APPENDIX F - INTERACTION OF UNITS 2 AND 3

TABLE OF CONTENTS

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F.1 SUMMARY DESCRIPTION

Units 2 and 3 are situated adjacent to Unit 1, an HTGR plant.

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

Units 2 and 3 share a number of systems. Design criteria have been established to assure that such sharing is not detrimental to the safe operation of the station.

F.2 SHARED SITE FACILITIES

F.2.1 Facilities Shared Between Units 2 and 3

F.2.1.1 Communications

A centralized telephone system is provided for the site, i.e., all extensions can be dialed from any site location.

F.2.1.2 Offices and Administration

The administration and the Site Management buildings serve as management headquarters for the site. Office space is provided for management, supervisory, and engineering personnel in these buildings. The Unit 1 office complex houses the TSC for Units 2 and 3.

F.2.1.3 Shops, Laboratories, and Storerooms

The shops, laboratories, and storerooms are used without restrictions for the support of activities at either plant.

F.2.1.4 Cooling Water Intake and Discharge

The pump structure design for Units 2 and 3 permits independent operation of each unit. In unusual circumstances, a sluice gate may be opened to permit communication of the water supply between the service water systems of the units.

The emergency service water system, a system common to Units 2 and 3, takes suction from a basin which may be supplied with water from either the Unit 2 or Unit 3 sides of the pump structure.

Units 2 and 3 cooling water is returned to Conowingo Pond through a common discharge canal. A cross tie gate between the Unit 2 intake canal and the discharge pond can be opened to provide recirculation heating to intake water during winter months to minimize the formation of frazil ice and also to provide a backup water supply to the intake pond if the outer screen structure should become clogged. No significant interaction results from this arrangement.

F.2.1.5 Control Room, Cable Spreading Room, and Turbine Hall

Units 2 and 3 share the main control room; however, physical separation of all control boards eliminates possible interaction between non-common systems. Common systems share a common control panel where it has been determined that this feature will not degrade the overall installation.

Examples of systems sharing common panels are the diesel generator 4 kV emergency panel and the meteorology panel. Units 2 and 3 share the cable spreading room. Physical separation of equipment and cables eliminates possible interaction except for shared systems.

The Unit 2 and Unit 3 turbine generators are located in the same building (turbine building). However, the turbine generators and their auxiliaries are spatially separated to reduce possible interaction.

F.2.1.6 Independent Spent Fuel Storage Installation (ISFSI)

The ISFSI is used to store spent fuel from both Units 2 and 3.

F.3 SHARED SYSTEMS AND EQUIPMENT

F.3.1 Criteria for Shared Systems and Equipment

The following criteria are used in the sharing of systems and equipment between Units 2 and 3:

1. Systems and equipment are shared only when it can be done without compromising safety or interfering with independent operation of Units 2 and 3.

2. Operation of either Unit 2 or Unit 3 after an accident in the other unit shall not be precluded because of common systems or equipment.

F.3.2 Systems Shared Between Units 2 and 3

F.3.2.1 Auxiliary Power System

Unit 2 is connected to the PECO 500 kV power system through the Peach Bottom south substation. Unit 3 is connected to the same system through the Peach Bottom north substation. The auxiliary power for each unit is supplied normally through the unit auxiliary transformer. The startup and emergency auxiliary power for both units is provided from two offsite sources. The 13 kV distribution system is designed so that either of the two offsite sources may furnish power to either or both units.

F.3.2.2 Standby Diesel Generators

The criterion followed for the diesel generator system is that any three of the four diesels provide the necessary power to either Unit 2 or 3 during an accident and, if necessary, can also supply power to the other unit (Unit 2 or 3) to shut it down safely and maintain it in the shutdown condition.

Additional design consideration has been given to the possible effects of interaction of Units 2 and 3 on the diesel generators. For the postulated case of design basis accident conditions for one unit, including the total loss of offsite power, it has been recognized that a loss of drywell cooling to the non-accident unit could eventually produce a spurious high drywell pressure (HDWP) for that non-accident unit. However, the RHR and core spray pumps will start only when the high drywell pressure condition exists coincidently with low reactor pressure. Further, the RHR pumps are electrically interlocked between units at the breaker level to preclude the operation of the RHR pumps of both units on one diesel generator. This affords additional protection for postulated interaction of Units 2 and 3 to assure that any adverse effects due to interaction are precluded.

F.3.2.3 125/250V Batteries

The Units 2 and 3 batteries supply DC power to the four shared diesel generators and their associated 4 kV emergency switchgear. The Unit 2 batteries supply control power to the E1 and E2 diesel generators and their associated 4 kV emergency switchgear in Units 2 and 3 (E12, E13, E22, E23). Similarly, the Unit 3 batteries supply control power to the E3 and E4 diesel generators and their associated 4 kV emergency switchgear in Units 2 and 3 (E32, E33, E42, E43).

F.3.2.4 Deleted

F.3.2.5 Liquid and Solid Radioactive Waste Systems

The purpose of the radioactive waste system is to process liquid radioactive waste for reuse or for discharge to the river, and to process solid waste for packaging for offsite shipment.

Radioactive liquid waste from Units 2 and 3 is released to the discharge canal through a single line downstream of the cooling towers. A circulating water discharge sampling station is provided at the common discharge canal.

F.3.2.6 Gaseous Radioactive Waste

The gaseous waste effluents from Units 2 and 3 use a common off-gas stack. A separate process off-gas system is provided for each unit, each with its independent monitoring system.

The combined effluent being discharged from both units is also monitored and recorded in the control room. The spare off-gas filter is shared by Units 2 and 3.

F.3.3 Standby Gas Treatment System

The standby gas treatment system serves the two reactor buildings and exhausts to the stack.

F.3.4 Service Water Systems

The high pressure service water system for the RHRS is normally on standby. The Unit 2 is separated from the Unit 3 system by an isolation valve. Redundancy in equipment and piping is provided for each unit. In addition, a cross tie between the systems may be manually opened, thus providing the maximum flexibility and availability of a water supply.

The emergency service water system for the diesel engine jacket coolers and the core standby cooling equipment room air coolers is common to both units.

F.3.5 Emergency Heat Sink

The common emergency heat sink removes decay and sensible heat from the reactors of Units 2 and 3 in case of the unavailability of the normal heat sink.

F.3.6 Fuel Pool Filter-Demineralizer System

Three fuel pool filter-demineralizers are provided for Units 2 and 3. Typically, one filter-demineralizer is used for Unit 2, and one for Unit 3, with the third as a spare. Up to three filter-demineralizers may be aligned to one unit to support water clarity and water chemistry improvements, as required.

F.3.7 Miscellaneous

The following systems are also shared by Units 2 and 3:

1. Cooling towers and circulating water system
2. Circulating water intake pond and discharge canal
3. Plant makeup water system
4. Fire protection system
5. Auxiliary steam
6. Condensate and refueling water storage system
7. Seismic monitoring instrumentation system.

F.4 INTERACTION OF UNITS 2 AND 3 FOLLOWING AN ACCIDENT

The logic described in Section F.3.2.2 above was developed to protect the emergency diesel generators (EDG) from being over loaded when both units are operating on emergency power such a as during a loss of offsite power (LOOP). It also assures that the EDGs are able to provide adequate power during the design basis LOCA on one unit and safe shutdown of the other unit, with a LOOP and a single failure of one EDG. This logic protects the EDGs but impacts the accident response of the units as discussed below.

Generation of a LOCA signal will result in the auto start and alignment of the ECCS pumps to the LPCI mode of operation on that unit. IF the RHR pumps are operating in suppression pool cooling (SPC), they will be re-aligned to the LPCI mode and SPC will be lost until operators can re-align RHR to the SPC mode. In addition, since the RHR pumps are interlocked between units as discussed above, generation of a LOCA signal in one unit could result in tripping RHR pumps on the other unit. In order to control this evolution, abnormal operating procedures (AOPs) instruct operators to secure RHR and HPSW pumps not required for adequate core cooling prior to depressurizing the other unit below 500 psig. This interaction between the two units (duel unit interaction) has been accounted for in the long-term containment analysis for design basis accidents and special events as described in Section 14.10.

The event in the non-accident unit is a LOOP followed by reactor scram and reactor pressure vessel (RPV) isolation, and includes the effects of the single active failure of the loss of one EDG postulated for the accident unit. The analysis assumes HPCI is the source for high-pressure makeup and one loop of RHR is used for suppression pool cooling (SPC) beginning one hour after reactor scram. Since the LOOP results in the loss of drywell cooling, it is assumed that drywell pressure will rise and generate the HDWP portion of the LOCA signal in less than one hour. The non-accident unit analysis also assumes that when suppression pool temperature reaches 110 F, but no sooner than 10 minutes after reactor scram, operators begin manual depressurization of the reactor and cool down at 100 F/hr. This results in the non-accident RPV reaching 450 psig and completing the LOCA signal approximately one hour and 10 minutes after the reactor scram. This timing is assumed for evaluation of the non-accident unit suppression pool temperature response. However, the timing of the non-accident unit LOCA signal for the dual unit interaction evaluations was varied to provide a conservative accident unit suppression pool temperature response for each accident/event. For analysis purposes, the generation of the dual unit interaction LOCA signal on the accident unit is assumed to occur 10 F prior to the peak pool temperature that would be reached if there was no interruption in SPC. This assumption provides a conservative evaluation of suppression pool temperature response for each specific accident or event.

Existing procedural guidance instructs the operators to depressurize the non-accident reactor at a slower rate than the maximum allowed rate of 100 F/hr and to stop when reactor pressure reaches 500 psig. This provides margin to the 450 psig LOCA signal setpoint and allows the operators to wait, until conditions permit, to continue depressurization of the reactor and generation of the LOCA signal. The operators of both units are then able to coordinate the depressurization of the non-accident unit and the resulting generation of the dual unit interaction LOCA signal with the subsequent interruption in containment cooling on the accident unit. This procedural guidance also instructs the operators to expect a 10 F rise in suppression pool temperature due to the interruption in SPC and to ensure adequate NPSH is maintained considering this 10 F rise. This guidance assures the suppression pool temperature remains within the bounds analyzed for the ECCS pump NPSH.

The control of the non-accident unit is also credited to assure that the non-accident unit LOCA signal doesn’t occur immediately prior to or following restoration of SPC on the accident unit which would result in a 20 minute interruption in containment cooling on both units. This is appropriate since the DBA LOCA and other larger break scenarios result in a rapid RPV depressurization and generation of the LOCA signal before the non-accident unit is depressurized. The other smaller liquid and steam line breaks and those accident/events without any break result in a longer and more controlled depressurization of the accident unit that allows coordination between both units to avoid sequential LOCA signals.

The interruption in SPC is assumed to exist for 10 minutes, and then operators restore SPC in the same configuration that existed prior to the interruption. The assumption of 10 minutes is conservative since there are only a few operator actions required to restore SPC, all actions are performed from the main control room, procedures are in place and the operators are prepared for the event.