PSEG Site
ESP Application
Part 5, Emergency Plan

ATTACHMENT 8

US-APWR – SPECIFIC INFORMATION

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SECTION 1: INTRODUCTION

1. US-APWR 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.

The US-APWR is an advanced light water reactor plant designed by Mitsubishi Heavy Industries, Ltd. The US-APWR reactor is a 4-loop pressurized water reactor (PWR) and has a net electrical power rating of approximately 1600 MWe, depending on site conditions. The rated core thermal power level of the US-APWR is 4451 MWt.

<u>Overview of US-APWR Buildings and Systems</u>

The main US-APWR power block is comprised of the following buildings and structures:

- The Reactor Building, including pre-stressed concrete containment vessel
- The Power Source Buildings
- The power source fuel storage vaults
- The essential service water pipe tunnel
- The Auxiliary Building
- The Access Building
- The Turbine Building

The Reactor Building, the Power Source Buildings, the power source fuel storage vaults, and the essential service water pipe tunnel are designed and constructed as safety-related structures, to the requirements of seismic Category I, as defined in Regulatory Guide 1.29. These safety-related structures are designed for the effects of all applicable loads and their combinations, including the postulated seismic response loads. These structures are designed to withstand the effects of such natural phenomena such as hurricanes, floods, tornados, tsunamis, and earthquakes without loss of capability to perform their safety functions. They are also designed to withstand the effects of postulated internal events such as fires and flooding without loss of capability to perform their safety functions.

The remaining power block buildings are designed as non safety-related structures, and are free-standing on separate concrete base mats. The Auxiliary Building and the Turbine Building are designed to meet seismic Category II requirements as defined in Regulatory Guide 1.206. Other structures are designed to American National Standard Institute (ANSI), ASCE, and other applicable codes, and meet non-seismic Category requirements.

Specific information about the US-APWR buildings is as follows:

1. Reactor Building

   The Reactor Building has five main floors and consists of five functional areas:

   - Containment facility and inner structure
   - Safety system pumps and the heat transfer area
   - Fuel storage and handling area
   - Main steam and feedwater area
   - Safety-related electrical area

   The containment facility is comprised of the pre-stressed concrete containment vessel and the annulus enclosing the containment penetration area, and an efficient leak-tight barrier and radiation protection under all postulated conditions, including a Loss of Coolant Accident (LOCA). The pre-stressed concrete containment vessel is designed to endure peak pressure under LOCA conditions. Access galleries are provided for periodic inspection and testing of the circumferential and axial pre-stressing tendons.

   For ease of access during operation, maintenance, repair, and refueling, the following accesses to the pre-stressed concrete containment vessel are also provided:

   - A normal personal airlock, located at floor level below the operating floor
   - An equipment hatch and emergency airlock, located at operating floor level

   The annulus is located adjacent to the pre-stressed concrete containment vessel and includes all penetration areas, to prevent direct release of containment atmosphere to the environment through the containment penetrations. The pressure in the annulus is kept at a slightly negative level following accident conditions to control the release of radioactive materials to the environment.

The radwaste storage pit (RWSP) is located in the lowest part of the containment. The RWSP provides a continuous suction for both the safety injection pumps and the containment spray/residual heat removal pumps, thereby eliminating the switchover of suction source from the injection to the recirculation phase of accident recovery. The RWSP has four recirculation strainers on the floor, and the wall and floor of the RWSP are lined with stainless steel plates.

The reactor vessel is located at the center of the containment and is surrounded by a cylindrical concrete wall as a primary shield. There are four reactor coolant loops, each loop comprised of a steam generator, a reactor coolant pump, and loop piping. Concrete walls surrounding the loops are provided as supporting media and as secondary biological shields. The pressurizer is located in its own compartment and is adjacent to the steam generators to minimize the length of the surge piping to the reactor coolant loop.

A refueling cavity with a stainless steel liner is provided above the reactor vessel for refueling operations. The fuel transfer tube connects this activity to the fuel storage and handling area located outside the containment. The main steam and feedwater pipes that connect to the steam generators are routed within the containment with consideration of minimizing pipe run lengths, while providing sufficient flexibility to accommodate thermal expansion.

The safety system pumps which require sufficient net positive suction head to draw water from the recirculation sumps inside the containment are located at the lowest level of the Reactor Building to secure the required net positive suction head. In addition, they are located adjacent to the containment to minimize pipe lengths. The safety system heat transfers are located on the upper floor of the Reactor Building.

The fuel storage and handling area is located in the Reactor Building. Fuel handling operations are performed on the top floor of the area at the same level as the containment vessel operating floor. The containment emergency airlock is located adjacent to the fuel handling area to facilitate easy access between the containment and the fuel handling area when refueling procedures are in progress. The bridge crane is located to span the spent fuel pit, the transfer canal, and the cask loading pit. The spent fuel cask handling crane is capable of lifting the spent fuel cask from ground level to the operating floor.

The main steam and feedwater piping room is located on the top floor of this area and contains the main steam and feedwater pipes, where they pass between the Turbine Building and the containment.

The safety-related electrical area has two floors and is located in the Reactor Building and under the main steam and piping area. It is normally a nonradioactive zone and is completely separated from the radioactive zones of the Reactor Building.

This area houses the following safety-related facilities:

- Control Room
- Safety metal crad switchgear and load center
- Safety I&C room

Four redundant safety systems containing radioactive material are located in each zone of the four quadrants surrounding the containment structure. Each of the quadrant areas is separated by a physical barrier to assure that the functions of the safety-related systems are maintained in the event of postulated incidents such as fire, floods, and high-energy pipe break events. Non-radioactive safety systems such as emergency feedwater system and core cooling water system and electrical systems are located in the non-radioactive control area of the reactor building. This area is also separated into four divisions by physical barriers to assure that the functions of the safety-related systems are maintained in the event of postulated incidents such as fires, floods, and high-energy pipe break events.

2. Power Source Buildings

Two Power Source Buildings are located adjacent to the Reactor Building. These buildings are freestanding on reinforced concrete mats, and each building contains two identical emergency power sources, which are separated from each other by physical barriers. The safety-related HVAC chillers are also located in these buildings. The electrical, I&C and HVAC equipment related to the EPSs are also contained in the Power Source Buildings.

3. Power Source Fuel Storage Vault

The power source fuel storage vaults are underground structures constructed with reinforced concrete, and classified as seismic Category I. The vaults contain the fuel oil tanks of safety-related turbine generators.

4. Essential Service Water Pipe Tunnel

The essential service water pipe tunnel is an underground structure constructed with reinforced concrete, and is classified as seismic Category I. Terminating in part under the Turbine Building, the structure is isolated from other structures to prevent any seismic interaction. The other termination point is located at the ultimate heat sink related structure that connects to the ultimate heat sink water.

5. Auxiliary Building

The Auxiliary Building is located adjacent to the Reactor Building. The Auxiliary Building contains the main components of the waste disposal system and the non safety-related electrical area. The non safety-related electrical area is normally a non-radioactive zone and is completely separated from the radioactive zones of the Auxiliary Building.

6. Access Building

The Access Building is located adjacent to the Auxiliary Building. The Access Building houses the access control area and the chemical sampling and laboratory area.

7. Turbine Building

The Turbine Building houses the non safety-related equipment of the turbine generator and its auxiliary systems (main condenser, feedwater heaters, moisture separator reheaters, etc.). The turbine generator is a steel structure, which is designed to withstand all loads, including the load of the overhead traveling crane. The foundation of the building is made of concrete.

The building is designed base on the following:

- The Turbine Building is oriented in such a way that any plane perpendicular to the turbine generator axis shall not intersect with the Turbine Building. This arrangement minimizes the probability of a turbine missile striking the Reactor Building.

- The Turbine Building is independent of the Reactor Building to prevent internal hazards in the Turbine Building from spreading.

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 US-APWR design-specific Control Room, Operations Support Center (OSC), and Technical Support Center (TSC).

a. Control Room

The Control Room is located in the Reactor Building. The Control Room includes 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 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

The US-APWR DCD does not include an OSC as part of the standard design; therefore, the location of the OSC is determined at a later date. The OSC is separate from the Control Room and the TSC. This location includes separate areas for coordinating and planning OSC activities.

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

The TSC is located within the Protected Area in the Access Building, in close proximity to the Control Room. The 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:

- Ventilation system which includes high-efficiency particulate air (HEPA) and charcoal absorbers.
- Exterior walls, roof, and floor are built to seismic Category II requirements.
- 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.

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 located in the Access 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 US-APWR DCD does not include a decontamination facility as part of the standard design; therefore, the location of the decontamination facility is determined at a later date. It 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 seismic instrumentation is solid-state multi-channel digital instrumentation with computerized recording and playback capability that allows the processing of data at the plant site within four hours of a seismic or other dynamic event.

The triaxial time-history accelograph consists of a centralized digital time history analyzer/recorder with multi-channel capability, which is located in a panel adjacent to the Main Control Room, and triaxial accelerator sensors at five different plant locations. These locations correlate to structural elements in the structures that have been modeled as mass points in the dynamic analysis so that the measured motion can be directly compared to the design spectra. The instrumentation at the five locations is not mounted on equipment, piping supports, or secondary structural frame members.

These locations have been determined to be consistent with maintaining dose rates as low as reasonably practical and maintaining occupational radiation exposures as low as reasonably achievable for access and maintenance of the instrumentation.

The time-history analyzer/recorder has the capability to provide pre-event recording of three seconds minimum and post-event recording time of five seconds minimum, and to record at least 25 minutes of sensed motion. The recorder portion of the time-history analyze has the capability of a sample rate of at least 200 samples per second in each of the three orthogonal directions of the plant, a bandwith of 0.20 Hz t 100 Hz, and a dynamic range of 1,000:1 zero to peak. The triaxial acceleration sensors have the same dynamic range as the time-history analyzer recorder and a frequency of 0.02 Hz to 100 Hz. The triggers of the triaxial acceleration sensor units are capable of being set within the range of 0.001g to 0.02g. Power supply for the seismic monitoring instrumentation system is from the non-Class-1E direct current and uninterruptible power supply system; however, the system is equipped with dedicated back-up batteries and charger in case of power outage or power failure.

The seismic instrumentation serves no safety-related function, and, therefore, has no nuclear safety design requirements. However, its design and location are in accordance with Regulatory Guide 1.12, which requires that seismic instrumentation:

- Is not affected by the failure of adjacent structure, system and components (SSC) during an earthquake;
- Operates during all modes of plant operation, including periods of plant shutdown; and
- Is protected as much as practical against accidental impacts.

As required by Regulatory Guide 1.12, the seismic instrumentation is rigidly mounted and oriented so that the horizontal components are parallel to the horizontal axes of the standard plant used in seismic analyses. These features of the seismic monitoring instrumentation are obtained by qualifying the equipment to IEEE Standard 344-1987.

The triggering of the seismic instrumentation is annunciated in the Control Room.

e. <u>On-Site Fire Detection Instrumentation</u>

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 unit DCD and Fire Protection Plan.

SECTION 3: REFERENCES

1. US-APWR DESIGN DESCRIPTION (OCTOBER 2006)

2. US-APWR DESIGN CONTROL DOCUMENT, REV. 1 (AUGUST 2008)