FACILITY  |
| 30   | WAREHOUSE 5000 SQ FT                   | LIGHTING, HEATING & VENTILATION                       | N/A                 | 4        | 4           | 0            | EXTEND PLANT COMMUNICATION SYSTEM TO FACILITY  |
| 31   | DECON FACILITY                         | BT TVA  | BT TVA              | 3        | 3           | 0            | BT TVA   |
| 32   | FIELD OFFICE @ BONE YARD (1 WIDE)      | LIGHTING, HEATING & VENTILATION                       | 100A @20/240V       | 0        | 1           | 0            | EXTEND PLANT COMMUNICATION SYSTEM TO FACILITY  |
| 33   | QUALITY/NOE TEAM (4 WIDE)              | LIGHTING, HEATING & VENTILATION                       | 100A @480V 3 PHASE  | 14       | 14          | 0            | SEE REMARKS NOTE NO. 4   |
| 34   | OLS AND MAMMOET (2 WIDE)               | LIGHTING, HEATING & VENTILATION                       | 200A @20/240V       | 0        | 0           | 0            | N/A  |
| 35   | SGT CRAFT BRIEFING FACILITY (2 WIDE)   | LIGHTING, HEATING & VENTILATION                       | SEE ITEM 12         | 0        | 0           | 0            | SEE ITEM 12  |

**The Steam Generating Team**  
**SGT**

Tennessee Valley Authority  
 Sequoyah Unit No. 2  
 Nuclear Generating Station

**SAFETY CLASS :**  
 NON-QUALITY RELATED

SKETCH TITLE  
 SITE LAYOUT PLAN  
 TEMP FACILITIES

SKETCH NO. SK-EP005-001 REV 0  
 SHEET 1 OF 1 SCALE: NONE