PSEG Nuclear LLC

# MITIGATION STRATEGIES FOR BEYOND DESIGN BASIS EXTERNAL EVENTS

# EA-12-049 OVERALL INTEGRATED PLAN RESPONSE

# SALEM GENERATING STATION

**SL-011725**
**Revision 0**
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**Project Classification:**
**Non-Safety Related**
**S&L Project No. 12800-214**

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## Section 1 - General Integrated Plan Elements (PWR)

| **Determine Applicable Extreme External Hazard**<br><br>**Ref: NEI 12-06 section 4.0 -9.0 JLD-ISG-2012-01 section 1.0** | *Input the hazards applicable to the site; seismic, external flood, high winds, snow, ice, cold, high temps.*<br>*Describe how NEI 12-06 sections 5 – 9 were applied and the basis for why the plant screened out for certain hazards.* |
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The applicable extreme external hazards for Salem Generating Station (SGS) Unit 1 and 2 are seismic, flooding, severe storms with high winds, snow, ice and extreme cold, and high temperatures.

**<u>NEI 12-06 Section 5: Assess Seismic Impact</u>**

Consistent with NEI 12-06 (Reference 2), Section 5.2, all sites will address seismic hazards. Seismic hazards are applicable to SGS. The current design basis safe shutdown earthquake (SSE) is 0.2g horizontal and 0.133g vertical. The associated spectra are included in SGS Updated Final Safety Analysis Report (UFSAR, Reference 1) Figures 2.5-12 and 2.5-13.

FLEX equipment required to mitigate a seismic event at SGS will be stored at its point of deployment in a seismically robust structure (e.g., auxiliary building, etc.) or will be stored in the cancelled Hope Creek Generating Station (HCGS) Unit 2 reactor building. An evaluation is in progress to verify that construction of the HCGS Unit 2 structures has been sufficiently completed, and will meet Reference 2, Section 5.3.1 criteria for protection of FLEX equipment against seismic hazards. Large portable FLEX equipment (other then the pre-positioned equipment) will be secured for a seismic event and located so that it is not damaged by other items in a seismic event.

As discussed in the SGS UFSAR Section 2.5.1.2, the Vincentown formation soils are not considered to be liquefiable. All critical buildings around the SGS site are surrounded by highly compacted backfill. Deployment pathways of FLEX equipment from the proposed storage location will consider the potential for debris due to failure of non-seismically designed structures. Debris removal equipment onsite will be capable of clearing pathways for deployment.

**<u>NEI 12-06 Section 6: Assess External Flooding Impact</u>**

External flooding is applicable to SGS. The current licensing basis, described in the SGS UFSAR Subsection 2.4.2, states the probable maximum hurricane event is the only applicable external flooding event for SGS. Flood re-evaluations pursuant to the 10 CFR 50.54(f) letter of March 12, 2012 are currently being developed based primarily on the analysis being prepared for the PSEG Site Early Site Permit Application. Upon completion of the analyses, PSEG will use the results to inform the flooding hazards applicable to SGS and associated FLEX protection and deployment strategies. Any changes required to SGS FLEX strategies as a result of the flooding hazard re-evaluation will be communicated in a future six-month update.

A hurricane event is assumed to have greater than 48 hours of warning time and flooding is expected to persist on the site for approximately 12 hours. The warning time is sufficient to pre-stage FLEX equipment as described in the FLEX strategies presented later in the Integrated Plan.

FLEX equipment required to mitigate a flooding event at SGS will be stored at its point of deployment in a flood protected structure (e.g., auxiliary building, etc.) or will be stored in the flood protected HCGS Unit 2 reactor building FLEX staging area.

FLEX equipment not pre-staged prior to the event will be located in the HCGS Unit 2 reactor building and will begin deployment at approximately 12 hours. Debris removal equipment will also be staged in the HCGS Unit 2 reactor building prior to the hurricane to support deployment of FLEX equipment in Phases 2 and 3.

**NEI 12-06 Section 7: Assess Impact of Severe Storms with High Winds**

Figures 7-1 and 7-2 from NEI 12-06 were used for this assessment. It was determined that SGS could experience hurricane winds of approximately 160 mph based on Figure 7-1. It was also determined that SGS is in Region 2 and could experience tornado force winds of approximately 166 mph based on Figure 7-2. Therefore, the high wind hazard is applicable to SGS.

FLEX equipment required to mitigate a beyond design basis external event (BDBEE) at SGS will be stored at its point of deployment in a seismically robust structure (e.g., auxiliary building, etc.) or will be stored in the HCGS Unit 2 reactor building.

High winds may delay deployment of FLEX equipment. Consequently, the FLEX strategy includes consideration of deployment of equipment prior to the high wind event, since typically, for a high wind event (such as a hurricane); significant warning time would be available. It is noted that for tornados there may not be significant warning time available. Since tornados are typically short term events, deployment of equipment during a tornado would not be anticipated. Debris removal equipment will be available to support deployment of FLEX equipment.

**NEI 12-06 Section 8: Assess Impact of Snow, Ice and Extreme Cold**

Based on NEI 12-06, Section 8.2, SGS must address impact of snow, ice and extreme cold on protection and deployment of FLEX equipment. Severe weather conditions, such as snow or ice may delay deployment of FLEX equipment. Consequently, the FLEX strategy will include consideration of deployment of equipment (pre-stage equipment) prior to the severe weather event, as necessary, since typically for these severe weather events, significant warning time would be available.

The SGS plan for storage locations includes either storage at the point of deployment or use of the existing HCGS Unit 2 reactor building. Equipment will be protected consistent with NEI 12-06 Section 8.3. These locations will provide adequate heating to prevent equipment from freezing, and will provide protection against snow and ice loads. Also, snow, ice, and extreme cold are predictable events, and equipment can be pre-staged in the event that weather with potential impacts is predicted.

Snow removal is a normal activity at the plant site because of the climate. Reasonable access to FLEX equipment will be maintained throughout a snow event. Ice management will be performed as required such that large FLEX equipment can be moved by vehicles. Debris removal equipment will be able to move through moderate snow accumulations and can also be used to move FLEX equipment.

**NEI 12-06 Section 9: Assess Impact of High Temperatures**

Consistent with NEI 12-06, Section 9.2, all sites will address high temperatures.

The SGS plan for storage locations includes storage at the point of deployment and use of the HCGS Unit 2 reactor building. These locations will have adequate ventilation to maintain reasonable storage temperatures. Backup ventilation cooling is not required when power is lost because the equipment is expected to be deployed shortly after the initiation of the Extended Loss of AC Power (ELAP).

High temperature does not impact the deployment of FLEX equipment. All FLEX equipment will be procured to be suitable for use in peak temperature for the region.

**References**

1. Salem 1 and 2 Generating Station Updated Final Safety Analysis Report, Revision 26
2. Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, NEI 12-06, Revision 0

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| **Key Site assumptions to implement NEI 12-06 strategies.**<br><br>**Ref: NEI 12-06 section 3.2.1** | *Provide key assumptions associated with implementation of FLEX Strategies:*<br>• *Flood and seismic re-evaluations pursuant to the 10 CFR 50.54(f) letter of March 12, 2012 are not completed and therefore not assumed in this submittal. As the re-evaluations are completed, appropriate issues will be entered into the corrective action system and addressed on a schedule commensurate with other licensing bases changes.*<br>• *Exceptions for the site security plan or other (license/site specific) requirements of 10CFR may be required.*<br>• *Deployment resources are assumed to begin arriving at hour 6 and fully staffed by 24 hours.*<br>• *Certain Technical Specifications cannot be complied with during FLEX implementation.* |

- Flood and seismic re-evaluations pursuant to the 10 CFR 50.54(f) letter of March 12, 2012 are not completed and therefore not assumed in this submittal. As the re-evaluations are completed, appropriate issues will be entered into the corrective action system and addressed.
- The following conditions exist:
  - Direct Current (DC) power supplies are available.
  - Alternating Current (AC) and DC distribution is available.
  - Plant initial response is the same as Station Blackout (SBO).
  - The ELAP condition will be identified and entry into the FLEX Support Guidelines (FSGs) will be at approximately 1 hour into the event.
  - WCAP-17601, RCS Response to the ELAP Event, and PA-PSC-0965, PWROG Core Cooling Position Paper, are used for decay heat, and will establish operator times and actions.
  - No additional events or failures are assumed and the turbine driven auxiliary feedwater (TDAFW) pump remains functional.
- The designed hardened connections will be protected against external events or are established at multiple and diverse locations.
- FLEX components will be designed to be capable of performing in response to screened in hazards in accordance with NEI 12-06. Portable FLEX components will be procured commercially.
- Margin will be added to the design of the FLEX components and hard connection points to address future requirements as re-evaluation warrants. This margin will be determined during the detailed design or evaluation process.
- Phase 2 FLEX components stored at the site will be protected against hazards in accordance with NEI 12-06.
- Deployment strategies and deployment routes will be assessed for hazards impact.
- For a hurricane event the site will have at least 48 hours notice and therefore the site will be fully staffed prior to the arrival of the event in accordance with OP-AA-108-111-1001, Severe Weather and Natural Disaster Guidelines (Reference 2).
- Additional staff resources are expected to arrive beginning at 6 hours. Between 6 to 24 hours there is limited site access. After 24 hours there is near normal site access per Section 2.2 sub item 4 of NEI 12-01.
- Maximum environmental room temperatures for habitability or equipment availability are based on NUMARC 87-00 (Reference 1) guidance if other design basis information or industry guidance is not available.

- The discussion presented in this Integrated Plan is generally discussed from the viewpoint of Salem Unit 1. Salem Units 1 and 2 are sufficiently similar with respect to the discussions provided in this plan to not detail both units.
- The result of the BDBEE may place the plant in a condition where it cannot comply with certain Technical Specifications and/or with its Security Plan, and, as such, may warrant invocation of 10 CFR 50.54(x) and/or 10 CFR 73.55(p).

<u>Mode Specific Impacts on FLEX Strategies:</u>
Mode 1 through 4 - Mode 1, Power Operation, FLEX strategies and equipment design assumptions bound Modes 2 through 4 impacts due to lower levels of decay heat.

Mode 5 - Cold Shutdown – The Phase 1 core cooling strategies using the TDAFW Pump and SG PORVs will either not be possible due to secondary system unavailability, or will only be used once plant heat up has occurred and secondary side steam is available. Portable equipment for Phase 2 FLEX strategies will be capable of performing required functions while in Mode 5. Gravity feed and spill from the RWST through an RCS vent path may be available for decay heat removal as a Phase 1 strategy. Prioritization of primary system vs. secondary system injection strategies with Phase 2 portable equipment will be considered based on RCS/Secondary configuration.

Mode 6 - Refueling – The Phase 1 core cooling strategy does not rely on installed equipment other than the reactor vessel and associated refueling cavity water inventory. Due to the lower decay heat level in the reactor and larger volume of water in the refueling cavity, response times for portable Phase 2 equipment for core cooling are expected to be bounded by Mode 1 requirements. Spent fuel pool (SFP) cooling assumptions for decay heat assume a freshly offloaded core and are sufficient to ensure adequate fuel pool makeup with portable equipment in Mode 6.

<u>References:</u>
1. NUMARC 87-00, Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors, Revision 1
2. OP-AA-108-111-1001, Severe Weather and Natural Disaster Guidelines

| **Extent to which the guidance, JLD-ISG-2012-01 and NEI 12-06, are being followed. Identify any deviations to JLD-ISG-2012-01 and NEI 12-06.**<br><br>**Ref: JLD-ISG-2012-01**<br>**NEI 12-06 13.1** | *Include a description of any alternatives to the guidance, and provide a milestone schedule of planned action.* |
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SGS has no known deviations to the guidelines in JLD-ISG-2012-01 and NEI 12-06. If deviations are identified, then the deviations will be communicated in a future 6 month status report following identification.

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| **Provide a sequence of events and identify any time constraint required for success including the technical basis for the time constraint.**<br><br>**Ref: NEI 12-06 section 3.2.1.7 JLD-ISG-2012-01 section 2.1** | *Strategies that have a time constraint to be successful should be identified with a technical basis and a justification provided that the time can reasonably be met (for example, a walk through of deployment).*<br><br>*Describe in detail in this section the technical basis for the time constraint identified on the sequence of events timeline Attachment 1A*<br><br>*See attached sequence of events timeline (Attachment 1A).*<br><br>*Technical Basis Support information, see attached NSSS Significant Reference Analysis Deviation Table (Attachment 1B)* |

Discussion of Time Constraints Identified in Attachment 1A

The sequence of events timeline is provided in Attachment 1A. The timeline presents the best estimate elapsed time for primary coping strategy for each key safety function. Validation of assumed response times will be required once all associated analyses are completed and FSGs have been developed.

Action Item (AI) 5, 9 – WCAP-17601 concludes Steam Generator (SG) dryout can occur within 55 minutes of loss of auxiliary feedwater (AFW) flow. Should the initiating event damage the auxiliary feedwater storage tank (AFST), another source of water must be aligned to the TDAFW pump as discussed in Section 2.2. It is estimated that suction from the demineralized water storage tank (DWST) header (fed from either the tank or submersible FLEX pump in the turbine building) can be established within 40 minutes. If the initiating event is a hurricane flood, the 240 VAC FLEX Diesel Generators (DGs) would have been pre-staged on the auxiliary building roof and could be started to support operation of the submersible FLEX pump in the turbine building.

AI 3, 7 – DC battery power load shedding activities are performed in accordance with (IAW) S1.OP-AB.LOOP-0001 to extend battery life to a minimum of 4 hours. Completion of these activities will provide 3 hours to deploy the 240 VAC FLEX DGs described in AI 13 from declaration of an ELAP in AI 10.

AI 8 – Ventilation related activities are performed IAW S1.OP-AB.LOOP-0001 to assure long term habitability of the main control room and reliability of equipment credited in FLEX strategies.

AI 11, 12 – The reactor coolant system (RCS) cooldown is assumed to follow the analysis contained in WCAP-17601 for response to an ELAP.

AI 13 – The 240 VAC FLEX DGs are deployed from the storage location in HCGS Unit 2 reactor building and connected to the SBO battery charger receptacles located in the auxiliary building as described in Section 6.2. It is estimated this activity can be completed within 3 hours of the declaration of an ELAP. If the initiating event is a hurricane flood, the 240 VAC FLEX DGs are pre-staged on the auxiliary building roof.

AI 14 – The 480 VAC FLEX DGs will be deployed from the storage location in HCGS Unit 2 reactor building and connected to the FLEX switchgear panel in the auxiliary building truck bay as described in Section 6.2. It is estimated this activity could be completed within 5 hours of the declaration of an ELAP. If the initiating event is a hurricane flood, the 480 VAC FLEX DGs will be pre-staged on the auxiliary building roof. This activity supports AI 18.

AI 15 – RCS injection will be required at approximately 8 hours (AI 16), operators will assess the condition of the refueling water storage tank (RWST) and align an available borated water source for injection within the next 2 hours as described in Section 3.2.

AI 16 – Temporary power cable will be routed from the 480 VAC FLEX switchgear panel (receptacle) to the "A" 460 VAC vital bus FLEX receptacle. This activity supports the operation of the 13 charging pump for RCS injection in AI 18.

AI 17 – Begin RCS injection with the 13 charging pump.

AI 19 – If the initiating event is a hurricane flood, see AI 21. The diesel driven FLEX service water (SW) pump will be deployed from the storage location in HCGS Unit 2 reactor building to the river and connected to the service water system as described in Section 2.2. It is estimated this activity can be completed within 11 hours of the declaration of an ELAP. This activity supports establishing an indefinite supply of water for the TDAFW pump.

AI 21 – In the event of a hurricane, the diesel driven FLEX SW pump will be deployed from the storage location in HCGS Unit 2 reactor building to the river and connected to the service water system as described in Section 2.2 at approximately 24 hours. The submersible FLEX pump (AI 5) in the turbine building has been supplying water to the TDAFW pump. This activity supports establishing an indefinite supply of water for the TDAFW pump.

AI 22 – Assuming the highest heat load (full core offload), the water level in the SFP would have boiled down to approximately 10 feet above top of fuel. Sufficient time will exist to establish the refill lineup (described in Section 6.2 and 2.2) from the FLEX AFW pump or diesel driven FLEX SW pump to maintain SFP inventory.

AI 23 – Phase 3 coping activities to maintain containment and establish indefinite coping capability rely on the use of a 4.16 kV DG, diesel driven pumps and water treatment equipment (amongst other commodities and equipment) provided by the regional response center (RRC). PSEG intends to notify the RRC of the ELAP at 2 hours after the event, which would deliver equipment to within 25 miles of the site at approximately 26 hours. Sufficient time exists, with continued operation of Phase 2 strategies, to deploy the equipment to the site and establish functionality.

Technical Basis Support information

1. On behalf of the PWR Owners Group (PWROG), Westinghouse developed documents, WCAP-17601-P, Revision 0, and PA-PSC-0965, Revision 0, to supplement the guidance in NEI 12-06 by providing additional PWR-specific information regarding the individual plant response to the ELAP and loss of ultimate heat sink (LUHS) events. The document includes identification of the generic event scenario and expected plant response, the associated analytical bases and recommended actions for performance of a site-specific gap analysis. As part of this document, a generic PWR Westinghouse 4 loop NSSS evaluation was performed. The PWR Westinghouse 4 loop analysis is applicable to the SGS coping strategy in that it supplements the NEI 12-06 guidance by providing PWR specific information regarding plant response for secondary cooling and RCS inventory control. The guidance provided in NEI 12-06 was utilized as appropriate to develop coping strategies and for prediction of the plant's response.
2. Per the guidance in 10 CFR 50.63 and Regulatory Guide 1.155, SGS is a 4 hr coping plant for SBO considerations.

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| **Identify how strategies will be deployed in all modes.**<br><br>**Ref: NEI 12-06 section 13.1.6** | *Describe how the strategies will be deployed in all modes.* |
| Deployment routes will be established for all equipment stored remotely from its deployment area. The identified paths and deployment areas will be assessed for accessibility during all modes of operation. This deployment strategy will be included within administrative programs in order to keep pathways clear or actions to clear the pathways. | |
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| **Provide a milestone schedule. This schedule should include:**<br>• **Modifications timeline**<br>  ○ **Phase 1 Modifications**<br>  ○ **Phase 2 Modifications**<br>  ○ **Phase 3 Modifications**<br>• **Procedure guidance development complete**<br>  ○ **Strategies**<br>  ○ **Maintenance**<br>• **Storage plan (reasonable protection)**<br>• **Staffing analysis completion**<br>• **FLEX equipment acquisition timeline**<br>• **Training completion for the strategies**<br>• **Regional Response Centers operational**<br><br>**Ref: NEI 12-06 section 13.1** | *The dates specifically required by the order are obligated or committed dates. Other dates are planned dates subject to change. Updates will be provided in the periodic (six month) status reports.* |
| See milestone schedule in Attachment 2. | |
| **Identify how the programmatic controls will be met.**<br><br>**Ref: NEI 12-06 section 11**<br>**JLD-ISG-2012-01 section 6.0** | *Provide a description of the programmatic controls equipment protection, storage and deployment and equipment quality. See section 11 in NEI 12-06. Storage of equipment, 11.3, will be documented in later sections of this template and need not be included in this section.*<br>*See section 6.0 of JLD-ISG-2012-01.* |
| SGS will implement an administrative program for implementation of the FLEX strategies in accordance with NEI 12-06 guidance. FLEX equipment will have unique identification numbers. Installed structures, systems and components pursuant to 10CFR50.63(a) will continue to meet the augmented quality guidelines of Regulatory Guide 1.155, Station Blackout. Standard industry preventive maintenance processes will be used for component maintenance. Testing procedures will be developed and frequencies established based on the type of equipment and considerations made within EPRI guidelines. | |
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| **Describe training plan** | *List training plans for affected organizations or describe the plan for training development* |
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| New training of general station staff and emergency preparedness (EP) will be performed, prior to completion of design installation in 2014 for SGS Unit 1 and 2015 for SGS Unit 2. Training will be implemented in accordance with the existing PSEG training and qualification processes. | |
| **Describe Regional Response Center plan** | |
| The industry will establish two (2) RRCs to support utilities during beyond design basis events. Each RRC will hold five (5) sets of equipment, four (4) of which will be able to be fully deployed when requested, the fifth set will have equipment in a maintenance cycle. Equipment will be moved from an RRC to a local assembly area, established by the Strategic Alliance for FLEX Emergency Response (SAFER) team and the utility. Communications will be established between the affected nuclear site and the SAFER team and required equipment moved to the site as needed. First arriving equipment, as established during development of the nuclear site's playbook, will be delivered within 25 miles of the site within 24 hours from the initial request. Also available will be locally held portable equipment that could be requested from site to site and utility to utility on an as required basis thus establishing 64 response centers capable of providing specific Phase 2 equipment. | |
| Notes:<br>None. | |

## Section 2 - Maintain Core Cooling and Heat Removal

### 2.1 - PWR Installed Equipment Phase 1

**Determine Baseline coping capability with installed coping[1] modifications not including FLEX modifications, utilizing methods described in Table 3-2 of NEI 12-06:**

- **AFW/EFW**
- **Depressurize RCS for injection with portable injection source**
- **Sustained water source**

**PWR Installed Equipment Phase 1:**

*Provide a general description of the coping strategies using installed equipment including modifications that are proposed to maintain core cooling. Identify methods (AFW/EFW) and strategy(ies) utilized to achieve this coping time.*

Following the occurrence of an ELAP/LUHS event, the reactor will trip and the plant will initially stabilize at no-load RCS temperature and pressure conditions, with reactor decay heat removal via steam release to the atmosphere through the SG safety valves and/or power-operated relief valves (SG PORVs). Natural circulation of the RCS will develop to provide core cooling and the steam TDAFW pump will provide flow from the AFST (or other available source) to the SGs to make-up for steam release.

Operators will respond to the event in accordance with emergency operating procedures (EOPs) to confirm reactor coolant system, secondary system, and containment conditions. A transition to 1-EOP-LOPA-1, "Loss of All AC Power" will be made upon the diagnosis of the total loss of AC power. This procedure directs isolation of reactor coolant system letdown pathways, confirmation of natural circulation cooling, verification of containment isolation, reducing DC loads on the station batteries, and establishment of electrical equipment alignment in preparation for eventual power restoration. The operators confirm auxiliary feedwater flow to the steam generators, establish manual control of the SG PORVs, and initiate a rapid cooldown of the RCS to minimize inventory loss through the RCP seals. 1-EOP-LOPA-1 directs local manual control of auxiliary feedwater flow to the steam generators and local manual control of the SG PORVs to control steam release to control the cooldown rate, as necessary.

**Core Cooling and Heat Removal Phase 1 Strategy**

The Phase 1 strategy for reactor core cooling and heat removal relies upon installed plant equipment and water sources for AFW supply to the steam generators and steam release to the atmosphere.

The TDAFW pump automatically starts on the loss of offsite power condition, and does not require AC electrical power to provide AFW to the SGs. The AFW system is pre-aligned for flow to the SGs, and the air operated flow control valves fail open to align flow to all four SGs.

Steam release from the SGs can be controlled by local manual operation of the SG PORVs. The SG PORVs will be modified to add an alternate nitrogen bottle air supply to the valve operator to support continued operation from the control room. RCS cooldown will be initiated as described in WCAP-17601 to a SG pressure of approximately 300 psia. The RCS cooldown minimizes adverse effects of high temperature coolant on RCP shaft seal performance and reduces SG pressure to allow feedwater injection from a portable pump in the event of TDAFW pump failure. The minimum SG pressure is

[1] Coping modifications consist of modifications installed to increase initial coping time, i.e. generators to preserve vital instruments or increase operating time on battery powered equipment.

## Section 2 - Maintain Core Cooling and Heat Removal

### 2.1 - PWR Installed Equipment Phase 1

established to prevent safety injection accumulator nitrogen gas from entering the RCS.

The primary AFW water supply is provided by the installed AFST. The tank has a minimum usable capacity of 200,000 gallons and will provide a suction source to the TDAFW pump for a minimum of 12 hours based on the AFW consumption requirements delineated in WCAP-17601. The AFST is not protected from the effects of hurricane wave activity or wind driven missiles. During a hurricane event, should the AFST become unavailable, the AFW water supply would be transitioned to pre-staged Phase 2 equipment discussed in Section 2.2. In the event of a missile strike to the AFST, the existing piping configuration allows TDAFW pump suction to be aligned to the 500,000 gallon DWST or the 350,000 gallon fire protection/fresh water storage tanks. The DWST and fire protection/fresh water storage tanks are not protected from external events, but are widely spaced from the AFST. It is reasonable to expect the DWST or fire protection/fresh water storage tanks will escape tornado and missile damage due to physical separation.

Vital AC and DC bus load shedding will be implemented to preserve battery life and selected vital instrument AC busses remain energized during the Phase 1 strategy response to provide power to necessary instrumentation in order to provide the key reactor parameter information indicated below. The load shedding of vital AC and DC loads is described in Section 6.1.

The key equipment relied upon to provide reactor core cooling and heat removal for the Phase 1 strategy are protected against the applicable external hazards as described below:

- The TDAFW Pump is located in the auxiliary building, a seismically qualified and flood protected structure.
- The AFST is a seismically qualified tank, however it is susceptible to damage from wind borne missiles and wave action during a hurricane event. As discussed above, alternate water supply tanks are reasonably expected to survive the BDBEE in the event of a single AFST failure.
- Vital instrument AC and DC busses are located in the seismic class I auxiliary building.
- SG PORVs are located in the seismic class I mechanical penetration area.

**Details:**

| **Provide a brief description of Procedures / Strategies / Guidelines** | *Confirm that procedure/guidance exists or will be developed to support implementation* |
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SGS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.

| Section 2 - Maintain Core Cooling and Heat Removal | |
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| **2.1 - PWR Installed Equipment Phase 1** | |
| **Identify modifications** | *List modifications* |
| • Nitrogen bottles will be connected to the air supply of the SG PORVs to allow operation of the valves without FLEX equipment. | |
| **Key Reactor Parameters** | *List instrumentation credited for this coping evaluation.* |

| **Core Cooling – Secondary Side** | | |
|---|---|---|
| **Description** | **Instrument** | **Power Supply** |
| 1(2) AFWST Level (Normal) | LA5744 | A VIB |
| 1(2) AFWST Level (Tech Spec) | LA2705 | B VIB |
| 13(23) AFW Pump Indications (Suction & Discharge Pressures) | PA5962, PA5738 | C VIB |
| 11(21) SG Channel I Pressure | PI514A | A VIB |
| 11(21) SG Channel II Pressure | PI515A | B VIB |
| 11(21) SG Channel IV Pressure | PI516A | D VIB |
| 11(21) SG Channel II Level | LI519 | B VIB |
| 11(21) SG Channel III Level | LI518 | C VIB |
| 11(21) SG Channel IV Level | LI517 | D VIB |
| 12(22) SG Channel I Pressure | PI524A | A VIB |
| 12(22) SG Channel II Pressure | PI 525A | B VIB |
| 12(22) SG Channel III Pressure | PI 526A | C VIB |
| 12(22) SG Channel I Level | LI529 | A VIB |
| 12(22) SG Channel III Level | LI528 | C VIB |
| 12(22) SG Channel IV Level | LI527 | D VIB |
| 13(23) SG Channel I Pressure | PI534A | A VIB |
| 13(23) SG Channel II Pressure | PI535A | B VIB |
| 13(23) SG Channel III Pressure | PI536A | C VIB |
| 13(23) SG Channel I Level | LI539 | A VIB |
| 13(23) SG Channel III Level | LI538 | C VIB |
| 13(23) SG Channel IV Level | LI537 | D VIB |
| 14(24) SG Channel I Pressure | PI544A | A VIB |
| 14(24) SG Channel II Pressure | PI 545A | B VIB |
| 14(24) SG Channel IV Pressure | PI 546A | D VIB |
| 14(24) SG Channel II Level | LI549 | B VIB |
| 14(24) SG Channel III Level | LI548 | C VIB |
| 14(24) SG Channel IV Level | LI547 | D VIB |
| 11(21)-14(24) SG Wide Range Level | LT501 – LT504 | C VIB |
| 11(21)-14(24) SG Wide Range Level MCR Indicator power | | 12(22) MAC |
| **Core Cooling – Primary Side** | | |
| **Description** | **Instrument** | **Power Supply** |
| Core Exit Thermocouples Channel A | Train A | A VIB |

| Section 2 - Maintain Core Cooling and Heat Removal | | |
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| **2.1 - PWR Installed Equipment Phase 1** | | |
| Core Exit Thermocouples Channel B | Train B | B VIB |
| RVLIS A | Train A | B VIB |
| RVLIS B | Train B | D VIB |
| Pressurizer Level Channel I | LI-459A | A VIB |
| Pressurizer Level Channel II | LI-460A | B VIB |
| Pressurizer Level Channel III | LT-461 | C VIB |
| Pressurizer Level Cold Calibrated | LI-462 | D VIB |
| Pressurizer Pressure Channel I | PI-455A | A VIB |
| Pressurizer Pressure Channel II | PI-456 | B VIB |
| Pressurizer Pressure Channel III | PI-457 | C VIB |
| Pressurizer Pressure Channel IV | PI-474A | D VIB |
| RCS Wide Range Pressure | PT-405 | A VIB |
| RCS Wide Range Pressure | PT-403 | B VIB |
| 11(21) RC Loop Thot & Tcold | TE413A & TE413B | A VIB |
| 12(22) RC Loop Thot & Tcold | TE423A & TE423B | B VIB |
| 13(23) RC Loop Thot & Tcold | TE433A & TE433B | C VIB |
| 14(24) RC Loop Thot & Tcold | TE443A & TE443B | D VIB |
| 11(21) SJ Accumulators Level & Pressure Channel A | LI934A<br>PI936A | A VIB |
| 11(21) SJ Accumulators Level & Pressure Channel B | LI935A<br>PI937A | B VIB |
| 12(22) SJ Accumulators Level & Pressure Channel A | LI935B<br>PI937B | A VIB |
| 12(22) SJ Accumulators Level & Pressure Channel B | LI934B<br>PI936B | B VIB |
| 13(23) SJ Accumulators Level & Pressure Channel C | LI934C<br>PI936C | C VIB |
| 13(23) SJ Accumulators Level & Pressure Channel D | LI935C<br>PI937C | D VIB |
| 14(24) SJ Accumulators Level & Pressure Channel C | LI935D<br>PI937D | C VIB |
| 14(24) SJ Accumulators Level & Pressure Channel D | LI934D<br>PI936D | D VIB |
| U/1 RWST Level Channel | LI-921 | 1B VIB |
| U/1 RWST Level Channel | LI-920 | 1D VIB |
| U/2 RWST Level Channel I | LI-960 | 2A VIB |
| U/2 RWST Level Channel II | LI-961 | 2B VIB |
| U/2 RWST Level Channel III | LI-962 | 2C VIB |
| U/2 RWST Level Channel IV | LI-963 | 2D VIB |
| **Maintain Containment Integrity** | | |
| **Description** | **Instrument** | **Power Supply** |
| Containment Pressure Channel I | PI-948D | A VIB |
| Containment Pressure Channel II | PI-948C | B VIB |

| Section 2 - Maintain Core Cooling and Heat Removal | | |
|---|---|---|
| **2.1 - PWR Installed Equipment Phase 1** | | |
| Containment Pressure Channel III | PI-948B | C VIB |
| Containment Pressure Channel IV | PI-948A | D VIB |
| **Spent Fuel Pool Instrumentation** | | |
| See SGS Response to NRC Order EA-12-051 | | |
| **Miscellaneous** | | |
| **Description** | **Instrument** | **Power Supply** |
| UHF/VHF Antenna System Main and Standby Repeaters Unit 1 | N/A | 1A VIB |
| UHF/VHF Antenna System Main and Standby Repeaters Unit 2 | N/A | 2A VIB |
| Emergency Radio Transmitter | N/A | 1A VIB |
| PA System Unit 1 | N/A | 12 MAC |
| PA System Unit 2 | N/A | 22 MAC |
| **Electrical** | | |
| **Description** | **Instrument** | **Power Supply** |
| 1(2) A 28VDC Bus Voltage | VM33 | A 28VDC Bus |
| 1(2) A 28VDC Bus Amperage | AM32 | A 28VDC Bus |
| 1(2) B 28VDC Bus Voltage | VM35 | B 28VDC Bus |
| 1(2) B 28VDC Bus Amperage | AM34 | B 28VDC Bus |
| 1(2) A 125VDC Bus Voltage | VM13 | A 125VDC Bus |
| 1(2) A 125VDC Bus Amperage | AM14 | A 125VDC Bus |
| 1(2) B 125VDC Bus Voltage | VM15 | B 125VDC Bus |
| 1(2) B 125VDC Bus Amperage | AM16 | B 125VDC Bus |
| 1(2) C 125VDC Bus Voltage | VM236 | C 125VDC Bus |
| 1(2) C 125VDC Bus Amperage | AM230 | C 125VDC Bus |
| **Notes:**<br>Power to the Vital Instrument Buses after Phase 1 is from the FLEX 240 VAC DG as discussed in Section 6.2. | | |

## Section 2 - Maintain Core Cooling and Heat Removal

### 2.2 - PWR Portable Equipment Phase 2

*Provide a general description of the coping strategies using on-site portable equipment including modifications that are proposed to maintain core cooling. Identify methods and strategy(ies) utilized to achieve this coping time.*

As described in Section 2.1, Phase 1 coping following an ELAP/LUHS is accomplished using the installed TDAFW pump to feed the SGs, SG PORVs for SG steam release to control RCS temperature and effect a RCS cooldown, and the AFST (or depending on the event, another available source of water) to provide the AFW water source to the TDAFW pump. The Phase 1 coping strategy will provide reactor core cooling and decay heat removal for a minimum of 12 hours and is sufficient to stabilize the plant at approximately 300 psia SG pressure, which will result in RCS cold leg temperature of approximately 425F with pressure greater than SI accumulator nitrogen injection pressure.

**Core Cooling and Heat Removal Phase 2 Strategy**

The Phase 2 strategy for reactor core cooling and heat removal provides an indefinite supply of water for feeding SGs and a motor driven backup AFW pump for use in the event that the TDAFW pump is unavailable. The TDAFW pump is expected to operate for an extended duration before SG steam pressure is reduced to the point where sufficient steam flow cannot be provided to the turbine inlet to support pump operation. The strategy includes repowering the vital 230/460 VAC busses to maintain key parameters monitoring instrumentation and restore equipment. Phase 2 electrical bus repowering strategies are described in Section 6.2.

<u>Water Supply</u>
An indefinite supply of water to the suction of the TDAFW pump or the pre-staged FLEX AFW pump, can be provided from the Delaware River. The Delaware River will remain available for any of the external hazards listed in Section 1. Refer to Attachment 3, Sketch 1M-6 for a diagram of the flowpath and equipment utilized to facilitate this water supply. The diesel engine driven FLEX SW pump will be transported from the HCGS Unit 2 reactor building to a location west of the auxiliary building. A hard suction hose will be routed from the pump suction to the river where water will be drawn through a strainer(s) sized to allow the required flowrate while limiting debris to prevent damage to the AFW pump. A discharge hose will be routed from the diesel engine driven FLEX SW pump discharge to two new, diversely located, connections on the SW nuclear headers.

Water from the river can be pumped through the SW system to provide a direct suction source to the TDAFW pump or FLEX AFW pump. Water from the river can also be pumped to the Spent Fuel Pool as described in Section 5.2. The diesel engine driven FLEX SW pump is preliminarily sized to provide a minimum of 700 gpm to AFW, 80 gpm for RCS inventory makeup and 200 gpm for Spent Fuel Pool make-up simultaneously to both units. As indicated in the sequence of events discussed in Section 1 and Attachment 1A, the back-up supply of SG injection water will be made available prior to the depletion of Phase 1 water supply to the suction of the TDAFW pump, which would occur no sooner than 12 hours after the ELAP/LUHS initiation. Hydraulic analysis of the flowpath from the river through the SW system and to the various users (TDAFW pump, SFP, etc.) will be performed to confirm that applicable performance requirements are met.

## Section 2 - Maintain Core Cooling and Heat Removal

### 2.2 - PWR Portable Equipment Phase 2

The above water supply strategy can be implemented following all applicable BDBEEs except the hurricane induced flooding event. Due to the duration the site would be inundated from the flooding (approximately 12 hours), an alternate strategy is used for this condition. During a flood on-site, the available water storage tanks could fail and the water supply to the TDAFW pump would become unavailable prior to deploying the diesel driven FLEX SW pump at the Delaware River. During a flooding event, the turbine building will flood and fill with a sufficient volume of water to supply the AFW pumps until the flood waters recede and the diesel driven FLEX SW pump can be deployed at the Delaware River.

Two redundant submersible pumps with strainer(s) will be pre-staged in the lowest elevation of the turbine building with the discharge piping routed to the demineralized water line that currently feeds the TDAFW pumps. This pipe is routed below grade in the turbine building and is not susceptible to hurricane wind induced missiles. The pumps could take suction from either the strainer or the condenser hotwells as shown on Attachment 3, Sketch CM-1. The appropriate valve lineup can be established by an operator from a location above the maximum flood elevation. The submersible pumps are preliminarily sized at 350 gpm to supply either the TDAFW pump or the FLEX AFW pump. Electrical power supply for the submersible pumps is discussed in Section 6.2.

As discussed above, an indefinite water supply strategy for supply to the AFW system can be employed following the applicable BDBEEs. PSEG will also implement other plant modifications shown on Attachment 3, Sketches 1M-6, CM-1 and CM-8 to provide a supply of higher quality water to the AFW system, if available. After declaration of an ELAP/LUHS, operators will assess the condition of available water supply sources across the site and use the highest quality water available for injection to the SGs through the TDAFW pump or the FLEX AFW pump.

<u>Water Injection</u>

The pre-staged, motor-driven FLEX AFW pump will provide a back-up SG injection method in the event that the TDAFW pump can no longer perform its function due to low turbine inlet steam flow from the SGs. The minimum required SG injection flowrate after one hour is 300 gpm at 300 psig to support reactor core cooling and decay heat removal. The FLEX AFW pump will be pre-staged in the auxiliary building near the system connection established for discharge to the SG (described below). Hose will be routed from the pump suction to the AFW suction line (Attachment 3, Sketch 1M-6). The FLEX AFW pump discharge is connected with hose to a permanent connection point downstream of the TDAFW pump discharge check valve and to the SFP as discussed in Section 5.2. Electrical power supply for the FLEX AFW pump is discussed in Section 6.2.

<u>Connections</u>

- The hose connections to the SW headers will be diversely located to assure the applicable hazard would not cause damage to both.
- The pre-staged submersible pump and associated piping and valves will be located below plant grade within the turbine building and would not be susceptible to hurricane wind induced missiles.
- The remaining connections will be located in the hardened seismic class 1 auxiliary building.

| Section 2 - Maintain Core Cooling and Heat Removal | |
|---|---|
| **2.2 - PWR Portable Equipment Phase 2** | |
| PSEG is continuing to assess the capability of on-site tanks to withstand the effects of BDBEEs, and the core cooling and heat removal requirements should the reactor be taken offline prior to the onset of the hurricane event. If changes are required to the Phase 2 strategy as a result of these assessments, they will be provided in a six-month status report. | |
| **Details:** | |
| **Provide a brief description of Procedures / Strategies / Guidelines** | *Confirm that procedure/guidance exists or will be developed to support implementation* |
| SGS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs. | |
| **Identify modifications** | *List modifications* |
| **<u>Water Supply – Delaware River</u>**<br>• Installation of a permanent, above grade, hose connection on both the 11 and 12 Nuclear Service Water headers external to the auxiliary building and above grade.<br><br>**<u>Water Supply – Turbine Building</u>**<br>• Installation of a permanent hose connection on the condenser hotwell drain valves.<br>• Installation of a stand pipe with three-way valve and hose connections for the suction of the submersible pumps.<br>• Modify the existing demineralized water line to the AFW pumps for the discharge from the submersible pumps. This includes installation of a by-pass line with appropriate valve configuration.<br>• Installation of a permanent strainer cage for the submersible pumps in the turbine building.<br><br>**<u>Water Injection – FLEX AFW Pump</u>**<br>• Installation of a permanent connection and valve configuration on the suction header for 11, 12 and 13 AFW pumps.<br>• Installation of a permanent connection on the outlet header piping from the 13 TDAFW pump.<br><br>**<u>Water Supply – Other Sources</u>**<br>The below modifications allow the use of higher quality sources of water prior to injecting river water in the SGs. These modifications are not credited in the coping strategy outlined above.<br>• Installation of a permanent hose connection on the Primary Water Storage Tank drain valves.<br>• Installation of a permanent wall penetration/pipe sleeve on the west wall of the auxiliary building near the truck bay. | |
| **Key Reactor Parameters** | *List instrumentation credited or recovered for this coping evaluation.* |
| See the list of key parameters provided in Section 2.1, Phase 1 Maintain Core Cooling and Heat Removal. | |

| Section 2 - Maintain Core Cooling and Heat Removal | |
|---|---|
| **2.2 - PWR Portable Equipment Phase 2** | |
| **Storage / Protection of Equipment :<br>Describe storage / protection plan or schedule to determine storage requirements** | |
| **Seismic** | *List how equipment is protected or schedule to protect* |
| The FLEX pumps, necessary hoses and fittings are protected from seismic events while stored in the Hope Creek Unit 2 reactor building or pre-staged in protected areas of the plant. | |
| **Flooding**<br>Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level | *List how equipment is protected or schedule to protect* |
| The FLEX pumps, necessary hoses and fittings are protected from flooding events while stored in the Hope Creek Unit 2 reactor building or pre-staged in protected areas of the plant. | |
| **Severe Storms with High Winds** | *List how equipment is protected or schedule to protect* |
| The FLEX pumps, necessary hoses and fittings are protected from severe storms with high wind events while stored in the Hope Creek Unit 2 reactor building or pre-staged in protected areas of the plant. | |
| **Snow, Ice, and Extreme Cold** | *List how equipment is protected or schedule to protect* |
| The FLEX pumps, necessary hoses and fittings are protected from snow, ice and extreme cold events while stored in the Hope Creek Unit 2 reactor building or pre-staged in protected areas of the plant. | |
| **High Temperatures** | *List how equipment is protected or schedule to protect* |
| The FLEX pumps, necessary hoses and fittings are protected from high temperature events while stored in the Hope Creek Unit 2 reactor building or pre-staged in protected areas of the plant. | |

| Section 2 - Maintain Core Cooling and Heat Removal | | |
|---|---|---|
| **2.2 - PWR Portable Equipment Phase 2** | | |
| **Deployment Conceptual Modification (Attachment 3 contains Conceptual Sketches)** | | |
| **Strategy** | **Modifications** | **Protection of connections** |
| *Identify Strategy including how the equipment will be deployed to the point of use.* | *Identify modifications (Detailed description of Modifications provided above)* | *Identify how the connection is protected* |
| **<u>Water Supply – Delaware River</u>**<br><br>The diesel engine driven FLEX SW pump will be transported from the Hope Creek Unit 2 reactor building to a location north of the existing service water intake structure. A hard suction hose will be routed from the pump suction to the river where water will be drawn through a strainer sized to allow the required flowrate while limiting debris to prevent damage to the AFW pump.<br><br>The diesel driven FLEX SW pump is a trailer-mounted, diesel engine driven centrifugal pump that will be stored in the Hope Creek Unit 2 reactor building. The pump will be deployed by towing the trailer to a designated location west of the auxiliary building. One end of a length of hose, equipped with a strainer(s), will be lowered into the river below the water surface, and the other end will be attached to the pump suction via quick-connect hose connection. A discharge hose will be routed from the diesel engine driven FLEX SW pump discharge to two diversely located new connections on the SW nuclear headers. | • Installation of a permanent above grade hose connection on both the 11 and 12 Nuclear Service Water headers external to the auxiliary building. | One hose connection will be provided on each of the two SW nuclear headers. The connections will be diversely located from one another. |
| **<u>Water Supply – Turbine Building</u>**<br><br>Submersible pumps with strainer will be deployed to elevation 84 ft. of the turbine building prior to a hurricane event. Permanently installed discharge piping with isolation valves will be | • Installation of a permanent hose connection on condensate pump suction line drain valves.<br>• Installation of a stand pipe with three-way valve and hose connections for the suction of the submersible pumps. | The submersible pumps and associated piping and valves will be located below grade in the turbine building and will not be susceptible to |

| Section 2 - Maintain Core Cooling and Heat Removal | | |
|---|---|---|
| **2.2 - PWR Portable Equipment Phase 2** | | |
| routed to the demineralized water line that currently feeds the TDAFW pumps.<br><br>The pump could take suction from either the strainer or the condenser hotwells as shown on Attachment 3, Sketch CM-1. Hoses with quick disconnect fittings will be routed from the existing 8 inch drain valves on the condensate pump suction piping.<br><br>The valves aligning the condensate pump suction to the submersible pump will be opened prior to the flood. An operator, from a location above the maximum flood elevation, through the use of reach rods, will be able to perform all other alignments. Electrical power connection for the FLEX submersible pump is discussed in Section 6.2. | • Modify the existing demineralized water line to the AFW pumps to support the operation of the submersible pumps.<br>• Installation of a permanent strainer cage for the submersible pump in the turbine building. | hurricane wind induced missiles. |
| **Water Injection – FLEX AFW Pump**<br><br>The pre-staged, motor-driven FLEX AFW pump will provide a back-up SG injection method in the event that the TDAFW pump could no longer function. The FLEX AFW pump will be pre-staged in the auxiliary building near the 11/12 AFW pumps on the 84 ft. elevation. Hose will be routed from the pump suction to the AFW suction line (Attachment 3, Sketch 1M-3). The FLEX AFW pump discharge will be connected with hose to a permanent connection downstream of the discharge check valve on the TDAFW pump and to the SFP as discussed in Section 5.2. Electrical power connection for the FLEX AFW pump is discussed in Section 6.2. | • Installation of a permanent connection and valve configuration on the suction header for 11, 12 and 13 AFW pumps.<br>• Installation of a permanent connection on the outlet header piping from the 13 TDAFW pump. | Piping connections for the FLEX AFW pump will be located within the seismic class I, missile protected auxiliary building. Therefore the connections will be protected from the external hazards described in Section 1. |
| **Notes:**<br>None. | | |

## Section 2 - Maintain Core Cooling and Heat Removal

### 2.3 - PWR Portable Equipment Phase 3

*Provide a general description of the coping strategies using phase 3 equipment including modifications that are proposed to maintain core cooling. Identify methods and strategy(ies) utilized to achieve this coping time.*

The Phase 3 coping strategy relies on one large generator per unit providing enough electrical power to the required safeguards equipment. Core cooling will be continued via the diesel driven FLEX SW pump (augmented by additional capacity from the RRC) that will be providing water from the UHS through the SW nuclear header for as long as required. The TDAFW pump or the FLEX AFW pump will provide SG make-up as long as required. When RRC water treatment equipment arrives on site, demineralized water for the SG makeup can be established.

**Details:**

| **Provide a brief description of Procedures / Strategies / Guidelines** | *Confirm that procedure/guidance exists or will be developed to support implementation* |
|---|---|
| SGS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs. | |
| **Identify modifications** | *List modifications* |
| See modifications identified in Section 6.3, Phase 3 Safety Function Support (Electrical). | |
| **Key Reactor Parameters** | *List instrumentation credited or recovered for this coping evaluation.* |
| See the list of key parameters provided in Section 2.1, Phase 1 Maintain Core Cooling and Heat Removal. | |

**Deployment Conceptual Modification**
**(Attachment 3 contains Conceptual Sketches)**

| **Strategy** | **Modifications** | **Protection of connections** |
|---|---|---|
| *Identify Strategy including how the equipment will be deployed to the point of use.* | *Identify modifications (Detailed description of Modifications provided above)* | *Identify how the connection is protected* |
| See deployment strategies identified in Section 6.3, Phase 3 Safety Function Support (Electrical). | | |

**Notes:**
None.

## Section 3 – RCS Inventory Control

### 3.1 - PWR Installed Equipment Phase 1

**Determine Baseline coping capability with installed coping[2] modifications not including FLEX modifications, utilizing methods described in Table 3-2 of NEI 12-06:**

- **Low Leak RCP Seals or RCS makeup required**
- **All Plants Provide Means to Provide Borated RCS Makeup**

*Provide a general description of the coping strategies using installed equipment including modifications that are proposed to maintain core cooling. Identify methods (Low Leak RCP Seals and/or borated high pressure RCS makeup)and strategy(ies) utilized to achieve this coping time.*

With an ELAP/LUHS the plant staff will implement a strategy for maintaining RCS inventory during plant stabilization and subsequent RCS cooldown and associated depressurization activities. In general, the Phase 1 FLEX strategy for RCS inventory control / reactivity management relies on RCP seal leakage being sufficiently low for initial control of RCS inventory for the first 16 hours of an ELAP / LUHS event. The RCS responses were evaluated using a generic Westinghouse unit assuming RCP seal leakage of 21 gpm per pump, which indicated that natural circulation flow could be sustained for approximately 16 hours.

**Details:**

| | |
|---|---|
| **Provide a brief description of Procedures / Strategies / Guidelines** | *Confirm that procedure/guidance exists or will be developed to support implementation* |
| SGS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs. | |
| **Identify modifications** | *List modifications* |
| No modifications are required. | |
| **Key Reactor Parameters** | *List instrumentation credited for this coping evaluation.* |
| See the list of key parameters provided in Section 2.1, Phase 1 Maintain Core Cooling and Heat Removal. | |

**Notes:**
None.

[2] Coping modifications consist of modifications installed to increase initial coping time, i.e. generators to preserve vital instruments or increase operating time on battery powered equipment.

## Section 3 – RCS Inventory Control

### 3.2 - PWR Portable Equipment Phase 2

*Provide a general description of the coping strategies using on-site portable equipment including modifications that are proposed to maintain core cooling. Identify methods(Low Leak RCP Seals and/or borated high pressure RCS makeup)and strategy(ies) utilized to achieve this coping time.*

In order to ensure RCS inventory and reactivity controls are maintained, borated water will be added to the RCS. For reactivity control, the maximum borated water volume of 11,500 gallons at a boron concentration of 2300 ppm will be injected from the RWST starting at approximately 8 hours after an event to ensure Keff is maintained at less than 0.99 for a RCS temperature of approximately 425 deg F. As RCS pressure and RCP seal leakage decrease, borated water requirements will decrease.

The primary strategy is to use the installed charging pumps re-powered from the 460 VAC vital bus from the FLEX generator to supply borated water using the existing installed flow paths. Alternatively, a pre-staged, electric powered, FLEX charging pump will be available to supply the borated water to the RCS. The FLEX charging pump will be capable of providing a flow rate of 40 gpm.

Borated water is available from the refueling water storage tank (RWST) using installed piping. The RWST is seismically qualified, but located outside and vulnerable to externally generated missiles and wave action during the hurricane event. Should a loss of inventory occur in either unit's RWST, the discharge of the opposite unit's charging pump can be aligned to provide injection to both unit's RCS using installed piping.

In addition, sufficient quantities of borated water are available in the Boric Acid Storage Tanks, located in the missile and flood protected auxiliary building. If required, the boric acid transfer pumps or a small FLEX boric acid transfer pump can be used to transfer this inventory to the suction of the charging pump or FLEX charging pump using installed piping.

In the event of a hurricane and for long term borated water preparation, a temporary trailer mounted mixing tank with a positive displacement pump and heater will be moved to the flood protected truck bay in the auxiliary building. A portable hose will be used to supply water from the temporary mixing tank's pump to the suction of the charging pump or FLEX charging pump.

**Details:**

| **Provide a brief description of Procedures / Strategies / Guidelines** | *Confirm that procedure/guidance exists or will be developed to support implementation* |
|---|---|

SGS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.

| **Identify modifications** | *List modifications* |
|---|---|

- Installation of a permanent connection to the suction inlet of the 1/2CVE22 charging pumps.
- Installation of a permanent connection downstream of 1AF72 to supply water from the fresh water storage tank, turbine building submersible FLEX pump, or diesel driven FLEX SW pump to the FLEX charging pump.

| Section 3 – RCS Inventory Control | |
|---|---|
| **3.2 - PWR Portable Equipment Phase 2** | |
| • Installation of a permanent connection downstream of 11SW161 to supply water from the service water system to the FLEX mixing tank.<br>• Installation of a permanent connection upstream of the 1SJ12/13 valves to inject borated water from the FLEX charging pump.<br>• Installation of a permanent connection downstream of 1WR122 to supply water from the primary water storage tank.<br>• Installation of a cooling line from the output of the charging pumps to the drain connection that supplies the charging pump component cooling lines.<br>• Installation of permanent hose connections on the drain valves for either the No.11 or 12 Boric Acid Storage Tanks.<br>• Installation of a permanent connection between the CV41 and CV42 to supply borated water to the charging pump from the FLEX boric acid transfer pump. | |
| **Key Reactor Parameters** | *List instrumentation credited or recovered for this coping evaluation.* |
| See the list of key parameters provided in Section 2.1, Phase 1 Maintain Core Cooling and Heat Removal. | |
| **Storage / Protection of Equipment :**<br>**Describe storage / protection plan or schedule to determine storage requirements** | |
| **Seismic** | *List how equipment is protected or schedule to protect* |
| The FLEX pumps, necessary hoses and fittings will be protected from seismic events while stored in the Hope Creek Unit 2 reactor building or pre-staged in protected areas of the plant. | |
| **Flooding**<br>Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level | *List how equipment is protected or schedule to protect* |
| The FLEX pumps, necessary hoses and fittings will be protected from flooding events while stored in the Hope Creek Unit 2 reactor building or pre-staged in protected areas of the plant. | |
| **Severe Storms with High Winds** | *List how equipment is protected or schedule to protect* |
| The FLEX pumps, necessary hoses and fittings will be protected from severe storms with high wind events while stored in the Hope Creek Unit 2 reactor building or pre-staged in protected areas of the plant. | |
| **Snow, Ice, and Extreme Cold** | *List how equipment is protected or schedule to protect* |
| The FLEX pumps, necessary hoses and fittings will be protected from snow, ice and extreme cold events while stored in the Hope Creek Unit 2 reactor building or pre-staged in protected areas of the plant. | |
| **High Temperatures** | *List how equipment is protected or schedule to protect* |
| The FLEX pumps, necessary hoses and fittings will be protected from high temperature events while stored in the Hope Creek Unit 2 reactor building or pre-staged in protected areas of the plant. | |

| Section 3 – RCS Inventory Control | | |
|---|---|---|
| **3.2 - PWR Portable Equipment Phase 2** | | |
| **Deployment Conceptual Modification (Attachment 3 contains Conceptual Sketches)** | | |
| **Strategy** | **Modifications** | **Protection of connections** |
| *Identify Strategy including how the equipment will be deployed to the point of use.* | *Identify modifications (Detailed description of Modifications provided above)* | *Identify how the connection is protected* |
| **<u>Water Source – RWST (Same Unit)</u>**<br>The primary strategy is to use the installed charging pump powered from the 460 VAC vital bus, which will be in turn powered from the 480 VAC FLEX generator as discussed in Section 6.2. Borated water will be supplied from the RWST using existing installed piping. | • Installation of a cooling line from the output of the charging pump to the drain connection that supplies the charging pump component cooling lines. | Piping connections for the charging pump cooling line will be located within the seismic class I, missile protected auxiliary building. Therefore the connections will be protected from the external hazards described in Section 1. |
| **<u>Water Source – RWST (Opposite Unit)</u>**<br>The secondary strategy is to use the installed charging pump from the opposite unit to supply borated water to both units. The pump is powered from the 460 VAC vital bus, which will be in turn powered from the 480 VAC FLEX generator as discussed in Section 6.2. Borated water will be supplied from the opposite unit's RWST using existing installed piping. | • Installation of a cooling line from the output of the charging pumps to the drain connection that supplies the charging pump component cooling lines. | Piping connections for the charging pump cooling line will be located within the seismic class I, missile protected auxiliary building. Therefore the connections will be protected from the external hazards described in Section 1. |
| **<u>Water Source – Boric Acid Storage Tanks</u>**<br>An additional strategy is to use the existing boric acid storage tanks (normally maintained at greater than 6600 gallons at a boron concentration of 6950 ppm per unit). A small FLEX boric acid positive displacement pump will be required to bypass the installed boric acid transfer pumps. The pump and hoses will be pre-staged for deployment in the auxiliary building. | • Installation of permanent hose connections on the drain valve for either the No.11 or 12 Boric Acid Storage Tanks.<br>• Installation of a permanent connection between the CV41 and CV42 to supply borated water to the charging pump.<br>• Installation of a 5 hp positive displacement pump with hose connections to pump between the Boric Acid Storage Tanks and | Piping connections for the FLEX boric acid pump will be located within the seismic class I, missile protected auxiliary building. Therefore the connections will be protected from the external hazards described in Section |

| Section 3 – RCS Inventory Control | | |
|---|---|---|
| **3.2 - PWR Portable Equipment Phase 2** | | |
| Power to the pump is discussed in Section 6.2. | between the CV41 and CV42. | 1. |
| **<u>Water Source – FLEX Mixing Tank</u>**<br>A long term borated water source will include a 1000 gallon trailer mounted mixing tank with agitator and positive displacement pump will be used to supply either the installed or FLEX charging pumps. Prior to a hurricane event, the trailer mounted FLEX mixing tank will be moved from its normal protected storage location at HCGS Unit 2 reactor building into the flood protected truck bay in the SGS auxiliary building.<br><br>Water could be supplied to the FLEX mixing tank from a number of sources discussed above via hose connections. Ultimately, river water from the diesel driven FLEX SW pump could supply water to the FLEX mixing tank. | • Power supply to the FLEX mixing tank is discussed in Section 6.2. | Piping connections for the FLEX mixing tank will be located within the seismic class I, missile protected auxiliary building. Therefore the connections will be protected from the external hazards described in Section 1. |
| **<u>Water Injection – FLEX Charging Pump</u>**<br>The pre-staged, motor-driven FLEX charging pump will provide a back-up RCS injection method in the event that the charging pump can no longer function. The FLEX charging pump will be pre-staged in the auxiliary building. Temporary hose with a quick disconnects will be routed from the pump suction to the charging pump suction line (Attachment 3, Sketch 1M-3). The FLEX charging pump discharge will be permanently piped (with removable spool piece) to a point upstream of the 1SJ12/13 valves. When required, the pre-staged spool piece will be installed to complete the piping lineup. Electrical power connection for the FLEX charging pump is discussed in Section 6.2. | • Installation of a permanent connection to the suction inlet of the 1/2CVE22 charging pumps.<br>• Installation of a permanent connection upstream of the 1SJ12/13 valves to inject borated water from the FLEX charging pump. | Piping connections for the FLEX charging pump will be located within the seismic class I, missile protected auxiliary building. Therefore the connections will be protected from the external hazards described in Section 1. |
| **Notes:**<br>None. | | |

## Section 3 – RCS Inventory Control

### 3.3 - PWR Portable Equipment Phase 3

*Provide a general description of the coping strategies using phase 3 equipment including modifications that are proposed to maintain core cooling. Identify methods (Low Leak RCP Seals and/or borated high pressure RCS makeup)and strategy(ies) utilized to achieve this coping time.*

The Phase 3 coping strategy relies on one large generator per unit providing enough electrical power to the required safeguards equipment. The charging pump or the FLEX charging pump can provide RCS Inventory Control as long as required. When RRC water treatment equipment arrives on site higher quality water for the RCS make-up can be established.

**Details:**

| | |
|---|---|
| **Provide a brief description of Procedures / Strategies / Guidelines** | *Confirm that procedure/guidance exists or will be developed to support implementation* |

SGS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.

| | |
|---|---|
| **Identify modifications** | *List modifications* |

See modifications identified in Section 6.3, Phase 3 Safety Function Support (Electrical).

| | |
|---|---|
| **Key Reactor Parameters** | *List instrumentation credited or recovered for this coping evaluation.* |

See the list of key parameters provided in Section 2.1, Phase 1 Maintain Core Cooling and Heat Removal.

**Deployment Conceptual Modification**
**(Attachment 3 contains Conceptual Sketches)**

| **Strategy** | **Modifications** | **Protection of connections** |
|---|---|---|
| *Identify Strategy including how the equipment will be deployed to the point of use.* | *Identify modifications (Detailed description of Modifications provided above)* | *Identify how the connection is protected* |

See deployment conceptual modification described in Section 6.3, Phase 3 Safety Function Support (Electrical).

**Notes:**
None.

## Section 4 –Maintain Containment

### 4.1 - PWR Installed Equipment Phase 1

**Determine Baseline coping capability with installed coping[3] modifications not including FLEX modifications, utilizing methods described in Table 3-2 of NEI 12-06:**

- Containment Spray
- Hydrogen igniters (ice condenser containments only)

**PWR Installed Equipment Phase 1:**

*Provide a general description of the coping strategies using installed equipment including modifications that are proposed to maintain containment. Identify methods (containment spray/Hydrogen igniter) and strategy(ies) utilized to achieve this coping time.*

Since the containment temperature and pressure response will be slow, operator actions to reduce containment pressure and temperature will not be required during Phase 1.

**Details:**

| | |
|---|---|
| **Provide a brief description of Procedures / Strategies / Guidelines** | *Confirm that procedure/guidance exists or will be developed to support implementation* |
| Not Applicable. | |
| **Identify modifications** | *List modifications* |
| None Required. | |
| **Key Containment Parameters** | |
| See the list of key parameters provided in Section 2.1, Phase 1 Maintain Core Cooling and Heat Removal. | |

**Notes:**
None.

[3] Coping modifications consist of modifications installed to increase initial coping time, i.e. generators to preserve vital instruments or increase operating time on battery powered equipment.

| Section 4 –Maintain Containment | |
|---|---|
| **4.2 - PWR Installed Equipment Phase 2** | |
| *Provide a general description of the coping strategies using on-site portable equipment including modifications that are proposed to maintain core cooling. Identify methods (containment spray/hydrogen igniters) and strategy(ies) utilized to achieve this coping time.*<br><br>Since the containment temperature and pressure response will be slow, operator actions to reduce containment pressure and temperature will not be required during Phase 2 following the ELAP event initiation. Assessment of the existing 16 hour SBO analysis reflects that SGS can wait until Phase 3 to establish containment cooling. PSEG will perform further containment analysis to demonstrate that containment integrity can be maintained up until a point in time when containment cooling can be restored during Phase 3. | |
| **Details:** | |
| **Provide a brief description of Procedures / Strategies / Guidelines** | *Confirm that procedure/guidance exists or will be developed to support implementation* |
| Not Applicable. | |
| **Identify modifications** | *List modifications* |
| None Required. | |
| **Key Containment Parameters** | *List instrumentation credited or recovered for this coping evaluation.* |
| See the list of key parameters provided in Section 2.1, Phase 1 Maintain Core Cooling and Heat Removal. | |
| **Storage / Protection of Equipment :**<br>**Describe storage / protection plan or schedule to determine storage requirements** | |
| **Seismic** | *List how equipment is protected or schedule to protect* |
| Not Required for Phase 2. | |
| **Flooding**<br>Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level. | *List how equipment is protected or schedule to protect* |
| Not Required for Phase 2. | |
| **Severe Storms with High Winds** | *List how equipment is protected or schedule to protect* |
| Not Required for Phase 2. | |
| **Snow, Ice, and Extreme Cold** | *List how equipment is protected or schedule to protect* |
| Not Required for Phase 2. | |

| Section 4 –Maintain Containment | | |
|---|---|---|
| **4.2 - PWR Installed Equipment Phase 2** | | |
| **High Temperatures** | *List how equipment is protected or schedule to protect* | |
| Not Required for Phase 2. | | |
| **Deployment Conceptual Design (Attachment 3 contains Conceptual Sketches)** | | |
| **Strategy** | **Modifications** | **Protection of connections** |
| Not required for Phase 2. | | |
| **Notes:**<br>None. | | |

## Section 4 –Maintain Containment

### 4.3 - PWR Portable Equipment Phase 3

*Provide a general description of the coping strategies using phase 3 equipment including modifications that are proposed to maintain core cooling. Identify methods (containment spray/hydrogen igniters) and strategy(ies) utilized to achieve this coping time.*

The Phase 3 coping strategy relies on one large generator per unit providing enough electrical power to the required safeguards equipment. The generator will be used to re-power containment cooling through the use of the installed Containment Fan Coil Units and Delaware River water supplied through the service water system as described in Section 2.2, Phase 2 Maintain Core Cooling and Heat Removal. In addition to the Phase 2 FLEX pumps, supplemental pumping capability will be supplied from the RRC to support this function.

PSEG will perform further containment analysis to demonstrate that containment integrity can be maintained up until a point in time when containment cooling can be restored during Phase 3. Assessment of the existing 16 hour SBO analysis reflects that SGS can wait until Phase 3 to establish containment cooling. SGS will implement resources received from the RRC to provide power to the containment ventilation system thereby ensuring pressure control in containment.

Alternative methods to control containment atmosphere are described in SH.OP-AM.TSC-0001, Supplemental Severe Accident Management Guidelines, which provides temporary chiller units to enhance Containment Fan Coil Unit capability. The temporary chiller units and associated pumps could be deployed per existing Technical Support Center guidelines and could use the SW piping connections described Section 2.2, Phase 2 Core Cooling.

**Details:**

| | |
|---|---|
| **Provide a brief description of Procedures / Strategies / Guidelines** | *Confirm that procedure/guidance exists or will be developed to support implementation* |

SGS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.

| | |
|---|---|
| **Identify modifications** | *List modifications* |

See modifications identified in Section 6.3, Phase 3 Safety Function Support (Electrical).

| | |
|---|---|
| **Key Containment Parameters** | *List instrumentation credited or recovered for this coping evaluation.* |

See the list of key parameters provided in Section 2.1, Phase 1 Maintain Core Cooling and Heat Removal.

**Deployment Conceptual Design**
**(Attachment 3 contains Conceptual Sketches)**

| Strategy | Modifications | Protection of connections |
|---|---|---|
| *Identify Strategy including how the equipment will be deployed to the point of use.* | *Identify modifications* | *Identify how the connection is protected* |

See deployment conceptual modification described in Section 6.3, Phase 3 Safety Function Support (Electrical).

**Notes:**
None.

| Section 5 - Maintain Spent Fuel Pool Cooling | |
|---|---|
| **5.1 - PWR Installed Equipment Phase 1** | |
| **Determine Baseline coping capability with installed coping[4] modifications not including FLEX modifications, utilizing methods described in Table 3-2 of NEI 12-06:**<br>• **Makeup with Portable Injection Source** | |
| *Provide a general description of the coping strategies using installed equipment including modifications that are proposed to maintain spent fuel pool cooling. Identify methods (makeup with portable injection source)and strategy(ies) utilized to achieve this coping time.*<br><br>There are no Phase 1 actions required at this time that need to be addressed. The SFP will not require makeup during Phase 1 as discussed in Section 5.2. | |
| **Details:** | |
| **Provide a brief description of Procedures / Strategies / Guidelines** | |
| Not Applicable. | |
| **Identify any equipment modifications** | |
| None Required. | |
| **Key SFP Parameter** | |
| See SGS Response to NRC Order EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation. | |
| **Notes:**<br>None. | |

[4] Coping modifications consist of modifications installed to increase initial coping time, i.e. generators to preserve vital instruments or increase operating time on battery powered equipment.

## Section 5 - Maintain Spent Fuel Pool Cooling

### 5.2 - PWR Portable Equipment Phase 2

*Provide a general description of the coping strategies using on-site portable equipment including modifications that are proposed to maintain spent fuel pool cooling. Identify methods (makeup with portable injection source)and strategy(ies) utilized to achieve this coping time.*

The SFP makeup requirements during ELAP events are based on the maximum design basis heat load in the spent fuel pool. The maximum boil off rate for a full core offload is less than 100 gpm. Assuming the technical specification minimum SFP water level, fuel uncovery would not occur for over 44 hours without fuel pool makeup flow.

<u>Water Source</u>
The water sources described in Sections 2.2 and 3.2 could also be aligned to provide make-up to the SFP as shown on Attachment 3, Sketches 1M-2 and 1M-6. Ultimately, an adequate supply of water pumped from the Delaware River is available to assure the SFP level is controlled to maintain inventory.

<u>Water Injection</u>
The diesel driven FLEX SW pump deployed to the Delaware River and the motor driven AFW FLEX pump located in the auxiliary building, as described in Section 2.2, could be aligned to provide makeup to the SFP through the piping configurations discussed in Section 2.2. A new stand pipe with appropriate valve configuration, spray nozzle and hose discharge connection will be permanently installed at each SFP with an inlet connection located in the auxiliary building or mechanical penetration area.

Even in under the most conservative full core offload heat load conditions, operators will have sufficient time to arrange for SFP makeup from the various FLEX sources.

**Schedule:**

| **Provide a brief description of Procedures / Strategies / Guidelines** | *Confirm that procedure/guidance exists or will be developed to support implementation* |
|---|---|

SGS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.

| **Identify modifications** | *List modifications* |
|---|---|

- A new stand pipe with appropriate valve configuration, spray nozzle and hose discharge connection will be permanently installed at each SFP with an inlet connection located in the auxiliary building.

| **Key SFP Parameter** | |
|---|---|

See SGS Response to NRC Order EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation.

**Storage / Protection of Equipment :**
**Describe storage / protection plan or schedule to determine storage requirements**

| **Seismic** | *List how equipment is protected or schedule to protect* |
|---|---|

The FLEX pumps, necessary hoses and fittings are protected from seismic events while stored in the Hope Creek Unit 2 reactor building or pre-staged in protected areas of the plant.

| Section 5 - Maintain Spent Fuel Pool Cooling | |
|---|---|
| **5.2 - PWR Portable Equipment Phase 2** | |
| **Flooding**<br>Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level. | *List how equipment is protected or schedule to protect* |
| The FLEX pumps, necessary hoses and fittings are protected from flooding events while stored in the Hope Creek Unit 2 reactor building or pre-staged in protected areas of the plant. | |
| **Severe Storms with High Winds** | *List how equipment is protected or schedule to protect* |
| The FLEX pumps, necessary hoses and fittings are protected from severe storms with high wind events while stored in the Hope Creek Unit 2 reactor building or pre-staged in protected areas of the plant. | |
| **Snow, Ice, and Extreme Cold** | *List how equipment is protected or schedule to protect* |
| The FLEX pumps, necessary hoses and fittings are protected from snow, ice and extreme cold events while stored in the Hope Creek Unit 2 reactor building or pre-staged in protected areas of the plant. | |
| **High Temperatures** | *List how equipment is protected or schedule to protec*t |
| The FLEX pumps, necessary hoses and fittings are protected from high temperature events while stored in the Hope Creek Unit 2 reactor building or pre-staged in protected areas of the plant. | |

| Deployment Conceptual Design (Attachment 3 contains Conceptual Sketches) | | |
|---|---|---|
| **Strategy** | **Modifications** | **Protection of connections** |
| *Identify Strategy including how the equipment will be deployed to the point of use.* | *Identify modifications (Detailed description of Modifications provided above)* | *Identify how the connection is protected* |
| Deployment of FLEX pumps is discussed in Section 2.2. A temporary hose will be connected when required from the discharge header of the appropriate FLEX pump to the SFP stand pipe. | A new stand pipe with appropriate valve configuration, spray nozzle and hose discharge connection will be permanently installed at each SFP with an inlet connection located in the auxiliary building or mechanical penetration area. | Piping connections for the SFP stand pipe will be located within the seismic class I, missile protected auxiliary building or mechanical penetration area. Therefore the connections will be protected from the external hazards described in Section 1. |
| **Notes:**<br>None. | | |

## Section 5 - Maintain Spent Fuel Pool Cooling

### 5.3 -PWR Portable Equipment Phase 3

*Provide a general description of the coping strategies using phase 3 equipment including modifications that are proposed to maintain spent fuel pool cooling. Identify methods (makeup with portable injection source)and strategy(ies) utilized to achieve this coping time.*

The Phase 3 coping strategy relies on one large generator per unit providing enough electrical power to the required safeguards equipment. The generator will be used to initiate SFP cooling using the component cooling system and a SFP pump. The component cooling system will be cooled via river water pumped through the SW nuclear header from the diesel driven FLEX SW pumps (augmented by additional capacity from the RRC) for as long as required, as described in Section 2.2.

**Schedule:**

| **Provide a brief description of Procedures / Strategies / Guidelines** | *Confirm that procedure/guidance exists or will be developed to support implementation* |
|---|---|

SGS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.

| **Identify modifications** | *List modifications* |
|---|---|

See the list of modifications described in Section 6.3, Phase 3 Safety Function Support (Electrical).

| **Key SFP Parameter** | |
|---|---|

See SGS Response to NRC Order EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation.

**Deployment Conceptual Design**
**(Attachment 3 contains Conceptual Sketches)**

| **Strategy** | **Modifications** | **Protection of connections** |
|---|---|---|
| *Identify Strategy including how the equipment will be deployed to the point of use.* | *Identify modifications* | *Identify how the connection is protected* |

See deployment conceptual modification described in Section 6.3, Phase 3 Safety Function Support (Electrical).

**Notes:**
None.

| Section 6 - Safety Functions Support (Electrical) | |
|---|---|
| **Determine Baseline coping capability with installed coping[5] modifications not including FLEX modifications.** | |
| **6.1 - PWR Installed Equipment Phase 1** | |
| *Provide a general description of the coping strategies using installed equipment including station modifications that are proposed to maintain and/or support safety functions. Identify methods and strategy(ies) utilized to achieve coping times.*<br><br>Maintaining power to necessary instrumentation and equipment is needed to successfully implement the planned FLEX strategy. SGS relies on station batteries to power instrumentation necessary to implement the initial activities of the Phase 1 coping strategy.<br><br><u>DC Power</u><br>The following coping strategy is implemented to increase usable battery life to provide power to the vital 125 VDC and 28 VDC busses for instrumentation and other vital loads during Phase 1. Non-essential loads will be removed from the busses in order to extend their availability. These load shedding actions will be completed during the first 30 minutes of the event in accordance with S1.OP-AB.LOOP-0001 and will extend the battery life to a minimum 4 hours of operation for either unit.<br><br>Battery life will be extended through a deep load shedding on each battery. With this deep load shedding strategy, it is expected that the station batteries can be extended through Phase 1 and do not require portable supplemental charging before 4 hours for the most limiting battery. Additional formal analysis will be performed to determine if additional load shedding strategies can extend this duration. If analysis results require a change in strategy, that change will be communicated in a six-month status report.<br><br>Prior to depletion of the usable battery power, a Phase 2 strategy to use portable DGs to provide power to the "A" 460 VAC vital bus and the battery chargers for the "A", "B" and "C" 125 VDC and "A" 28 VDC vital buses per unit will be implemented. | |
| **Details:** | |
| **Provide a brief description of Procedures / Strategies / Guidelines** | *Confirm that procedure/guidance exists or will be developed to support implementation.* |
| Following recognition of an ELAP condition, procedures will direct the operators to initiate load shedding of all non-essential DC loads and battery backed AC loads after the unit is stabilized. | |
| **Identify modifications** | *List modifications and describe how they support coping time.* |
| No modifications are required for Phase 1. | |
| **Key Parameters** | *List instrumentation credited for this coping evaluation phase.* |
| See the list of key parameters provided in Section 2.1, Phase 1 Maintain Core Cooling and Heat Removal. | |
| **Notes:**<br>None. | |

[5] Coping modifications consist of modifications installed to increase initial coping time, i.e. generators to preserve vital instruments or increase operating time on battery powered equipment.

## Section 6 - Safety Functions Support (Electrical)

## 6.2 - PWR Portable Equipment Phase 2

*Provide a general description of the coping strategies using on-site portable equipment including station modifications that are proposed to maintain and/or support safety functions. Identify methods and strategy(ies) utilized to achieve coping times.*

Maintaining power to necessary instrumentation and equipment, and providing means to repower equipment is needed to successfully implement the planned FLEX strategy. SGS relies on station batteries to power instrumentation and equipment necessary to implement the initial activities of the Phase 1 coping strategy. Prior to depletion of the usable battery power, portable DGs will be deployed to provide power to vital 230/460 VAC busses.

Deployment of the 240 VAC FLEX DG is sufficient to power needed instrumentation and motor operated valves. The 480 VAC FLEX DG will power the 480 VAC FLEX switchgear located in the auxiliary building truck bay and loads distributed from that location. The 240 VAC FLEX DG also allows for recharging of the batteries in addition to other AC loads.

**<u>240 VAC Diesel Generator</u>**
The portable 240 VAC DGs will be deployed from the HCGS Unit 2 reactor building FLEX storage location to a location north of the service building. Power extension cables will be directly routed from the DG to the 230 VAC SBO battery charger receptacles (four per unit, eight total) located at elevation 84 ft. of the auxiliary building. Alternatively, the four existing SBO cables can be utilized to run power from the portable DGs from a connection on the service building wall through the SBO cables to the SBO receptacles. An electrical one-line diagram is provided in Attachment 3, Sketch E-1.

In the event of a hurricane, the DGs and cabling will be pre-staged on the auxiliary building roof prior to the event. Power extension cables will be run through stairwells from the roof location to the SBO battery charger receptacles in the auxiliary building. An additional cable will be routed through stairwells to the submersible FLEX pumps (see Section 2.2) in the turbine building.

When the DGs are connected to the SBO battery charger receptacles, and appropriate breaker alignment completed, the portable generators may be started to power vital instrumentation and 230 VAC motor operated valves.

**<u>480 VAC Switchgear and Diesel Generator</u>**
The strategy for providing 480 VAC power to FLEX equipment and the "A" 460 VAC vital bus includes the use of portable 480 VAC FLEX DGs and a permanently installed 480 VAC FLEX switch gear panel in the auxiliary building truck bay.

The portable 480 VAC FLEX DGs and necessary connecting power cables will be transported from the HCGS Unit 2 reactor building storage location to their deployed positions near the auxiliary building truck bay. The 480 VAC FLEX switchgear panel will be mounted on the west end of the truck bay in the seismic class I auxiliary building. Receptacles will be provided at the ground level truck bay location and on the roof of the auxiliary building to connect the power cables from the DGs. In the event of a hurricane, the DGs will be pre-staged prior to the event on the auxiliary building roof near the receptacle feeding the 480 VAC FLEX switchgear. An electrical one-line diagram is provided in Attachment 3, Sketch E-1.

The 480 VAC FLEX switchgear panel will include motor starters appropriately sized for the various motor driven pumps required in the FLEX coping strategies. A breaker will be provided to supply power to the "A"

**Section 6 - Safety Functions Support (Electrical)**

**6.2 - PWR Portable Equipment Phase 2**

460 VAC vital bus. Each of the 480 VAC FLEX switchgear panel branches will terminate to receptacles located in the truck bay. Power extension cables will be routed as needed to the "A" 460 VAC vital bus and FLEX equipment deployed in the auxiliary building.

**Details:**

| | |
|---|---|
| **Provide a brief description of Procedures / Strategies / Guidelines** | *Confirm that procedure/guidance exists or will be developed to support implementation with a description of the procedure / strategy / guideline.* |

SGS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.

| | |
|---|---|
| **Identify modifications** | *List modifications necessary for phase 2* |

**<u>480 VAC DG Power Distribution</u>**

- Install two sets of 480 VAC FLEX switchgear (one per unit) in the auxiliary building truck bay. Power will be fed to the 480 VAC FLEX switchgear from the 480 VAC FLEX DGs through permanently installed receptacles in the truck bay. The 480 VAC FLEX switchgear will include breakers and motor starters routed to receptacles in the truck bay to power FLEX equipment and back-feed the "A" 460 VAC vital bus through extension cables.
- Install auxiliary building roof receptacle, and cable in conduit routed to the 480 VAC FLEX switchgear for the alternate staging location of the 480 VAC DGs.

**<u>480 VAC "A" Vital Bus</u>**

- An existing spare breaker will be hard wired to a receptacle to allow connection from the 480 VAC FLEX switchgear.

**<u>230 VAC DG Power Distribution</u>**

- Modify existing external SBO 230 VAC connection to allow installation of an alternate connection point from the auxiliary building roof.

| | |
|---|---|
| **Key Parameters** | *List instrumentation credited or recovered for this coping evaluation.* |

See the list of key parameters provided in Section 2.1, Phase 1 Maintain Core Cooling and Heat Removal.

**Storage / Protection of Equipment :**
**Describe storage / protection plan or schedule to determine storage requirements**

| | |
|---|---|
| **Seismic** | *List how equipment is protected or schedule to protect* |

The FLEX DGs, necessary cables and connectors will be protected from seismic events while stored in the HCGS Unit 2 reactor building or pre-staged in protected areas of the plant.

| | |
|---|---|
| **Flooding**<br>Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level. | *List how equipment is protected or schedule to protect* |

The FLEX DGs, necessary cables and connectors will be protected from flooding events while pre-staged above the design basis flood height at diverse locations on the auxiliary building roof, or pre-staged in protected areas of the plant or the HCGS Unit 2 reactor building.

| Section 6 - Safety Functions Support (Electrical) | | |
|---|---|---|
| **6.2 - PWR Portable Equipment Phase 2** | | |
| **Severe Storms with High Winds** | *List how equipment is protected or schedule to protect* | |
| The FLEX DGs, necessary cables and connectors will be protected from severe storms with high winds while stored in the HCGS Unit 2 reactor building or pre-staged in protected areas of the plant. | | |
| **Snow, Ice, and Extreme Cold** | *List how equipment is protected or schedule to protect* | |
| The FLEX DGs, necessary cables and connectors will be protected from snow, ice and extreme cold while stored in the HCGS Unit 2 reactor building or pre-staged in protected areas of the plant. | | |
| **High Temperatures** | *List how equipment is protected or schedule to protect* | |
| The FLEX DGs, necessary cables and connectors will be protected from high temperatures while stored in the HCGS Unit 2 reactor building or pre-staged in protected areas of the plant. | | |
| **Deployment Conceptual Design (Attachment 3 contains Conceptual Sketches)** | | |
| **Strategy** | **Modifications** | **Protection of connections** |
| *Identify Strategy including how the equipment will be deployed to the point of use.* | *Identify modifications* | *Identify how the connection is protected* |
| To operate the charging pump and boric acid transfer pump used for RCS inventory control (see Section 3.2), the "A" 460 VAC vital bus must be energized. Temporary extension cable will be routed from the auxiliary building truck bay to the switchgear room on elevation 84 ft. | • Install receptacle at the "A" 460 VAC Vital Bus Switchgear.<br>• Install 480 VAC FLEX Switchgear, breaker and receptacle in truck bay.<br>• Install permanent hardened connections for the 480 VAC DG on the auxiliary building roof. | The 480 VAC FLEX switchgear and receptacles will be located within the seismic class I, missile protected auxiliary building. Therefore the connections will be protected from the external hazards described in Section 1. |
| <u>Instrumentation and Controls</u><br>To recharge the batteries associated with the "A" 28 VDC, "A", "B", "C" 125 VDC vital batteries and power the corresponding 230 VAC vital buses to provide instrumentation discussed in Section 2.1, a 240 VAC FLEX DG will be deployed to either a location north of the service building or pre-staged on the auxiliary building roof.<br><br><u>Motor Operated Valves</u><br>Once powered, the 230 VAC vital buses can supply power to MOVs as required. | • Modify the SBO extension cables to provide connection for the 240 VAC FLEX DG.<br>• Install permanent hardened connections for the 240 VAC DG on the auxiliary building roof. | The 230 VAC SBO receptacles are located within the seismic class I, missile protected auxiliary building. Therefore the connections are protected from the external hazards described in Section 1. |

| Section 6 - Safety Functions Support (Electrical) | | |
|---|---|---|
| **6.2 - PWR Portable Equipment Phase 2** | | |
| The FLEX charging pump, described in Section 3.2, will be powered from a temporary extension cable routed from the auxiliary building truck bay to the pump location on elevation 84 ft. of the auxiliary building. | • Install 480 VAC FLEX Switchgear, motor starter and receptacle in truck bay. | The 480 VAC FLEX switchgear receptacle for this pump will be located within the seismic class I, missile protected auxiliary building. Therefore the connections will be protected from the external hazards described in Section 1. |
| The FLEX AFW pump, described in Section 2.2, will be powered from a temporary extension cable routed from the auxiliary building truck bay to the pump location on elevation 84 ft. of the auxiliary building. | • Install 480 VAC FLEX Switchgear, motor starter and receptacle in truck bay. | The 480 VAC FLEX switchgear receptacle for this pump will be located within the seismic class I, missile protected auxiliary building. Therefore the connections will be protected from the external hazards described in Section 1. |
| The FLEX trailer mounted mixing tank, heater and pump, described in Section 3.2, will be powered from a temporary extension cable routed from the auxiliary building truck bay to the trailer. The trailer will be pre-staged in the truck bay or deployed just outside, depending on the initiating event. | • Install 480 VAC FLEX Switchgear, motor starter and receptacle in truck bay. | The 480 VAC FLEX switchgear receptacle for this equipment will be located within the seismic class I, missile protected auxiliary building. Therefore the connections will be protected from the external hazards described in Section 1. |
| The FLEX boric acid transfer pump, described in Section 3.2, will be powered from a temporary extension cable routed from the auxiliary building truck bay to the pump location in the auxiliary building. | • Install 480 VAC FLEX Switchgear, motor starter and receptacle in truck bay. | The 480 VAC FLEX switchgear receptacle for this pump will be located within the seismic class I, missile protected auxiliary building. Therefore the connections will be protected from the external hazards described in Section 1. |
| The FLEX diesel fuel oil pump, as described in Section 7.2, will be powered from a temporary extension cable routed from the auxiliary building truck bay to the pump location in the auxiliary building. | • Install 480 VAC FLEX Switchgear, motor starter and receptacle in truck bay. | The 480 VAC FLEX switchgear receptacle for this pump will be located within the seismic class I, missile protected auxiliary building. Therefore the connections will be protected from the external hazards described in Section 1. |

| Section 6 - Safety Functions Support (Electrical) | | |
|---|---|---|
| **6.2 - PWR Portable Equipment Phase 2** | | |
| The FLEX Turbine Building submersible pump discussed in Section 2.2 will be powered from the 240 VAC FLEX DG located on the auxiliary building roof during a flooding event. Prior to the storm, temporary power cabling will be routed from the roof through the service building stairwell to the pump location. | • No modifications are required. | There are no permanent FLEX electrical connections associated with this strategy. |
| **Notes:**<br>None. | | |

| Section 6 - Safety Functions Support (Electrical) | | |
|---|---|---|
| **6.3 - PWR Portable Equipment Phase 3** | | |
| *Provide a general description of the coping strategies using phase 3 equipment including modifications that are proposed to maintain and/or support safety functions. Identify methods and strategy(ies) utilized to achieve coping times.*<br>The Phase 3 coping strategy is to establish the necessary long-term electrical capacity to meet all FLEX strategy needs until such time that normal power to the site can be restored. This is accomplished by the utilization of one 4.16 kV AC portable DG per unit provided by the RRC. This 4.16 kV DG will be used to power one of the A/B/C 4KV Vital Buses. | | |
| **Details:** | | |
| **Provide a brief description of Procedures / Strategies / Guidelines** | *Confirm that procedure/guidance exists or will be developed to support implementation with a description of the procedure / strategy / guideline.* | |
| SGS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs. | | |
| **Identify modifications** | *List modifications necessary for phase 3* | |
| Procure a specialized 4.16 kV switchgear truck (power connection truck). The truck is designed to be racked into a spare 4.16 kV switchgear cubicle and is equipped with 4.16 kV quick disconnected terminals. | | |
| **Key Parameters** | *List instrumentation credited or recovered for this coping evaluation.* | |
| See the list of key parameters provided in Section 2.1, Phase 1 Maintain Core Cooling and Heat Removal. | | |
| **Deployment Conceptual Design**<br>**(Attachment 3 contains Conceptual Sketches)** | | |
| **Strategy** | **Modifications** | **Protection of connections** |
| *Identify Strategy including how the equipment will be deployed to the point of use.* | *Identify modifications* | *Identify how the connection is protected* |
| Two 4.16 kV RRC generators, one for each unit, are stationed near the auxiliary building truck bay. A 4.16 kV extension cable is run from each generator to the vital 4.16 kV switchgear in each unit at the 64 ft. elevation. A power connection truck is racked into a spare cubicle in one of the 4.16 kV vital buses in each unit. After connecting the cables, one 4.16 kV vital bus can be powered up in each unit. | • Modify a spare 4.16 kV cubicle to ensure the power connection truck physically racks into place.<br>• Modify and test the 4.16 kV protective relaying to ensure the power connection truck operates reliably. | The 4.16 kV switchgear is located in a safety related structure and is protected from all BDBEEs. The power connection truck will be safely stored in the same safety related structure as the switchgear. |
| **Notes:**<br>None. | | |

## Section 7 - Safety Functions Support (Other)

**Determine Baseline coping capability with installed coping[6] modifications not including FLEX modifications.**

### 7.1 - PWR Installed Equipment Phase 1

*Provide a general description of the coping strategies using installed equipment including station modifications that are proposed to maintain and/or support safety functions. Identify methods and strategy(ies) utilized to achieve coping times.*

**MCR Environmental Conditions**

Shortly after the onset of an SBO, station operators will block open Main Control Room (MCR) doors in accordance with S1.OP-AB.LOOP-0001. These actions will prevent MCR temperatures from rising above 110 deg F until Phase 2 actions can be implemented. Additional formal analysis will be performed to support this assessment. If analysis results require a change in strategy, that change will be communicated in a six-month status report.

**TDAFW Room Environmental Conditions**

Procedure S1.OP-AB.LOOP-0001 directs station operators to prop open the TDAFW room doors to establish natural circulation immediately after the loss of offsite power condition is determined to mitigate room temperature rise. TDAFW room temperatures are not expected to exceed the equipment limitations during Phase 1. Additional formal analysis of the TDAFW room will be performed to assure that these areas remain accessible and temperatures are within the equipment functional limitations. If changes to the Phase 1 strategy are required as a result of the analysis they will be provided in a six-month status report.

**Battery Rooms Environmental Conditions**

Battery room temperatures and hydrogen levels are not expected to exceed the equipment limitations during Phase 1. Hydrogen generation is only a concern when batteries are charging, and therefore hydrogen generation will not occur during Phase 1. Additional formal analysis of the battery rooms will be performed to assure that these areas remain accessible and temperatures are within the equipment functional limitations. If changes to the Phase 1 strategy are required as a result of the analysis they will be provided in a six-month status report.

**Ventilation**

No forced ventilation is expected to be required during Phase 1 as described above for each area. Plant doors may be opened as necessary to provide additional ventilation.

**Lighting**

Lighting is required for operator actions and access in the plant to implement actions associated with the SBO procedure. Emergency lighting is provided by local battery-powered emergency lighting and the availability of this lighting is at least 8 hours.

**Communications**

See letter from PSEG to NRC dated February 21, 2013.

[6] Coping modifications consist of modifications installed to increase initial coping time, i.e. generators to preserve vital instruments or increase operating time on battery powered equipment.

| **<u>Diesel Fuel</u>**<br><br>No portable equipment is used in Phase 1; therefore no refueling is needed. | |
|---|---|
| **Details:** | |
| **Provide a brief description of Procedures / Strategies / Guidelines** | *Confirm that procedure/guidance exists or will be developed to support implementation.* |
| SGS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs. | |
| **Identify modifications** | *List modifications and describe how they support coping time.* |
| None required. | |
| **Key Parameters** | *List instrumentation credited for this coping evaluation phase.* |
| See the list of key parameters provided in Section 2.1, Phase 1 Maintain Core Cooling and Heat Removal. | |
| **Notes:**<br>None. | |

## Section 7 - Safety Functions Support (Other)

### 7.2 - PWR Portable Equipment Phase 2

*Provide a general description of the coping strategies using on-site portable equipment including station modifications that are proposed to maintain and/or support safety functions. Identify methods and strategy(ies) utilized to achieve coping times.*

Portable equipment in Phase 2 is required to support continued strategies from Phase 1 and includes ventilation, lighting, air/gas supplies for operation of valves and charging pump control, communication equipment, and fuel. Each of these is discussed below relative to the Phase 2 coping time.

**Gas Supply for Pneumatic Valves**

In Phase 2, the SG PORV nitrogen bottles will be changed out with replacement bottles, if required. The system will be designed to allow for replacement of nitrogen bottles without interruption to the gas supply. Additional formal analysis of the nitrogen quantities required for Phase 1 and 2 operations will be performed to assure that on site quantities are sufficient for at least 72 hours. If changes are required to the Phase 2 strategy as a result of the analysis, they will be provided in a six-month status report.

**MCR Environmental Conditions**

In Phase 2, supplemental ventilation is provided for the operators in the Main Control Room using portable fans for air circulation as necessary to maintain a temperature below 110°F. Portable fans would be powered by the FLEX portable diesel generator. Circulation can be established from outdoors by propping open the doors at the either end of the service building, the doors in and out of the stairwell and the MCR room doors. Additional formal analysis will be performed to determine the timing and scope of the supplemental cooling, or heating required, and the results of this analysis will be provided in a six-month status report.

**TDAFW Room Environmental Conditions**

The strategy for maintaining the environment of the TDAFW room is the same as in Phase 1. If required, the TDAFW room is provided with supplemental ventilation using portable fans to lower the room temperature. Portable fans will be powered by the FLEX diesel generator. Additional formal analysis will be performed to determine the timing and scope of the supplemental cooling required, and the results of this analysis will be provided in a six-month status report.

**Battery Rooms Environmental Conditions**

In Phase 2 Battery room cooling and hydrogen ventilation may be required. Portable fans, if required, are placed outside the battery room doors to circulate air through the rooms for cooling and to mitigate hydrogen buildup. Additional formal analysis will be performed to determine the timing and scope of the supplemental cooling or hydrogen ventilation required, and the results of this analysis will be provided in a six-month status report.

**Ventilation**

Ventilation for the TDAFW Room, battery rooms, inner and outer penetrations, auxiliary building and Main Control Room will be provided as needed from portable fans that are powered from the FLEX diesel generator. Plant doors may be opened as necessary to provide additional ventilation.

**Lighting**

Control Room emergency lighting will be available because the 125 VDC system will have power supplied to the battery chargers from the FLEX diesel generator.

Portable lights will be available for use in areas that require operator access to perform Phase 2 equipment

| Section 7 - Safety Functions Support (Other) | |
|---|---|
| **7.2 - PWR Portable Equipment Phase 2** | |
| connections. These lights will either be battery powered, or will be capable of being powered by the FLEX DGs.<br><br>**<u>Communications</u>**<br><br>See letter from PSEG to NRC dated February 21, 2013.<br><br>**<u>Diesel Fuel</u>**<br><br>Portable equipment used in Phase 2 will be equipped with fuel storage tanks sufficient for at least 24 hours of operation without refueling to minimize actions required to keep equipment running. A fuel line will be routed from the diesel fuel oil storage tank (DFOST) room in the auxiliary building to elevation 100 ft. and the roof of the auxiliary building for refueling of FLEX equipment. A small motor driven FLEX diesel fuel oil transfer pump will be used to pump diesel fuel oil from either 30,000 gallon DFOST to each elevation. Equipment operators can fill equipment through hose runs or portable containers. | |
| **Details:** | |
| **Provide a brief description of Procedures / Strategies / Guidelines** | *Confirm that procedure/guidance exists or will be developed to support implementation with a description of the procedure / strategy / guideline.* |
| SGS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs. | |
| **Identify modifications** | *List modifications necessary for phase 2* |
| • Modification required providing a fuel line with isolation valves at auxiliary building elevation 100 ft (truck bay area) and roof.<br>• Install permanent hose disconnect fittings on the DFOST drain valves. | |
| **Key Parameters** | *List instrumentation credited or recovered for this coping evaluation.* |
| See the list of key parameters provided in Section 2.1, Phase 1 Maintain Core Cooling and Heat Removal. | |
| **Storage / Protection of Equipment :**<br>**Describe storage / protection plan or schedule to determine storage requirements** | |
| **Seismic** | *List how equipment is protected or schedule to protect* |
| The FLEX support equipment is protected from seismic events while stored in the Hope Creek Unit 2 reactor building or pre-staged in protected areas of the plant. | |
| **Flooding**<br>Note: if stored below current flood level, then ensure procedures exist to move equipment prior to exceeding flood level. | *List how equipment is protected or schedule to protect* |
| The FLEX support equipment is protected from flooding events while stored in the Hope Creek Unit 2 reactor building or pre-staged in protected areas of the plant. | |
| **Severe Storms with High Winds** | *List how equipment is protected or schedule to protect* |
| The FLEX support equipment is protected from severe storms with high wind events while stored in the Hope Creek Unit 2 reactor building or pre-staged in protected areas of the plant. | |

<table>
<tr><td colspan="3">Section 7 - Safety Functions Support (Other)</td></tr>
<tr><td colspan="3">7.2 - PWR Portable Equipment Phase 2</td></tr>
<tr><td>Snow, Ice, and Extreme Cold</td><td colspan="2">List how equipment is protected or schedule to protect</td></tr>
<tr><td colspan="3">The FLEX support equipment is protected from snow, ice and extreme cold events while stored in the Hope Creek Unit 2 reactor building or pre-staged in protected areas of the plant.</td></tr>
<tr><td>High Temperatures</td><td colspan="2">List how equipment is protected or schedule to protect</td></tr>
<tr><td colspan="3">The FLEX support equipment is protected from high temperature events while stored in the Hope Creek Unit 2 reactor building or pre-staged in protected areas of the plant.</td></tr>
<tr><td colspan="3">Deployment Conceptual Design<br>(Attachment 3 contains Conceptual Sketches)</td></tr>
<tr><td>Strategy</td><td>Modifications</td><td>Protection of connections</td></tr>
<tr><td>Identify Strategy including how the equipment will be deployed to the point of use.</td><td>Identify modifications</td><td>Identify how the connection is protected</td></tr>
<tr><td>Compressed gas bottles will be deployed when a reduction in system pressure is identified. Bottles are moved from the designated storage areas to the connection point.</td><td>• No modifications are required to deploy the nitrogen bottles.</td><td>The nitrogen connections are located in the seismic class I auxiliary building or mechanical penetration area.</td></tr>
<tr><td>Diesel fuel will be pumped, when required, from the DFOST to each elevation where diesel equipment is in use. Operators will fill fuel tanks using portable containers or hoses as required. A small FLEX diesel fuel oil pump will be connected from a DFOST drain valve to the new fuel line using quick disconnect hoses (Attachment 3, Sketch CM-7).</td><td>• Modification required providing a fuel line with isolation valves at auxiliary building elevation 100 ft (truck bay area) and roof.<br>• Install permanent hose disconnect fittings on the DFOST drain valves.</td><td>The fuel oil tanks and associated pumps and piping are located in the seismic class I auxiliary building.</td></tr>
<tr><td>Portable ventilation equipment will be deployed within the auxiliary building.</td><td>• No modifications are required to deploy portable ventilation equipment.</td><td>Portable ventilation does not require a hard connection.</td></tr>
<tr><td colspan="3">Notes:<br>None.</td></tr>
</table>

<table>
<tr><td colspan="3">Section 7 - Safety Functions Support (Other)</td></tr>
<tr><td colspan="3">7.3 - PWR Portable Equipment Phase 3</td></tr>
<tr><td colspan="3">Provide a general description of the coping strategies using phase 3 equipment including modifications that are proposed to maintain and/or support safety functions. Identify methods and strategy(ies) utilized to achieve coping times.<br><br>Phase 3 portable equipment is to be supplied by the Regional Response Center. As part of Phase 3 portable equipment, consumables such as diesel fuel and nitrogen will be provided to support continued implementation of FLEX strategies.</td></tr>
<tr><td colspan="3">Details:</td></tr>
<tr><td>Provide a brief description of Procedures / Strategies / Guidelines</td><td colspan="2">Confirm that procedure/guidance exists or will be developed to support implementation with a description of the procedure / strategy / guideline.</td></tr>
<tr><td colspan="3">SGS will utilize the industry developed guidance from the Owners Groups, EPRI and NEI Task team to develop site specific procedures or guidelines to address the criteria in NEI 12-06. These procedures and/or guidelines will support the existing symptom based command and control strategies in the current EOPs.</td></tr>
<tr><td>Identify modifications</td><td colspan="2">List modifications necessary for phase 3</td></tr>
<tr><td colspan="3">No additional modifications are required beyond what has been discussed previously.</td></tr>
<tr><td>Key Parameters</td><td colspan="2">List instrumentation credited or recovered for this coping evaluation.</td></tr>
<tr><td colspan="3">See the list of key parameters provided in Section 2.1, Phase 1 Maintain Core Cooling and Heat Removal.</td></tr>
<tr><td colspan="3">Deployment Conceptual Design<br>(Attachment 3 contains Conceptual Sketches)</td></tr>
<tr><td>Strategy</td><td>Modifications</td><td>Protection of connections</td></tr>
<tr><td>Identify Strategy including how the equipment will be deployed to the point of use.</td><td>Identify modifications</td><td>Identify how the connection is protected</td></tr>
<tr><td>Installed diesel fuel oil transfer pumps will be used to move fuel from the fuel storage tanks to portable tanks as required.<br><br>RRC equipment may be used to deliver diesel fuel to the portable diesel-driven equipment.</td><td>None.</td><td>Installed pumps and connections are located inside seismic class I areas.</td></tr>
<tr><td colspan="3">Notes:<br>None.</td></tr>
</table>

| **PWR Portable Equipment Phase 2** | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Use and (potential / flexibility) diverse uses* | | | | | | *Performance Criteria[(a)]* | *Maintenance* |
| *List portable equipment[(b)]* | Core | Containment | SFP | Instrumentation | Accessibility | | Maintenance / PM requirements |
| (1) 460 VAC Diesel Driven Generator | X | | X | X | X | 500 KW | Will follow EPRI template requirements |
| (1) 230 VAC Diesel Driven Generator | X | | | X | | 120 KW | Will follow EPRI template requirements |
| (1) 2500 gpm Diesel Driven FLEX SW pump | X | | X | | | 2500 gpm @ 200 psig | Will follow EPRI template requirements |
| (1) 230VAC submersible pump | X | | | | | 350 gpm @ 50 psig | Will follow EPRI template requirements |
| (1) FLEX Charging Pump - 460 VAC motor and pump | X | | X | | | 40 gpm @ 1600 psig | Will follow EPRI template requirements |
| (1) FLEX AFW Pump - 460 VAC motor and pump | X | | X | | | 350 gpm @ 350 psig | Will follow EPRI template requirements |
| (1) FLEX motor driven diesel fuel oil pump | X | | X | X | | 1 hp | Will follow EPRI template requirements |
| (2) Truck or Bulldozer | | | | | X | Sufficient combined capability to clear debris and snow, perform minor earthwork, transport equipment and material. | Will follow EPRI template requirements |

a) Performance criteria are estimates and will be finalized through formal analysis.

b) Quantities presented are on a per unit basis and do not account for N+1 requirements.

| PWR Portable Equipment Phase 3 | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Use and (potential / flexibility) diverse uses* | | | | | | *Performance Criteria* | *Notes* |
| *List portable equipment* | Core | Containment | SFP | Instrumentation | Accessibility | | |
| (1) 4160 VAC Diesel Driven Generator | X | X | X | X | X | Sufficient capacity to support one division of safeguards equipment. | Will follow EPRI template requirements |
| (1) 2500 gpm Diesel Driven Pump | X | X | X | | | 2500 gpm @ 200 psig | Will follow EPRI template requirements |
| (1) Water Treatment Unit | X | | X | | | Sufficient capacity to support RCS and SFP makeup. | Will follow EPRI template requirements |

| Phase 3 Response Equipment/Commodities | |
|---|---|
| **Item** | **Notes** |
| **Radiation Protection Equipment**<br>• Survey instruments<br>• Dosimetry<br>• Off-site monitoring/sampling | |
| **Commodities**<br>• Food<br>• Potable water | |
| **Fuel Requirements**<br>• Diesel Fuel | |
| **Heavy Equipment**<br>• Transportation equipment<br>• Debris clearing equipment | |

## Attachment 1A
## Sequence of Events Timeline

| Action Item | Elapsed Time | Action | Time Constraint (Y/N)[7] | Remarks / Applicability |
|---|---|---|---|---|
| 0 | 0 | Event Starts | N/A | Plant @ 100% power |
| 1 | 0 sec | TDAFW Pump Start Initiation | N | Standard station trip response. |
| 2 | 1 min | EDGs failed to start.<br>Enter 1-EOP-LOPA-1, Loss of all AC Power. | N | Current SBO event response. |
| 3 | 10 min | Begin DC load shedding on 125 VDC vital busses IAW S1.OP-AB.LOOP-0001. | Y | Current LOOP event response. |
| 4 | 15 min | Control SG and RCS level with TDAFW pump. | N | Current SBO event response. |
| 5 | 15 min | Loss of AFST Inventory Identified<br>Provide suction from DWST or pre-staged turbine building submersible FLEX pumps. | Y | NEI 12-06, 3.2.1.7<br>WCAP 17601 (SG Dryout) |
| 6 | 30 min | SBO DG failed to start. | N | Current SBO event response. |
| 7 | 30 min | Complete DC load shedding on 125 VDC vital busses IAW S1.OP-AB.LOOP-0001. | Y | NEI 12-06, 3.2.1.7 |
| 8 | 30 min | IAW S1.OP-AB.LOOP-0001, block open doors in the MCR and the TDAFW pump rooms. | Y | NEI 12-06, 3.2.1.7 |
| 9 | 55 min | Alternate suction source aligned to TDAFW pump and supplying AFW to SGs | Y | NEI 12-06, 3.2.1.7<br>WCAP 17601 (SG Dryout) |
| 10 | 1 hr | ELAP Declared<br>Attempts to start EDGs are unsuccessful, determination made that it will take > 4 hours to restore power via "normal" means. | N | Future Revision to SBO Procedure to enter ELAP |
| 11 | 2 hrs | Initiate RCS cooldown | Y | WCAP 17601 |
| 12 | ~ 4 hrs | Target SG pressure reached for RCS cooldown | Y | WCAP 17601 |
| 13 | < 4 hrs | 240 VAC FLEX DG deployed and providing power to 28 VDC and 125 VDC battery chargers | Y | NEI 12-06, 3.2.1.7 |

[7] Instructions: Provide justification if No or NA is selected in the remark column
If yes include technical basis discussion as requires by NEI 12-06 section 3.2.1.7

# Attachment 1A
# Sequence of Events Timeline

| | | | | |
|---|---|---|---|---|
| 14 | < 6 hrs | 480 VAC FLEX DG deployed and providing power to FLEX switchgear panel | Y | NEI 12-06, 3.2.1.7 |
| 15 | 6 hrs | Assess borated water inventory and prepare for RCS injection per Section 3.2 | Y | NEI 12-06, 3.2.1.7 |
| 16 | 7 hrs | "A" 460 VAC Vital Bus powered from FLEX switchgear panel | Y | NEI 12-06, 3.2.1.7 |
| 17 | ~ 8 hrs | Begin RCS makeup to restore inventory and ensure sub-criticality using installed charging pump | Y | WCAP 17601 |
| 18 | 8 hrs | Prepare FLEX charging pump as backup to the installed charging pump if required. | N | Backup strategy |
| 19 | < 12 hrs | Diesel driven FLEX SW pump deployed at river, SW header pressurized and aligned to AFW pump (Non-Flood) | Y | NEI 12-06, 3.2.1.7 |
| 20 | 16 hrs | Prepare FLEX AFW pump as backup to TDAFW if required. | N | Backup strategy |
| 21 | ~ 24 hrs | Diesel driven FLEX SW pump deployed at river and SW header pressurized (Flood) | Y | NEI 12-06, 3.2.1.7 |
| 22 | 24 hrs | Preferred water source for SFP makeup identified and aligned for refill using FLEX pump. | Y | NEI 12-06, 3.2.1.7 |
| 23 | >72 hrs | Phase 3 coping equipment (e.g., 4.16 kV DG, diesel driven pumps, water treatment equipment, etc.) from the RRC is deployed and functional. Phase 3 coping strategies are initiated to maintain containment integrity and establish indefinite coping capability. | Y | NEI 12-06, 3.2.1.7 |

# Attachment 1B
# NSSS Significant Reference Analysis Deviation Table

| Item | Parameter of interest | WCAP value (WCAP-17601-P August 2012 Revision 0) | WCAP page | Plant applied value | Gap and discussion |
|---|---|---|---|---|---|
| | No Deviations. | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

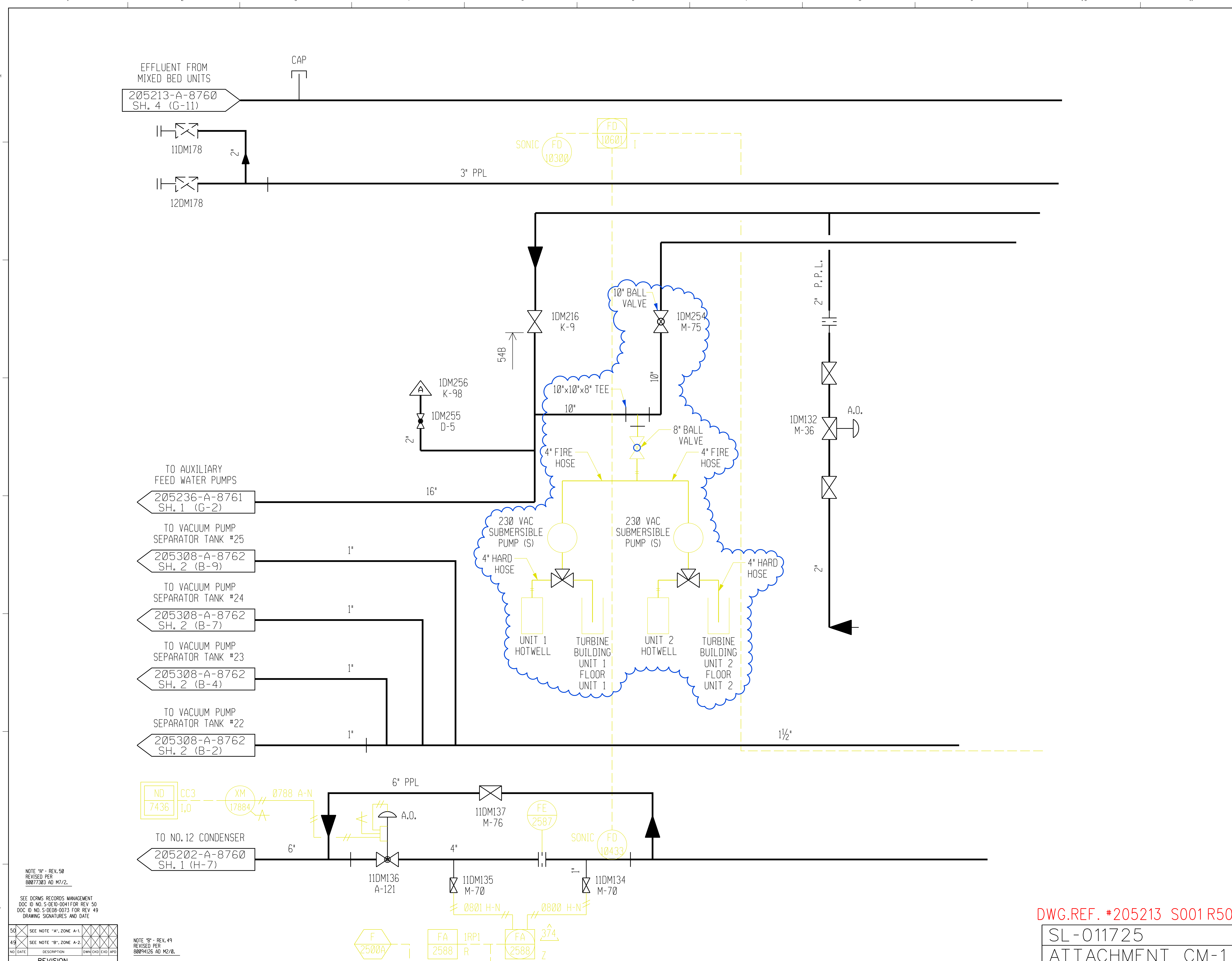
# Attachment 2
# Milestone Schedule

| Task | Feb-13 | Mar-13 | Apr-13 | May-13 | Jun-13 | Jul-13 | Aug-13 | Sep-13 | Oct-13 | Nov-13 | Dec-13 | Jan-14 | Feb-14 | Mar-14 | Apr-14 | May-14 | Jun-14 | Jul-14 | Aug-14 | Sep-14 | Oct-14 | Nov-14 | Dec-14 | Jan-15 | Feb-15 | Mar-15 | Apr-15 | May-15 | Jun-15 | Jul-15 | Aug-15 | Sep-15 | Oct-15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 Month Status Update | | | | | | | ■ | | | | | | ■ | | | | | | ■ | | | | | | ■ | | | | | | ■ | | |
| Submit Integrated Plan | ■ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Develop Strategies | ■ | ■ | ■ | ■ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Develop Mods | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | | | | | | | | | | | | | | | | | |
| Implement Mods | | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Perform Staffing Analysis | | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | | | | | | | | | | | | | | | | | |
| Develop Training Plan | | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | | | | | | | | | | | |
| Implement Training | | | | | | | | | | | | | | | | | | ■ | ■ | ■ | | | | | | | | | | | | | |
| Develop FSGs | | | | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | | | | | | | | | | | | | | | | | |
| Develop Strategies/Contract with RRC | | | | | | ■ | ■ | ■ | ■ | | | | | | | | | | | | | | | | | | | | | | | | |
| Procure Equipment | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | | | | | | | | | | | | | | | | | |
| Create Maintenance Procedures | | | | | | | | | | | ■ | ■ | ■ | ■ | ■ | ■ | | | | | | | | | | | | | | | | | |
| SGS1 Refueling Outage* | | | ■ | | | | | | | | | | | | | | | | | | ■ | | | | | | | | | | | | |
| SGS2 Refueling Outage* | | | | | | | | | | | | | | | ■ | | | | | | | | | | | | | | | | | | ■ |

*(Full compliance after second listed refueling outage)

# Attachment 3
# Conceptual Sketches

**List of Attachments**




NOTE "A" - REV. 50
REVISED PER
80077303 AD M7/2.

SEE DCRMS RECORDS MANAGEMENT
DOC ID NO. S-DE10-0041 FOR REV 50
DOC ID NO. S-DE08-0073 FOR REV 49
DRAWING SIGNATURES AND DATE

| NO | DATE | DESCRIPTION | DWN | CKD | EXD | APD |
|---|---|---|---|---|---|---|
| 50 | | SEE NOTE "A", ZONE A-1. | | | | |
| 49 | | SEE NOTE "B", ZONE A-2. | | | | |

REVISION

NOTE "B" - REV. 49
REVISED PER
80094126 AD M2/0.

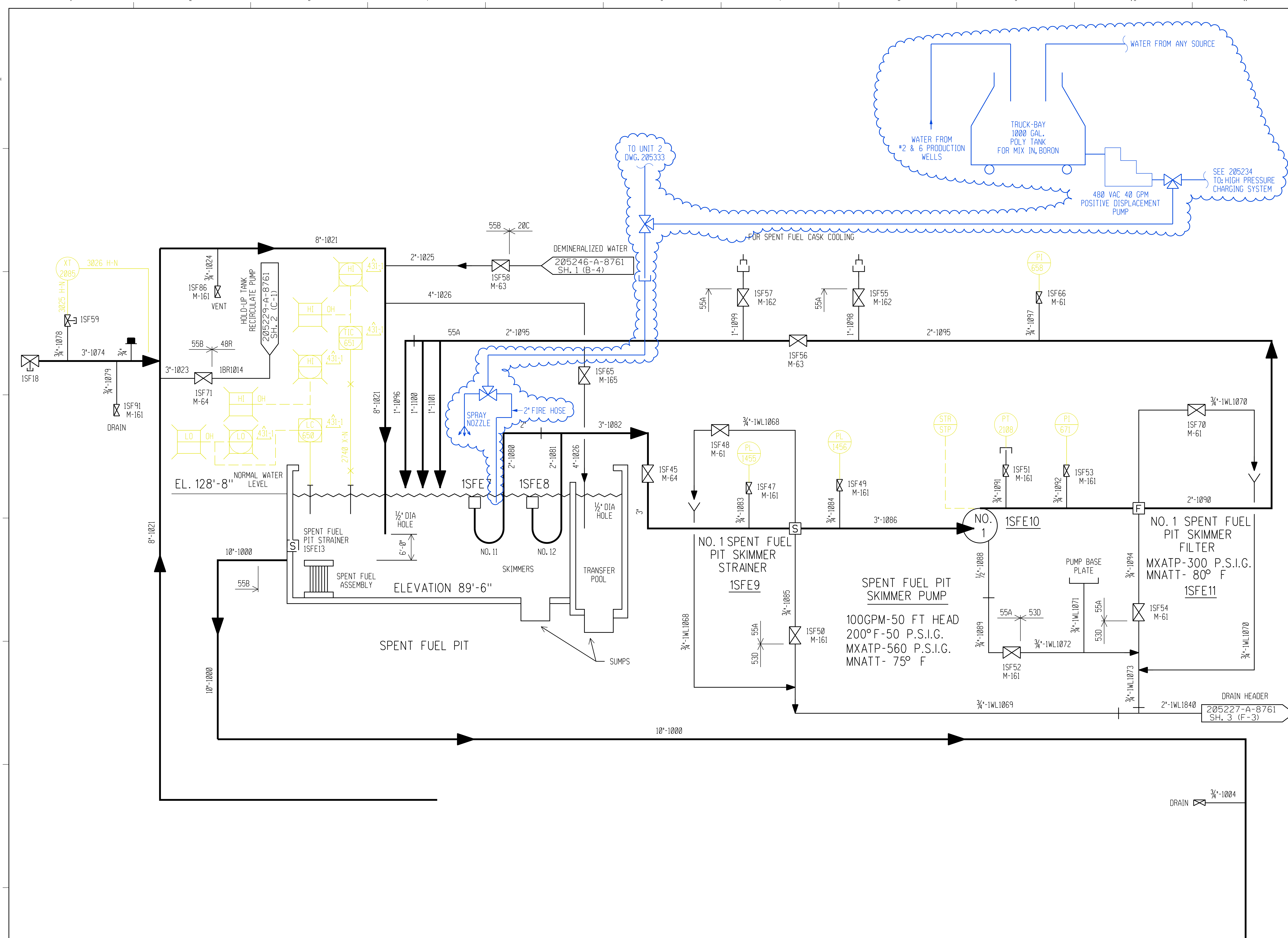
NOTE: FOR VALVE MARK NO'S. NOT SHOWN ON THIS SHEET, REFER TO SAP.

DWG.REF. #205213 S001 R50

SL-011725

ATTACHMENT CM-1

ATTACHMENT CM-1.dgn 2/25/2013 2:54:51 PM




REF. DWG. #205233 S001 R26

SL-011725

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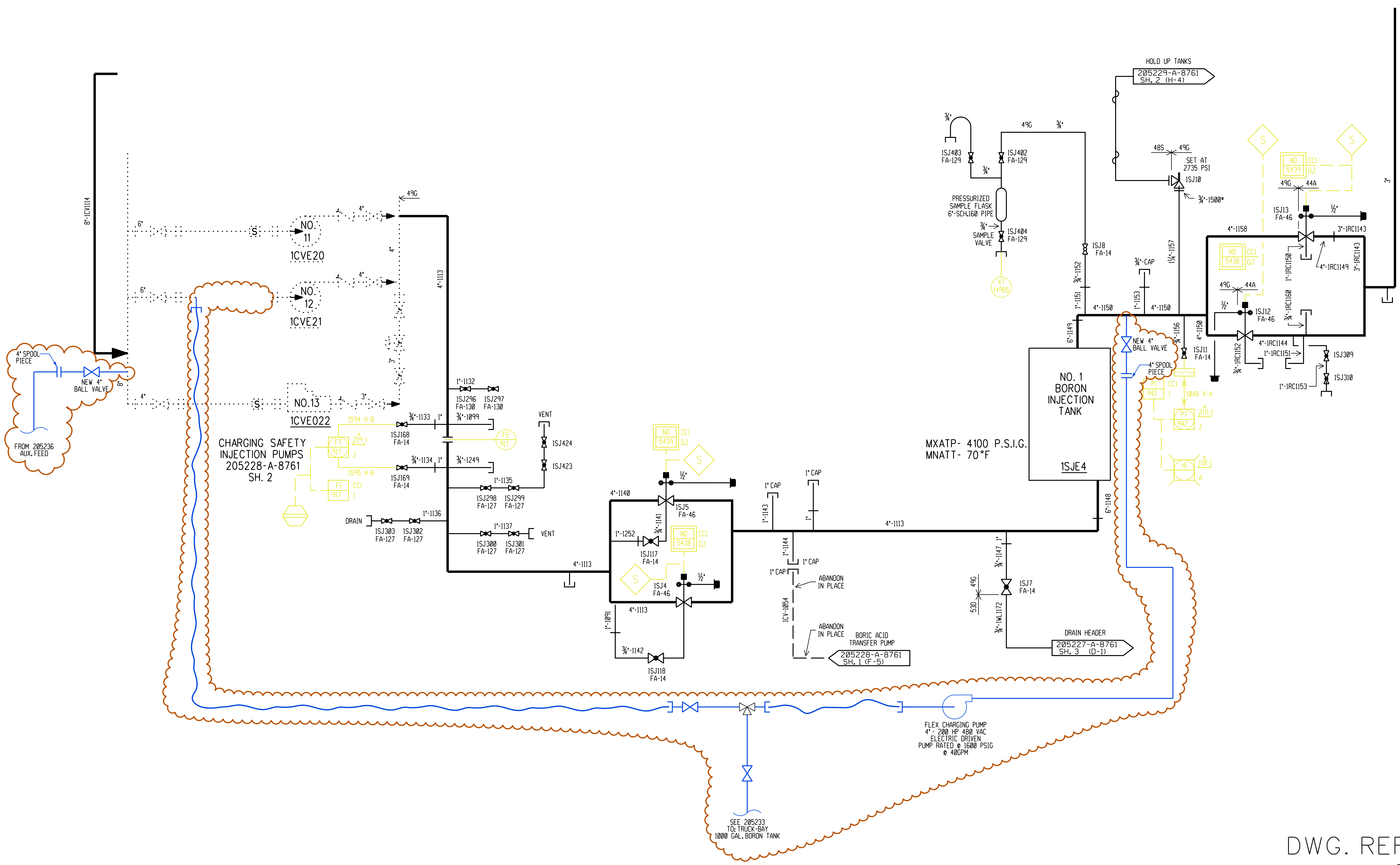


DWG. REF. 205234 S001 R54

SL-011725

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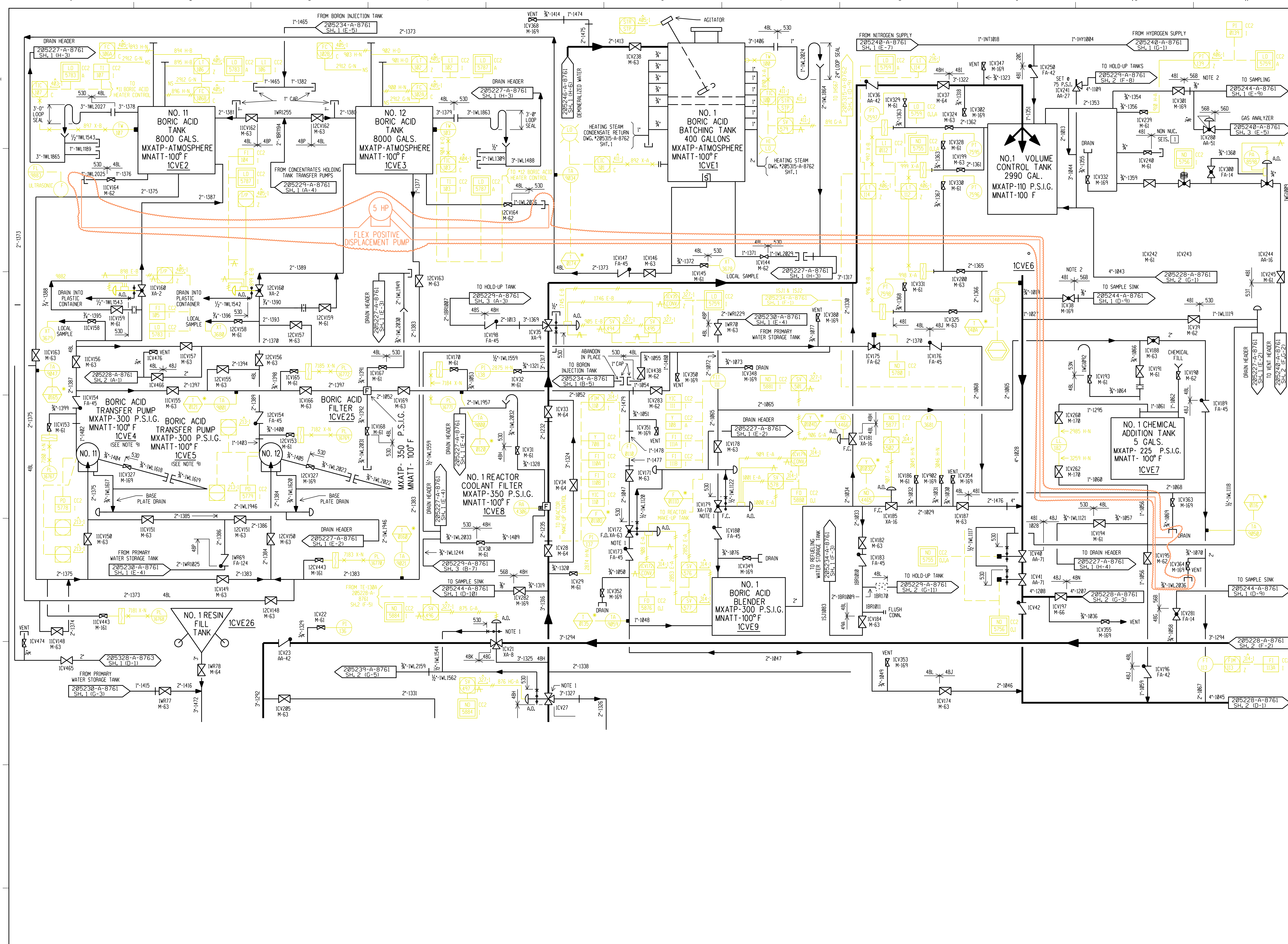


REV. DWG. #205228S001R73

SL-011725

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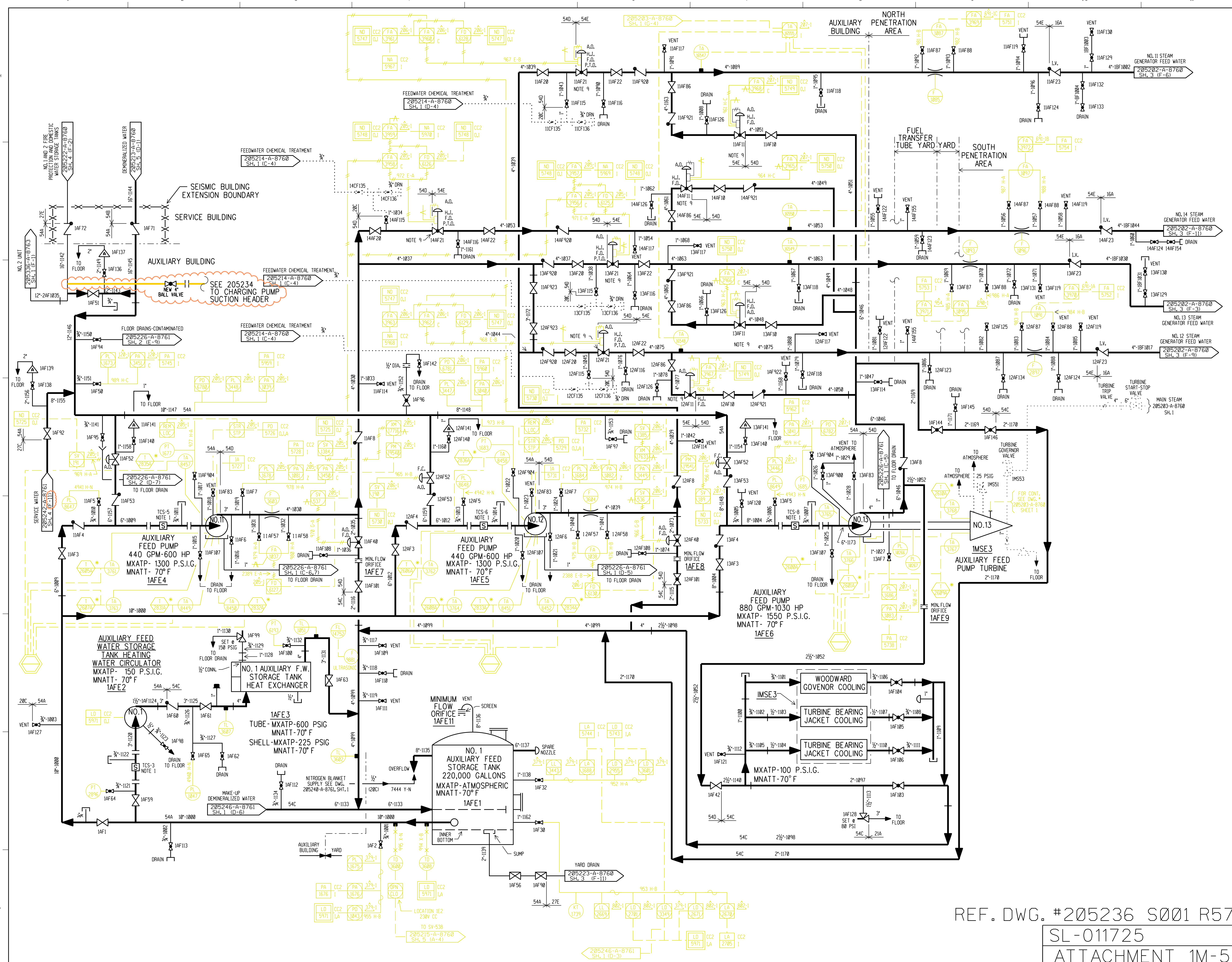


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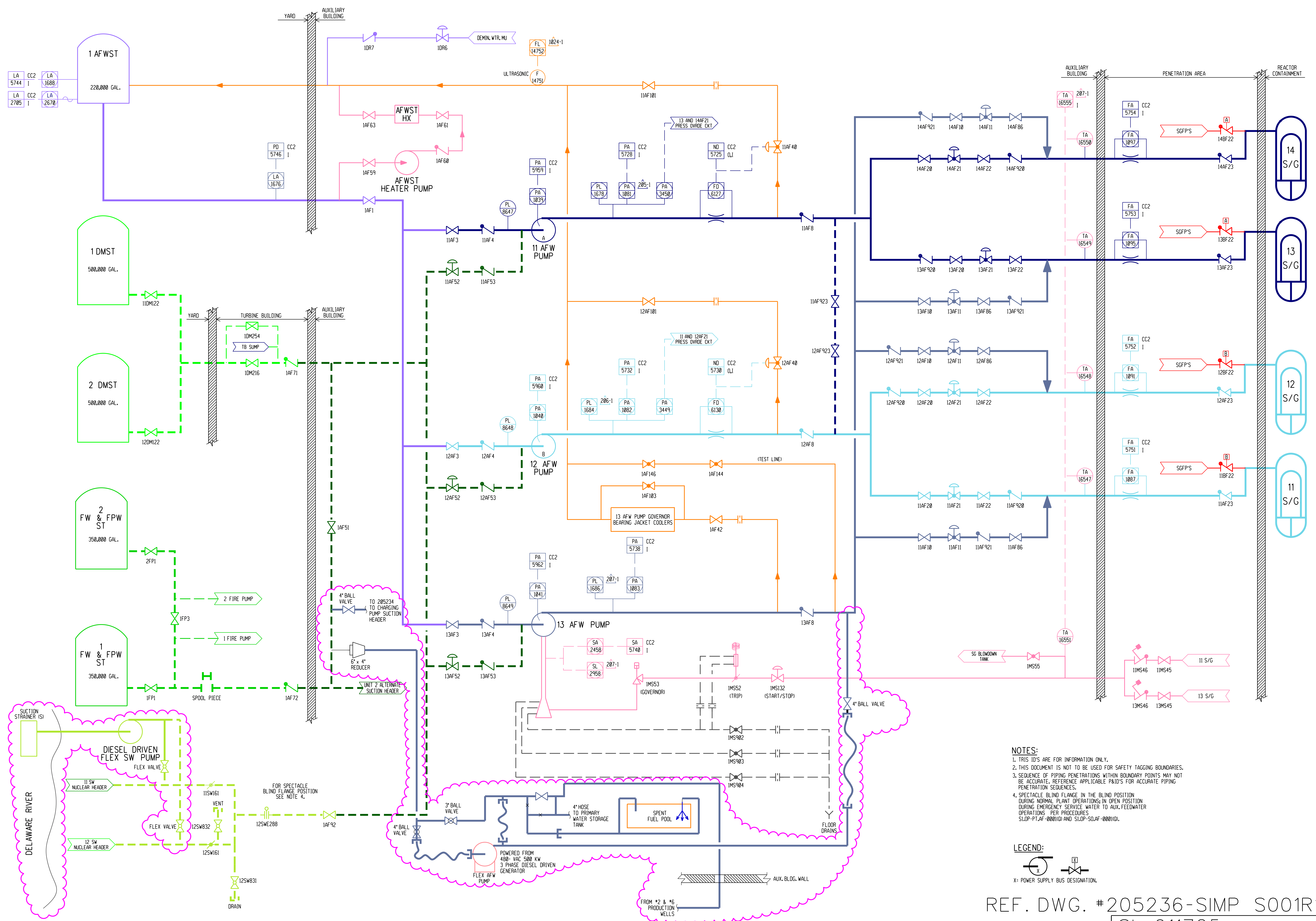



NOTES:

1. TRIS ID'S ARE FOR INFORMATION ONLY.
2. THIS DOCUMENT IS NOT TO BE USED FOR SAFETY TAGGING BOUNDARIES.
3. SEQUENCE OF PIPING PENETRATIONS WITHIN BOUNDARY POINTS MAY NOT BE ACCURATE. REFERENCE APPLICABLE P&ID'S FOR ACCURATE PIPING PENETRATION SEQUENCES.
4. SPECTACLE BLIND FLANGE IN THE BLIND POSITION DURING NORMAL PLANT OPERATIONS; IN OPEN POSITION DURING EMERGENCY SERVICE WATER TO AUX. FEEDWATER OPERATIONS PER PROCEDURES S1.OP-PT.AF-0001(Q) AND S1.OP-SO.AF-0001(Q).

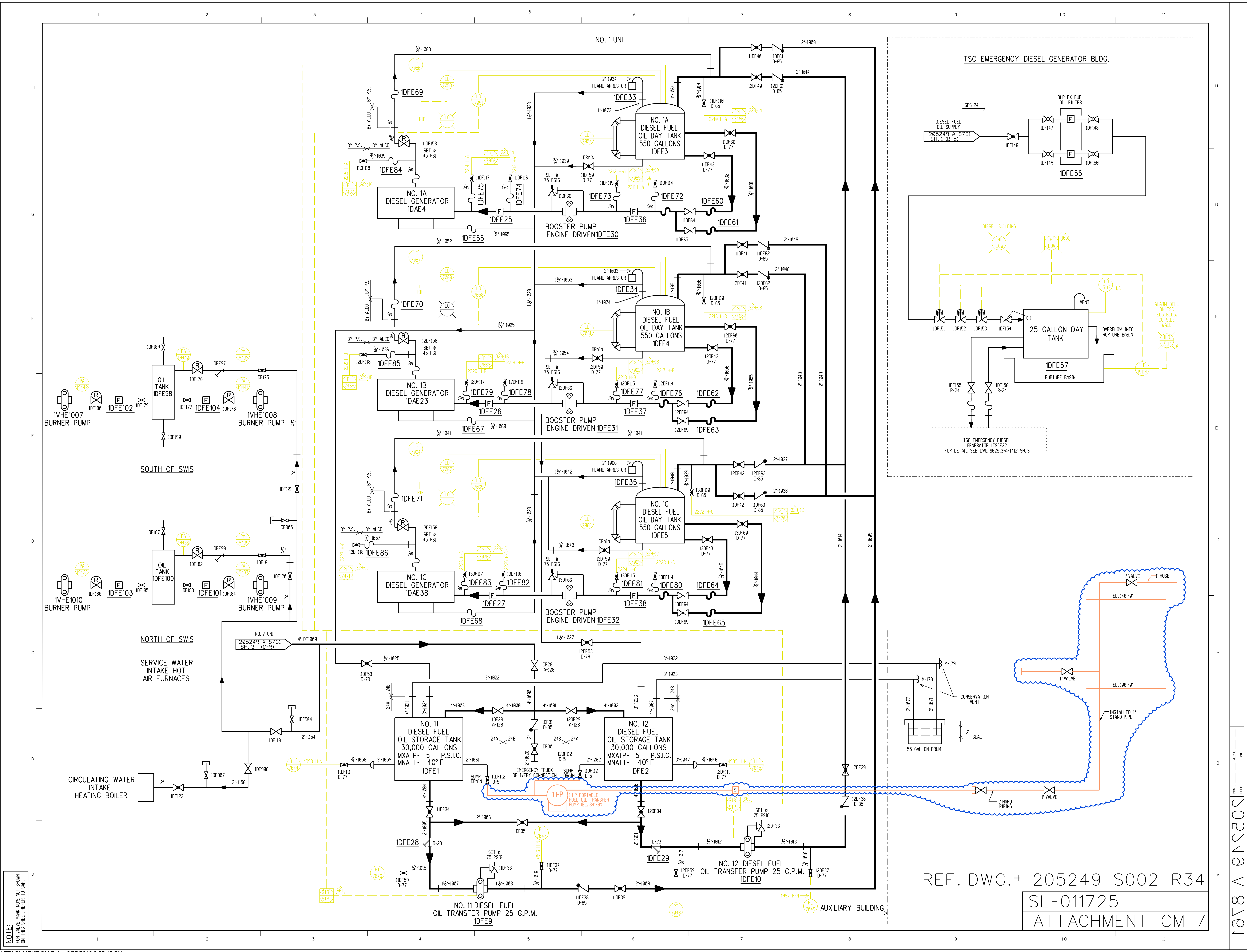
LEGEND:

X= POWER SUPPLY BUS DESIGNATION.

REF. DWG. #205236-SIMP S001R1

SL-011725

ATTACHMENT 1M-6

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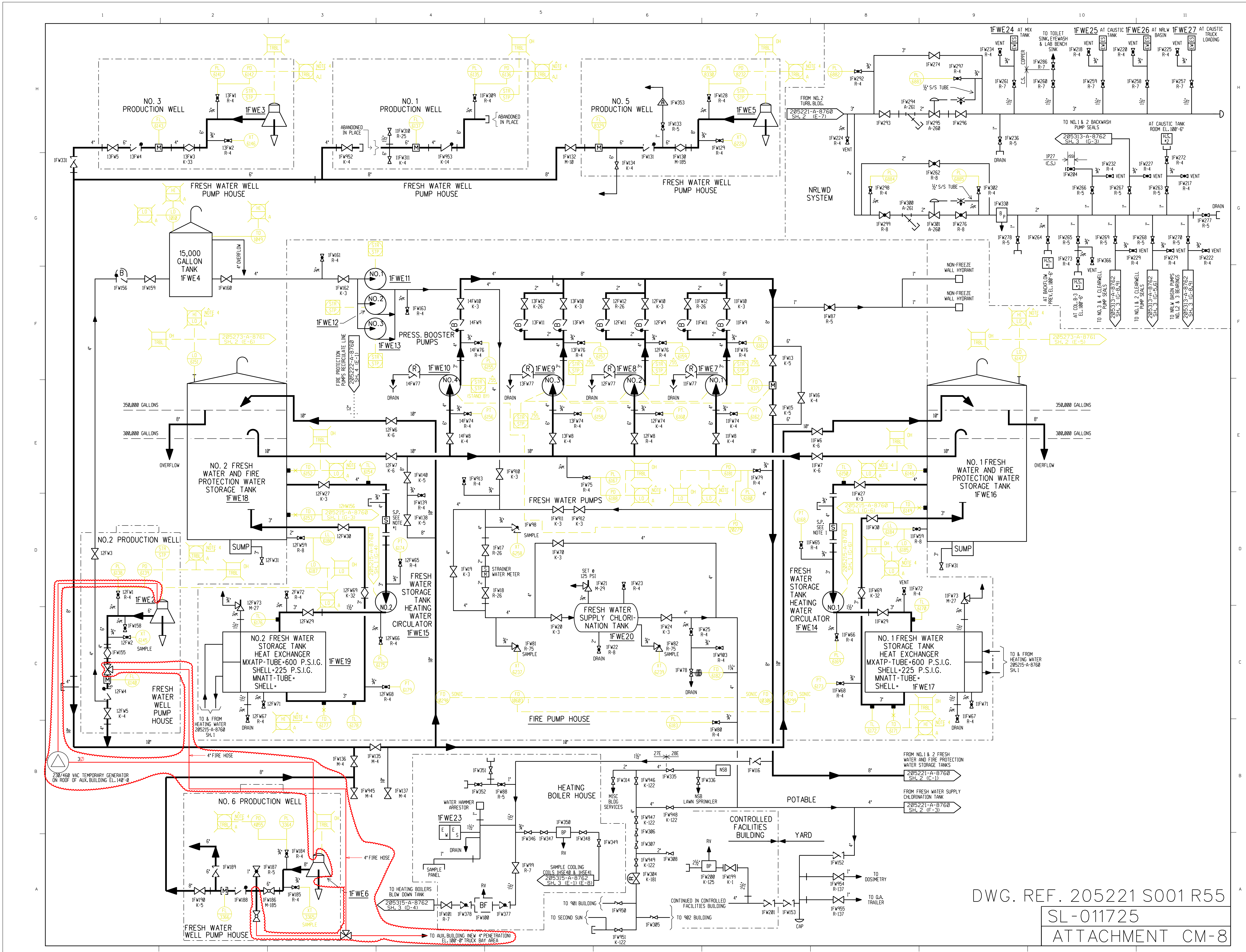


ATTACHMENT CM-8.dgn 2/25/2013 2:55:48 PM

attachment e-1.dgn 2/25/2013 2:56:06 PM