PSEG Site
ESP Application
Part 5, Emergency Plan

ATTACHMENT 6

AP1000 – SPECIFIC INFORMATION

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SECTION 1: INTRODUCTION

1. AP1000 DESCRIPTION

The PSEG Site is owned and operated by PSEG. An area map showing geographical location of the facility is provided in Section 1 of this Emergency Plan.

This Emergency Plan Attachment provides unit specific details for the AP1000 reactor. This includes a unit description, such as type of reactor, relationship to other units, special emergency equipment, Emergency Response Organization staffing, Emergency Action Levels (EALs), and any emergency facility locations which differ from those described in the emergency plan to provide a full understanding and representation of the PSEG Site's emergency response capabilities.

The Westinghouse Advanced Passive PWR AP1000 is a 1117 MWe pressurized water reactor (PWR) with thermal power of 3415 MWt. The AP1000 design includes advanced passive safety features and extensive plant simplifications to enhance the safety, construction, operation, and maintenance of the plant. If selected, the AP1000 would be constructed as a dual-unit plant.

Safety systems use natural driving forces such as pressurized gas, gravity flow, natural circulation flow, and convection. Safety systems do not use active components (such as pumps, fans or diesel generators) and are designed to function without safety-grade support systems (such as ac power, component cooling water, service, and HVAC). The number and complexity of operator actions required to control the safety systems are minimized; the approach is to eliminate operator action rather than automate it. Major safety systems are passive; they require no operator action for 72 hours after an accident, and maintain core and containment cooling for a protracted time without ac power.

The AP1000 is designed to meet U. S. NRC deterministic criteria and probabilistic risk criteria with large margins. Safety analysis has been completed and documented in the Design Control Document (DCD) and Probabilistic Risk Analysis (PRA). Predicted core damage frequency of 2.4E-07/year is well below the 1E-05/year requirement, and frequency of significant release of 1.95E-08/year is well below the 1E-06/year requirement.

An important aspect of the AP1000 design philosophy focuses on plant operability and maintainability. The AP1000 design includes features such as simplified system design

to improve operability while reducing the number of components and associated maintenance requirements.

The AP1000 has a well-designed design basis that has been confirmed through thorough engineering analyses and testing. Some of the high-level design characteristics of the plant are:

- Occupational radiation exposure expected to be below 0.7 person-Sv/yr (70 person-rem/yr).

- Security enhanced with all safe shutdown equipment located in safely reinforced concrete nuclear island buildings.

- In-vessel retention of core debris following core melt which significantly reduces the uncertainty in the assessment of containment failure and radioactive release to the environment due to ex-vessel severe accident phenomena.

- No reactor pressure vessel penetrations below the top of the core. This eliminates the possibility of a loss of coolant accident by leakage from the reactor vessel, which could lead to core uncovery.

<u>Overview of the AP1000 Design:</u>

The power block complex of each AP1000 unit consists of five principal building structures: the nuclear island, the Turbine Building, the Annex Building, the Diesel Generator Building and the Radwaste Building. Each of these building structures is constructed on individual basemats.

- The nuclear island consists of the Containment Building, the Shield Building, and the Auxiliary Building, all of which are constructed on a common base-mat.

    a. The containment contains a 16-foot (4.9 m) diameter main equipment hatch and a personnel airlock at the operating deck level, and a 16-foot (4.9 m) diameter maintenance hatch and a personnel airlock at grade level. The Reactor Building is a Shield Building surrounding the containment. The Containment Building is the containment vessel and all structures contained within the containment vessel. The principal systems located within the Containment Building are the reactor coolant system, the passive core cooling system, and the reactor coolant purification portion of the chemical and volume control system.

b. The Shield Building is the structure and annulus area that surrounds the containment vessel. The functions of the Shield Building are:

- In conjunction with the internal structures of the Containment Building, providing the required shielding for the reactor coolant system and all the other radioactive systems and components housed in the containment.
- Providing the required shielding for radioactive airborne materials that may be dispersed in the containment as well as radioactive particles in the water distributed throughout the containment.
- Serving as an integral part of the passive containment cooling system.
- Protecting the containment vessel and the reactor coolant system from the effects of tornadoes and tornado produced missiles.

c. The Auxiliary Building contains the Control Room, I&C systems, electrical power systems, fuel handling area, mechanical equipment areas, containment penetration areas, and the main steam and feedwater valve compartments. The Auxiliary Building provides the following:

- Protection and separation for the safety-related seismic Category I mechanical and electrical equipment located outside the containment building.
- Protection for the safety-related equipment against the consequences of either a postulated internal or external event.
- Shielding for the radioactive equipment and piping that is housed within the building.

The Auxiliary Building contains all of the containment penetration areas for mechanical, electrical, and instrumentation and control penetrations. The Auxiliary Building provides separation of the radioactive piping penetration areas from the non-radioactive penetration areas and separation of the electrical and instrumentation and control penetration areas from the mechanical penetration areas. Separation of redundant divisions of instrumentation and control and electrical equipment is also provided. The main steam and feedwater isolation valve compartment is contained within the Auxiliary Building. The Auxiliary Building provides an adequate venting area for the main steam and feedwater isolation valve compartment in the event of a postulated leak in either a main steam line or feedwater line.

- The Turbine Building houses the main turbine, generator, and associated fluid and electrical systems. It provides weather protection for the laydown and maintenance of major turbine/generator components. The Turbine Building also houses the makeup water purification system.

- The Annex Building provides the main personnel entrance to the power generation complex. It includes access-ways for personnel and equipment to the clean areas of the nuclear island in the Auxiliary Building and to the radiological control area. The building includes the health physics facilities for the control of entry to and exit from the radiological control area as well as personnel support facilities such as locker rooms. The building also contains the non-1E ac and dc electric power systems, the ancillary diesel generators and their fuel supply, other electrical equipment, the Technical Support Center, and various heating, ventilating and air conditioning systems.

  The Annex Building includes the health physics facilities and provides personnel and equipment access-ways to and from the Containment Building and the rest of the radiological control area via the Auxiliary Building. Large, direct access-ways to the upper and lower equipment hatches of the Containment Building are provided for personnel access during outages and for large equipment entry and exit. The building includes a hot machine shop for servicing radiological control area equipment. The hot machine shop includes decontamination facilities including a portable decontamination system that may be used for decontamination operations throughout the nuclear island.

- The Diesel Generator Building houses two identical slide along diesel generators separated by a three-hour fire wall. These generators provide backup power for plant operation in the event of disruption of normal power sources.

- The Radwaste Building includes facilities for segregated storage of various categories of waste prior to processing, for processing by mobile systems, and for storing processed waste in shipping and disposal containers. Dedicated floor areas and trailer parking space for mobile processing systems are provided for the following:

  - Contaminated laundry shipping for off-site processing
  - Dry waste processing and packaging
  - Hazardous/mixed waste shipping for off-site processing
  - Chemical waste treatment
  - Empty waste container receiving and storage

- Storage and loading packaged wastes for shipment

The Radwaste Building also provides for temporary storage of other categories of plant wastes.

SECTION 2: EMERGENCY FACILITIES AND EQUIPMENT

1. UNIT-SPECIFIC EMERGENCY FACILITIES

Section 9 of this Plan contains information regarding the function and operation of the emergency response facilities. This section describes the AP1000 design-specific Control Room, Operations Support Center (OSC), and Technical Support Center (TSC).

a. Control Room

The Control Room is located in the Auxiliary Building (of each unit). The Control Rooms include the main control area, operations staff areas, and offices for the shift. Plant operations are directed from the Control Room. Nuclear Plant Instrumentation, Area and Process Radiation Monitoring System Instrumentation, Controls and Instrumentation for Reactor and Turbine Generator operation are provided here.

Control Room habitability and radiation protection is served by the nuclear island non-radioactive ventilation system (VBS) and the emergency habitability system (VES), as described in Sections 9.4 and 6.4 respectively, of the DCD. A description of the Control Room is in the DCD. Emergency equipment available to the Control Room is listed and maintained in accordance with emergency plan implementing procedures and/or administrative procedures.

b. OSC

There is an OSC for each unit. The OSC is located inside the Protected Area on the second floor of the Annex Building adjacent to the Unit 1 and 2 Control Rooms. The OSC is separate from the Control Room and the TSC. The total area for each OSC is approximately 2888 square feet in the ALARA Support Center and Office Area. This location includes separate areas for coordinating and planning OSC activities. Additional space is available in adjacent offices and locker rooms to accommodate additional personnel, as required.
Both the Control Room and TSC have diverse means of communication with various plant locations including the OSC. During an emergency, if the OSC

becomes uninhabitable, an alternate location for OSC activities is designated. Evacuation of the OSC is conducted in accordance with emergency plan implementing procedures.

c. TSC

There is a TSC for each unit. The TSC is located within the Protected Area in the passage from the Annex Building to the Control Room. Each TSC command room covers 2144 square feet with four (4) adjoining conference rooms which cover 988 square feet. Each TSC is sized for a minimum of 25 persons, including 20 persons designated by PSEG and five NRC personnel.

The TSC is designed as follows:

- Exterior walls, roof, and floor are built to seismic Category II requirements.
- Served by the nuclear island nonradioactive ventilation system (VBS), as described in Section 9.4 of the DCD. Provided with radiation protection equivalent to Control Room habitability requirements, such that the dose to an individual in the TSC for the duration of a design basis accident is less than 5 Rem TEDE.
- Environmentally controlled to provide room air temperature, humidity and cleanliness appropriate for personnel and equipment.
- Reliable power for habitability systems and battery pack emergency lighting are provided.
- Equipment is non-safety related and non-redundant.
- Using human factors criteria contained in APP-GW-GLR-136, AP1000 *Human Factors Program Implementation for the Emergency Operations Facility and Technical Support Center.*

During an emergency, if the TSC becomes uninhabitable, an alternate location for TSC activities is designated. Evacuation of the TSC is conducted in accordance with emergency plan implementing procedures.

d. On-Site Laboratories

The radiochemistry laboratory in the Auxiliary Building is available for emergency response during an accident. The laboratory can receive power from the plant's diesel generators. General capabilities include:

- Radionuclide identification in various sample media.
- Analysis and measurement of radionuclides in samples taken within the plant and samples taken in the plant site and off-site environment.

e. Decontamination Facilities

The personnel decontamination facility is located in the Annex Building and contains provisions for radiological decontamination of personnel, their wounds, supplies, instruments and equipment. This facility has extra clothing and decontaminants suitable for the type of contamination expected, including radioiodine skin contamination.

2. ASSESSMENT/MONITORING RESOURCES

a. On-Site Meteorological Monitoring Instrumentation

The PSEG Site uses the existing Salem and Hope Creek Generating Stations' meteorological monitoring program. The meteorological program is in accordance with the recommendation of NRC Regulatory Guide 1.23 "Onsite Meteorological Program" and Section 2.3.3 of NUREG 75/087 (Rev. 3).

b. On-Site Radiological Monitoring Instrumentation

The on-site radiation monitoring capability includes an installed process, effluent, and area radiation monitoring system (RMS); portable survey instrumentation; counting equipment for radiochemical analysis; and a personnel dosimetry program to record integrated exposure. Some on-site equipment is particularly valuable for accident situations.

1. Area Radiation Monitoring

The area monitoring system provides information on existing radiation levels in various areas of the plant to ensure safe occupancy. It is equipped with Control Room and local readout and audible alarms to warn personnel of a raised radiation level.

2. Radiological Noble Gas Effluent Monitoring

The wide range gas monitors are installed on normal station effluent release points. Each monitor system has a microprocessor which uses digital

processing techniques to analyze data and control monitor functions. These monitors provide readout and alarm functions to the Control Room.

3. Radioiodine and Particulate Effluent Monitoring

   The wide range gas monitor includes a sampling rack for collection of the auxiliary building vent stack particulate and radioiodine samples. Filter holders and valves are provided to allow grab sample collection for isotopic analyses in the plant's counting rooms. The sampling rack is shielded to minimize personnel exposure. The sampling media is analyzed by a gamma ray spectrometer which uses a gamma spectrometer system. In addition, silver zeolite cartridges are available to further reduce the interference of noble gases.

4. High-Range Containment Radiation Monitors

   High-range containment radiation monitors are installed. The monitors detect and measure the radiation level within the reactor containment during and following an accident. The monitors are in range of postulated accidents and in support of emergency response.

5. In-Plant Iodine Instrumentation

   Effective monitoring of increasing iodine levels in buildings under accident conditions includes the use of portable instruments using silver zeolite as a sample media. It is expected that a sample can be obtained, purged, and analyzed for iodine content within a two-hour time frame.

c. On-Site Process Monitors

   An adequate monitoring capability exists to properly assess the plant status for all modes of operation and is described in each unit's DCD. The operability of the post-accident instrumentation ensures information is available on selected plant parameters to monitor and assess important variables following an accident. Instrumentation is available to monitor the parameters in Technical Specifications.

   The unit's emergency operating procedures assist personnel in recognizing inadequate core cooling using applicable instrumentation.

d. Seismic Monitors

The units have four triaxial acceleration sensor units, and they are connected to a time-history analyzer. The time-history analyzer recording and playback system is located in a panel in the nuclear island in a room near the Control Room. Seismic event data from these is recorded on a solid-state digital recording system at 200 samples per second per data channel.

This solid-state recording and analysis system has internal batteries and a charger to prevent the loss of data during a power outage, and to allow data collection and analysis in a seismic event during which the power fails. Normally, 120-volt alternating current power is supplied from the non-Class 1E dc and uninterruptible power supply system. The system uses triaxial acceleration sensor input signals to initiate the time-history analyzer recording and Control Room alarms. The system initiation value is adjustable from 0.002 g to 0.02 g.

The time-history analyzer starts recording triaxial acceleration data from each of the triaxial acceleration sensors after the initiation value has been exceeded. Pre-event recording time is adjustable from 1.2 to 15.0 seconds and is set to record at least 3 seconds of pre-event signal. Post-event run time is adjustable from 10 to 90 seconds. A minimum of 25 minutes of continuous recording is provided. Each recording channel has an associated timing mark record with 2 marks per second, with an accuracy of about 0.02 percent.

The sensor installation anchors are rigid so that the vibratory transmissibility over the design spectra frequency range is essentially unity.

Each sensor unit contains three accelerometers mounted in a mutually orthogonal array with one horizontal axis parallel to the major axis assumed in the seismic analysis. The triaxial acceleration sensors have a dynamic range of 1000 to 1 (0.001 to 1.0 g) and a frequency range of 0.2 to 50 hertz.

One sensor unit is located in the free field. A second sensor unit is located on the nuclear island basemat in the spare battery charger room. A third sensor unit is located on the shield building structure. The fourth sensor unit is located on the containment internal structure on the east wall of the east steam generator compartment just above the operating floor.

Seismic instrumentation is not located on equipment, piping, or supports since experience has shown that data obtained at these locations is obscured by vibratory motion associated with normal plant operation.

e. On-Site Fire Detection Instrumentation

The fire detection system is designed in accordance with applicable National Fire Protection Association (NFPA) standards. The system is equipped with electrically supervised ionization smoke and heat detectors to quickly detect any fires and the instrumentation to provide local indication and control room annunciation. In addition to the smoke and heat detection systems, each fire protection carbon dioxide, halon, or water system is instrumented to inform the Control Room of its actuation or of system trouble.

In the event that a portion of the fire detection instrumentation is inoperable, fire watches in affected areas may be required.

Further details on the unit fire detection system can be found in the DCD and Fire Protection Plan.

SECTION 3: REFERENCES

1. THE WESTINGHOUSE AP1000 ADVANCED NUCLEAR PLANT—PLANT DESCRIPTION (2003)

2. AP1000 DESIGN CONTROL DOCUMENT, REV. 17