SECTION 10

ACCIDENT ASSESSMENT

1.0 General

1.1 Emergency Action Level Determination

The plant parameter and instrument values used to identify an emergency class are provided in Plan Attachment 5.

2.0 Accident Assessment and Instrumentation – Salem – Not Used

3.0 Accident Assessment and Instrumentation – Hope Creek – Not Used

4.0 Accident Assessment and Instrumentation – PSEG Site

There are several monitoring systems used to support emergency planning activities at the PSEG Site. The primary systems utilized are listed below.

- Radiation Monitoring System (RMS).
- Safety Parameters Display System (SPDS)
- Reactor Coolant Sampling System

4.1 Radiological Monitoring Instrumentation – PSEG Site

The radiological monitors consist of process radiation monitors, effluent radiation monitors and area radiation monitors. The system continuously displays and/or records the radiation levels in key areas. The PSEG Site Radiation Monitoring System (RMS) will comply with the recommendations of NUREG 0578.

Permanent monitor channels are not always available at a location of interest and the use of portable area monitors may be required during an accident.

4.2 Process and Area Monitors

In order to provide the operators with essential information on plant conditions during an emergency, various plant processes are continuously monitored. Many of these processes involve Limiting Conditions for Operations (LCO) and are controlled by the Technical Specifications. If an LCO parameter "goes out of specification" it requires the operators to implement the action required by the associated action statement. The intent of this action is to take corrective measures under abnormal conditions before a situation becomes more serious. These parameters would be monitored closely during an accident for assessment purposes.

4.3 Gaseous Release Path Monitoring

In addition to the main plant vent, a monitored vent, the other potential major release points from the plant during an accident will be identified upon the selection of the reactor

technology for the PSEG Site. Procedures are utilized to monitor these potential release pathways and perform the necessary dose assessment.

4.4 Reactor Coolant and Containment Air Sampling – PSEG Site

Reactor coolant and containment gaseous activity sampling (normal and high activity/emergency samples) are performed using station procedures and the normal day-to-day sampling systems. The plant vent, which is the final release point, is continuously monitored by the RMS for noble gases. The iodine cartridge is physically removed and taken into a laboratory for analysis by a multi-channel analyzer available at the PSEG Site.. There are also provisions provided in the plant vent for extracting a grab sample.

Analysis of reactor coolant and containment air samples provides detailed information on the status of the reactor core. These samples are used to provide confirmation of a loss of the fission product barriers.

5.0 Dose Assessment From Plant Effluent Monitors

Plume dose calculation procedures use plant effluent monitor data to project offsite doses due to noble gases and iodines. The primary purposes of the offsite dose calculation are to determine the axial location of highest expected dose at selected distances from the release point, to project dose rates and time integrated doses for downwind portions of the Emergency Planning Zone, and to determine if a Protective Action Recommendation (PAR) is needed. These procedures and calculation capabilities are available at the PSEG Site Control Room, Control Point, TSC, and EOF. The procedures use the meteorological dispersion factor (X/Q), dose rate or commitment conversion factors, and plant effluent monitor readings to project an offsite dose. The X/Qs are selected according to the existing temperature differentials, wind speed, and distance from the plant vent. The dose calculation is based on expected isotopic mixtures or specific mixtures if an isotopic mix has been determined. The plant effluent monitor readings are used in the calculations. The actual isotopic mix of the releases is used if the releases have been sampled and analyzed. Calculated offsite doses are then compared to Protective Action Guides developed using EPA-400-R-92-001.

The PSEG Site Radiation Monitoring System computer and/or Safety Parameter Display System provide early indication of abnormal radiological conditions from both process and area monitors. The computer systems provide monitoring capability for the radiological parameters identified in Regulatory Guide 1.97, including high range monitoring capability for effluent release paths. This data is input to the dose assessment computers at the PSEG Site.

The Radiation Monitoring System provides radiological release rate information and computer systems provide meteorological data acquisition for the PSEG Site. A computerized dose assessment program provides redundant emergency dose assessment modeling capability in manual mode and all modes at the EOF.

Dose assessment or projection represents the calculation of an accumulated dose at some time in the future, if current or projected conditions continue. During an accident, the plant parameter display system and personal computers provide the ERO with the timely information required to make decisions. Radiological and meteorological instrumentation

readings are used to project dose rates at predetermined distances from the plant, and to determine the integrated dose received. A computerized dose assessment program with the following methods is used:

a. Monitored Release Points: This method uses the plant's effluent radiation monitors and system flow rates. Effluent release points are used to directly calculate a release rate. The point of the release determines the way the source term is affected and is adjusted by the dose assessment process.
b. Containment Leakage/Failure: This method uses a variety of containment failures or leak rates in conjunction with available source term estimations to develop a release rate to the environment. A direct vent of containment can be modeled as a failure to isolate.
c. Release Point Samples: This method uses a sample at the release point and an estimated flow rate to develop a release rate at the point of release.
d. Field Monitoring Team Data: This method uses a field survey or sample and the atmospheric model to back calculate a release rate and ratio concentrations of radioactive material at various points up and downwind of plume centerline.

The computer applications are used to provide dose calculations to evaluate dose against the EPA -400 plume exposure protective action guides (PAGs) applicable for the early phase of an accident. These evaluations place an emphasis on determining the necessity for an offsite PAR.

The model is time dependent and provides integrated doses as well as dose rates using EPA 400 dose factors.

Ingestion pathway calculations including (1) airborne concentrations, (2) ground level contamination, (3) foodstuff contamination, (4) ground shine committed dose, and (5) population doses are performed in accordance with the intermediate phase objectives provided in EPA 400.

Several choices are available to the user for determining the source term. If a Design Basis Accident is assumed, but the release rate is unknown, preset release scenarios can be used for accident scenarios. Otherwise, real time data from effluent monitors is used.

Upon declaration of a General Emergency (which is done by evaluating specific system parameters), a predetermined PAR is provided to the State governments in New Jersey and Delaware.

The predetermined PARs are developed as outlined in NUREG-0654, Rev. 1, Appendix 1, and Inspection and Enforcement Information Notice 83-28. These PARs are incorporated into both the Event Classification Guide and Emergency Plan Implementing Procedures for Protective Action Recommendations. The use of predetermined PARs allows the transmission and consideration of protective actions in a manner, which affords timely notification of the Emergency Planning Zone (EPZ) municipalities/counties.

The dose calculations use the best information available from the plant effluent monitoring and sample system and the field monitoring team surveys. The doses are integrated over the appropriate sectors and distances around the station.

Transient population is not expected to affect person-rem dose calculations significantly within 10 miles of the plant.

6.0 Dose Assessment From Containment Radiation Monitoring

Dose assessment, utilizing containment high range dose rate monitors, is obtained with the use of dose assessment computer programs.

7.0 Dose Estimates When Instruments Are Off-Scale or Out of Service

7.1 Defaults for the PSEG Site

Emergency Plan Procedures describe in detail how projected dose calculations are made if radiation monitors normally used for monitoring plant release points or containment radiation are inoperable or off-scale. The procedures call for determining the type of accident, which is occurring and classifying it according to a set of default classes that are dependent on the reactor technology.

Once a determination of the type of accident has been made, Total Effective Dose Equivalent (TEDE) and thyroid committed doses are projected in accordance with Emergency Plan Implementing Procedures.

8.0 Dose Assessment From Field Monitoring – PSEG Site

The PSEG Site Offsite Dose Calculation Manual (ODCM) summarizes Environmental Radiological Monitoring. Field monitoring within the plume exposure EPZ takes place whenever the radiological emergency response organization is fully activated. Field teams take direction from the radiological support personnel in the TSC and/or EOF. Data is obtained and updated quarter hourly and hourly on the meteorological variables of wind direction, speed and vertical temperature change (Delta T). This data is used to direct the onsite and offsite survey teams. Each field monitoring team is capable of performing the necessary functions required to obtain reliable data. Communications are accomplished by the use of emergency radios and cellular phones by each team. Deployment times range from 30 to 60 minutes for the onsite and offsite emergency radiation survey team(s). Field monitoring is performed in accordance with Emergency Plan Implementing Procedures. Procedures have been prepared which allow personnel to determine release rates from field data and then calculate doses at other locations.

PSEG Site survey instruments are able to detect radioiodine concentrations as low as l.0E-07 uCi/cc provided that noble gases and background radiation (which can adversely affect the Minimum Detectable Activity (MDA) are minimized. In order to achieve this, silver zeolite cartridges, which can be placed in portable field samplers, are used. The silver zeolite cartridges have better iodine to noble gas adsorption ratio than standard charcoal cartridges. Since high background can also adversely affect readings, survey team personnel are pre-directed to count the cartridges in low background areas.

Emergency Plan Implementing Procedures list equipment required for a field survey team. This equipment provides the means for directly measuring or relating measured field contamination levels to dose rates. The dose rate due to contamination and the plume are obtained directly from the dose rate meter.

9.0 Dose Assessment from Liquid Sample Activity Concentration

Since the Delaware River is not a source of potable water in the vicinity of the PSEG Site, the major critical pathways by which a population would receive a radiation exposure from liquid effluent releases are swimming and boating activities.

The radiation dose received by such activities is dependent upon three factors:

a. The isotopic mixture of the release;

b. The concentration of the nuclides at the point of interest; and

c. The time period of exposure.

All three factors are highly variable, but certain assumptions can be made to calculate a conservative dose conversion factor. The isotopic mixture varies according to the operating history of the plant and on the status of the radwaste system at the time of the incident. The concentration of the nuclides is also dependent upon plant conditions but of equal importance is that this factor varies according to the hydrological mixing and dilution during transport of the liquid release to the site of interest. Based on predicted surface temperature profile data, a dilution factor of 10 can be assumed for swimming and boating activities near The PSEG Site.

In the event of a radioactive release to the Delaware River, water samples are taken and counted. The total counts per minute determined would then be converted to a gross gamma concentration.

9.1 Water Immersion (Swimming)

The radiation dose from water immersion (swimming) depends upon the concentration of the nuclides present at the location of the immersion and the period of exposure. Dose rate conversion factors have been calculated on the assumption that the swimmer is completely submerged and surrounded on all sides by a large volume of water. This physical arrangement approximates 4 π geometry for gamma radiation and 2 π for beta radiation.

9.2 Normalized Conversion Factors for Water Immersion and Boating

Based on a typical isotopic mixture, general dose equations can be formulated which incorporate a weighted average dose rate conversion factor, a gross isotopic concentration value, and the time period of exposure.

Based on sample analysis, exposure time, and the normalized conversion factors, dose can be calculated for any swimming or boating activities in the vicinity of the PSEG Site. A comparison would then be made of these calculated doses with State Action Levels as indicated in the State Radiological Emergency Response Plans for Nuclear Power Plants.

10.0 Other Onsite Emergency Equipment- Assessment

Onsite instrumentation, which can be used to initiate emergency measures, is described in the implementing procedures of this plan.

10.1 Meteorological Monitoring

A meteorological program in accordance with the recommendation of NRC Regulatory Guide 1.23 "Onsite Meteorological Programs" and Section 2.3.3 of NUREG 75/087 (Rev. 1) has been established.

The primary meteorological monitoring system measures wind speed and direction at three elevations (300 ft., 150 ft., and 33 ft.). Temperature difference is measured between 300 ft. and 33 ft. and between 150 ft. and 33 ft., in order to provide vertical lapse rates for air stability estimates. Calculated sigma theta values of the wind direction at the three elevations are also provided.

Backup meteorological data is provided by a backup tower located onsite approximately 500 ft. south of the primary meteorological tower. Backup meteorological data is provided through wind speed and wind direction sensors mounted on a ten-meter pole. In addition to the 15-minute averaged wind speed and wind direction, a computed sigma theta value is provided. The primary as well as the backup meteorological information is available in the PSEG Site Control Room, TSC, and the EOF.

The meteorological monitoring system is provided with a dedicated battery backup power supply. The system is calibrated quarterly using equipment traceable to an NBS Standard. The Meteorological Monitoring Program is reviewed biennually in accordance with the Hope Creek and Salem UFSAR. (A detailed description of the onsite meteorological measurements program is provided in the PSEG Site SSAR).

A system to provide alternate remote interrogation of the meteorological system is available by way of direct telephone dial-up capability.

The Emergency Plan Implementing Procedures provide for meteorological support from the closest NOAA Weather Station (National Weather Service-NWS). Information, including synoptic weather conditions, forecast, regional precipitation and severe weather alerts from this NWS station is available on a 24-hour-per-day basis. Monthly communication checks with this NWS station are made in accordance with Section 15.0 of this Plan. It has been determined that the data from this nearby NOAA weather station is representative of the combination of local and regional meteorology. Backup communication with this weather station uses the Delaware NAWAS.

10.2 Seismic Monitoring

A Control Room alarm is provided in the event of seismic activity associated with the Operating Basis Earthquake (OBE). The seismic monitoring system measures and records the acceleration (earthquake ground motion) of the structure. Attachments 6 through 9 of this Plan describe technology specific seismic instrumentation.

10.3 River Level Monitoring

River water level monitoring requirements will be determined when the reactor technology is selected.

The geophysical instrumentation monitors the parameters required for evaluating action levels contained in the Event Classification Guide (ECG) and Emergency Plan Implementing Procedures.

10.4 Fire Detection

The PSEG Site Fire Protection System is designed in general accordance with the National Fire Protection Association's standards. Any fire initiates fire alarms and the protection systems as appropriate. An alarm is initiated by automatic sprinkler actuation, smoke detector actuation, heat sensor actuation or by manual action.