## 11.5 PROCESS AND EFFLUENT RADIOLOGICAL MONITORING AND SAMPLING SYSTEMS

The Process and Effluent Radiological Monitoring Systems monitor and furnish information to operators concerning activity levels in selected plant process systems and plant effluents.

The systems consist of permanently installed continuous off-line monitoring devices together with provisions for specific routine sample collections and laboratory analyses. The overall systems are designed to assist the operator in providing information for evaluating and controlling the radiological consequences of normal plant operation, anticipated operational occurrences, and postulated accidents such that resultant radiation exposures and releases of radioactive materials in effluents to unrestricted areas are maintained as low as reasonably achievable.

The radiation monitoring system is essentially a digital system, with the following subsystems supplied by CE for process monitoring:

Information from monitors a, c, d, and e is transmitted to the control room for display in CP-6 by interfacing microprocessors.

a) SGB Monitor

→ (DRN 02-263)

b) Deleted

←(DRN 02-263)

c) Liquid Waste Management System

d) Gaseous Waste Management

e) Boron Management System.

These systems are supplemented by the Area and Airborne Radiation Monitoring Systems described in Subsection 12.3.4.

### 11.5.1 DESIGN BASES

#### 11.5.1.1 Process Radiological Monitoring System

The continuous Process Radiological Monitoring System, supplemented by the Sampling System, is designed to perform the following functions:

a) Provide assistance to operators to insure the proper functional performance of the selected systems being monitored.

b) Provide for early detection of radioactivity leakage into normally nonradioactive systems, including primary-to-secondary leakage, and process system leakage into normally nonradioactive systems.

c) Provide information to plant personnel of radiation levels in liquid and gaseous process lines.

d) Provide information to plant personnel of any abnormal increase in normally radioactive or potentially radioactive process and effluent lines.

11.5.1.2 Effluent Radiological Monitoring System

11.5.1.2.1 Normal Operations and Anticipated Operational Occurrences

The Effluent Radiological Monitoring System is designed to perform the following functions in order to meet the requirements of 10CFR20, 10CFR50, and follow the recommendations of Regulatory Guide 1.21 (June 1974) to the extent specified in the Technical Specifications during normal operations, including anticipated operational occurrences. Principal normally radioactive or potentially radioactive release paths are monitored.

a) Provide representative sampling, monitoring, storage of information, indication and if necessary alarm of liquid and gaseous radioactivity levels.

b) Provide the capability, during the release of radioactive liquid wastes, to alarm and initiate automatic closure of the appropriate waste discharge valves before Technical Specifications limits are approached or exceeded.

c) Provide radiation level indication and alarm annunciation to the control room operators whenever Technical Specification limits for release of radioactivity are approached or exceeded.

→ (DRN 99-2115; 02-263)

d) Deleted

← (DRN 99-2115; 02-263)

e) Provide capability for automatically redirecting the plant discharge from the normal discharge path to the Waste Management System in the event of high radiation content.

11.5.1.2.2 Postulated Accidents

Post-accident monitoring is discussed in Subsection 1.9.29.

11.5.1.3 Sampling System

11.5.1.3.1 Normal Operations and Anticipated Operational Occurrences

The Sampling System provides grab samples to supplement the Process and Effluent Radiological Monitoring System, and in particular is designed to provide specific information regarding specific radionuclide composition of process and effluent streams and to monitor tritium as required in the Technical Specifications.

Principal effluent streams as well as selected process streams are sampled at regular intervals, as described in Subsection 11.5.2.6.

11.5.1.3.2 Postulated Accidents

The use of sampling systems for post-accident monitoring is discussed in Subsection 1.9.29.

## 11.5.2 SYSTEM DESCRIPTION

### 11.5.2.1 Continuous Process and Effluent Radiological Monitoring

The requirements of the system design bases for continuous monitoring are satisfied by a system of off-line monitoring channels for the in-plant liquid and gaseous process lines.

Continuous monitoring means that the monitor operates uninterrupted for extended periods during normal plant operation.  The monitor may occasionally be out of service for maintenance, repair, calibration etc., during which time the frequency of sampling of the particular stream may be increased, depending on the past history of the radioactivity level of the stream.

System equipment is designed to function properly under the following environmental conditions:

a) ambient temperature range of 30°F to 131°F

b) relative humidity range of 0 to 95 percent

c) a typical external background radiation field of 2.5 mr/hr (1 MeV $\gamma$)

Subsection 11.5.2.1.1 provides a description of system hardware including design features such as instrumentation, types and locations of readouts, annunciators, and alarms, provisions for emergency power supplies, and provisions for decontamination and replacement.

Table 11.5-1 is a tabulation of basic information describing each of the continuous process and effluent radiological monitors and samples, including monitor location, type of monitor and measurement made, sampler and/or detector type, range of activity concentrations to be monitored and expected concentrations, alarm setpoint, provisions for power supplies, and automatic actions initiated.

The basis for the ranges listed in Table 11.5-1 are as follows:

a) Process Monitors

   1) Maximum expected concentrations during normal operations and anticipated operational occurrences, as well as range of expected concentrations as given in the tables referenced in Table 11.5-1.

   2) The highest sensitivity commercially available when purchased in order to detect process system leakage contamination as early as possible.

b) Effluent Monitors

1) Range of expected concentrations during normal operations and anticipated operational occurrences as given in the tables referenced in Table 11.5-1.

2) Sufficient sensitivity to detect gross $\gamma$ or $\beta$ activities below the limits specified in 10CFR20 prior to dilution in the atmosphere or water discharge canal.

Actual values of these alarm limits depend on the maximum anticipated flow rates; therefore the values listed in Table 11.5-1 should be interpreted as theoretical preliminary values.

11.5.2.1.1 General System Description

The Process and Effluent Radiological Monitoring Systems provide the means for monitoring all of the liquid and gaseous paths by which radionuclides may be released to the environment either under normal operating conditions or under abnormal plant accident conditions. The Process and Effluent Radiological Monitoring Systems are also supplemented by the Area and Airborne Radiation Monitoring Systems which are described in Subsection 12.3.4 and by the Sampling System. These systems utilize local micro processors with inputs to two Radiation Monitoring Computers which provide for data logging processing, editing and displaying of information obtained from the radiation sensors. These computers in turn communicate, via a data link, with the main plant computer. This microprocessor approach provides considerable flexibility in the means of collecting data and the manner of displaying and utilizing such data.

The Radiation Monitoring System (RMS) is a comprehensive, plant-wide radiation information gathering and control system encompassing the process and effluent monitors and the area and airborne monitors. The RMS is a digital, distributed microprocessor-based system in which full functional capability resides locally at the microprocessor controlling each monitor. The RMS is divided into a non-safety related portion and a safety related portion, with all equipment in the latter in accordance with IEEE 279-1971, 308-1971, 323-1974, 336-1971, 344-1975 and 384-1974.

The non-safety related portion is composed of the local monitors, two RMS computers and two operator's consoles. Each operator's console consists of a keyboard, CRT, and hard copy type. Each monitor is part of a loop, each loop connecting two RMS computers. The two operator consoles are located in the main control room and the Health Physics room. The two RMS computers are located in the computer room which is adjacent to the main control room.

Communication is in either direction along the loop, thereby assuring redundancy in the event of any single failure. Both RMS computers support approximately half of the monitor units simultaneously and share data between themselves. Should either RMS computer fail, the remaining operating machine picks up the entire load with no degradation in capacity. Information from the monitors is displayed at the CRT. Since the two RMS computers are interconnected, the information is shared among both RMS computers and available to both operator's consoles. Information includes radiation level in the proper engineering units or cpm, effluent flow histories, monitor status and alarm status.

Each monitor has two upscale trips for alert and high radiation, and one downscale trip to indicate monitor failure. Monitor failure includes: low flow, torn filter paper, high differential pressure, and detector failure (low count). Controlled functions include monitor setpoints, purging, check source activation, and monitor testing.

→(EC-12329, R306)
Those channels identified on Table 11.5-1 as safety related are first indicated and recorded on digital ratemeters and recorders housed on the radiation monitoring panels in the main control room as shown in Figure 12.3-11.
←(EC-12329, R306)

Additionally, the safety related monitors are grouped into loops, each between two non-safety RMS computers similar to those of the non-safety monitors, with the exception that all communication ports between the safety monitors and non-safety related computers have qualified 150OV, optical isolation buffers, and are used solely for the purpose of transmitting information from the monitor to the RMS computers: no control can be exercised by the non-safety related portion of the RMS over the safety related monitors. With this technique, information from all the monitors is normally available at the operator's consoles' CRT. Information, control and annunciation capabilities of each of the safety related monitors from its display/control module are the same as those capabilities described for the non-safety related monitors.

The RMS computer collects concentration (i.e., μCi/cc) and process flow data from the radiation monitors in the Effluent Monitoring System and transmits it on demand to the main plant computer.

A channel consists of a sampling chamber, a local microprocessor check source, the detector, and local indicator and annunciation unit. The detector assembly usually consists of either a $\gamma$ or $\beta$ sensitive scintillation crystal, a photo multiplier tube and local amplifier.

The Process and Effluent Radiological Monitoring Systems consist of individual liquid and gaseous process monitoring channels. The systems extract a sample from the process stream to be monitored in a shielded chamber for radioactivity levels and then returned back to the process line.

11.5.2.1.2 Monitor Cabinet/Skid

Each sampling assembly is within an enclosure or is skid mounted and consists of a sampler and the associated piping, fittings, and other components as required.

11.5.2.1.3 Power Supplies

Each monitoring channel is provided with an independent power supply, designed such that a failure in that channel does not affect any other channel. Monitoring channels that are identified as safety related are redundant and are supplied power from the station 120V ac safety related buses. The power supplies for these channels are identified in Table 11.5-1. Power to the channels that monitor only normal operations is supplied from the station regulated 120V ac instrumentation bus.

11.5.2.1.4 Recording

→(EC-12329, R306)

The digital information originating from all non-safety related channels is stored as required on magnetic tapes, through the main plant computer, in the main control room. Those channels identified on Table 11.5-1 as safety related channels are, in addition, recorded by means of recorders. The recorders are housed on two seismic Category I panels in the main control room.

←(EC-12329, R306)

11.5.2.1.5 RMS Detector Types

11.5.2.1.5.1 Beta Sensitive Detector

This beta sensitive detector monitors beta emitting samples within its solid angle sensitive volume (4 x 4 x 4 ft duct).

The detector is constructed from a two inch diameter plastic beta scintillator coupled to a photomultiplier tube.

Per ANSI N13.10-1974, and using the microprocessor software for signal processing, the minimum detectable concentration for Kr-85 in a 2.2 mr/hr Co-60 gamma background is 7.23 x 10 micro-Ci/cc, with a sensitivity for Kr-85 of 2.81 x 10 cpm/micro-Ci/cc, and a background count of 1919 cpm/mr/hr at 1.0 MeV and an ambient background response of 318 cpm due to noise. A Cl-36 beta check-source is provided.

11.5.2.1.5.2 Noble Gas Detector

The noble gas detector assembly is constructed from a three inch thick, steel jacketed, horizontal, cast-lead cylinder which provides a four-pi shield around an easily removable 3.2 liter stainless steel sample canister. Inside the canister the gas is viewed by an aluminum-foil-covered two inch diameter beta scintillation phosphor coupled to a two inch diameter photomultiplier tube through a pressure boundary light pipe.

Per ANSI 13.10-1974, and using the microprocessor software for signal processing, the minimum detectable concentration for Xe-133 in a 2.5 mr/hr Co-60 gamma background is 1.38 x 10 micro-Ci/cc, with a sensitivity for Xe-133 of 4.3 x 10 cpm/ micro-Ci/cc, and a background count of 45 cpm/mR/hr at 1 MeV and an ambient noise background of 20 cpm. Maximum operating temperature is 131°F.

Maximum operating pressure is 30 psia. Sample flowrate is approximately 4 $ft^3$ /min. A C1-36 beta checksource actuated by a spring return solenoid is used to provide a one-decade response indication on actuation.

11.5.2.1.5.2.1 Iodine Detector

The iodine detector assembly is constructed from a three inch thick, steel jacketed horizontal, cast-lead cylinder which provides a four-pi shield around an easily removable stainless steel sample canister. Gas containing radioiodine enters the shield, passes through a charcoal filter element, and is exhausted. The charcoal filter is viewed by the NaI (Tl) integral lines gamma scintillator assembly which maintains gamma emissions from the radioactive iodine described in the filter. Sample flowrate is approximately 2ft$^3$/min. A Ba-133 checksource actuated by a spring return solenoid is used to provide a one decade response indication on actuation.

11.5.2.1.5.3 Liquid Detector

The detector assembly is constructed from a three inch thick, steel-jacketed, horizontal case lead cylinder which provides a four-pi shield around a removable 6.2 liter polished stainless steel sample canister. Inside the canister, the fluid is viewed from a detector well by a one inch thick by one and one-half inch diameter NaI (Tl) gamma scintillation crystal coupled to a one and one-half inch diameter photomultiplier tube.

Per ANSI N13.10-1974, and using the microprocessor software signal processing, concentration for a liquid Cs-137 sample in a 2.5-mR/hr, Co-60 background, is 3.71 x 10$^{-7}$ micro-Ci/cc, with a sensitivity Cs-137 of 1.28 x 10$^8$ cpm/micro-Ci/cc, and a background count of 404 cpm/mr/hr for Co-60 and an ambient noise background of 52 cpm. Maximum operating temperature is 131°F. Maximum operating pressure is 150 psia. The sample flowrate is approximately 4 gpm.

Actual background will of course vary from this reference condition and will depend on the particular location of the liquid detector for the locations located in Table 11.5-1. Background radiation is expected to be less than 1.0 mR/hr during normal operation.

A Cs-137 gamma checksource actuated by a spring return solenoid is used to provide a one-decade response indication on actuation.

11.5.2.1.5.4 Moving Filter Particulate Detector

The detector uses a rotary solenoid to advance a two inch wide filter paper across a 1.7 inch x 1.9 inch sample point aperture. The filter advance rate can be varied or stopped entirely, and operated as a fixed filter. Particulate-laden air enters the assembly through the sample inlet and is deposited on the face of the filter (dropout is onto the filter). The point of deposition is viewed by a 0.625 x 1.125 x .01 inch thick side window beta scintillation detector which, together with the aperture port and filtering point, is surrounded by 2.5 inches of four-pi lead shielding.

Per ANSI N13.10-1974, and using the microprocessor software signal processing the minimum detectable concentration for Cs-137 in a 2.5-mR/hr Co-60 gamma background (after equilibrium) with a filter speed of 0.5 in/hr; a filter efficiency of 99 percent for particulates 0.3 microns or larger; and a flowrate of 4 ft$^3$/ min is 3.11 x 10$^{-12}$ micro-Ci/cc, with a sensitivity for Cs-137 of 1.08 x 10$^5$ cpm/micro-Ci deposited, and a background count of 15 cpm/mR/hr for Co-60 and with an ambient noise background of 36 cpm. Maximum operating temperature is 131°F. Maximum operating pressure is 5 psia.

A Cl-36 beta checksource actuated by a spring return solenoid is used to provide a one-decade response indication on actuation.

11.5.2.1.6 Equipment Configuration

11.5.2.1.6.1 Liquid Radiation Monitors (L)

Each liquid radiation monitor uses the liquid detector described in Subsection 11.5.2.1.5.3. Each monitor skid with the exception of those of the CCW system is supplied with one centrifugal pump used to obtain a continuous fluid sample, demineralized water for purging, heat exchanger where the sample temperature may exceed 125°F, and drain connection to the appropriate waste system. A sample connection to which a sample bomb may be attached is provided.

11.5.2.1.6.2 Airborne Particulate, Iodine and Noble Gas Monitor (PIG)

Each particulate, iodine, and noble gas monitor uses the moving filter particulate detector and the iodine and noble gas detector described in Subsections 11.5.2.1.5.4 and 11.5.2.1.5.2, respectively.

Each monitor skid is supplied with two vacuum pumps. One pump draws a constant 2 cfm sample through the iodine detector. The other pump draws a 4 cfm nominal flow sample through first the iodine detector then the noble gas detector. All PIGs are supplied with automatic flow control, and sample probes used to obtain isokinetic samples in accordance with ANSI N13.1-1969. The particulate and iodine filters can be removed routinely for analysis.

11.5.2.1.6.3 Noble Gas Monitor (G)

→(DRN 06-1028, R15)

Each noble gas monitor uses the noble gas detector described in Subsection 11.5.2.1.5.2. Each monitor skid is supplied with one sample pump, heat exchanger when the sample temperature can exceed 125°F, and heat tracing to prevent condensation where sample humidity is near condensation.

←(DRN 06-1028, R15)

11.5.2.2 Redundancy, Diversity, and Independence

Monitors designated as safety-related in Table 11.5-1 are designed for redundancy, diversity and independence in accordance with IEEE 308-1974, IEEE 279-1971, IEEE 323-1971, IEEE 336-1971, IEEE 344-1975 and IEEE 384 1974.

11.5.2.3 Microprocessor and Computer Functions

The functions of each monitor are controlled by a local dedicated microprocessor mounted in its own NEMA-12 cabinet. The microprocessor performs all required communications, calculations, data logging, and validity checking, control and annunciation: The microprocessor shall receive, process, and transmit system information upon request. Alarms will be generated and displayed following the exceeding of alarm setpoints or whenever a channel becomes inoperative. The microprocessor also has the capacity to activate the check source into position, control sampling, and purging as appropriate for the monitor.

Each microprocessor can be controlled locally by a plug-in readout and control unit which can perform all the display and control functions which the panel mounted display and control module of the safety related portion can perform.

All microprocessors are designed to operate at 40°F to 131°F, 0 to 95 percent humidity, and are designed for an integrated lifetime radiation dose of 1000 rads.

Information recorded at the microprocessor includes radiation histories, expressed in the proper engineering units. Data files will be grouped into 24-10 minute, 24-one hour, and 28-one day history averages.

All information is protected in RAM for eight hours in the event of power interruption; all microprocessors are capable of self initialization and reload from their own data base within this eight hour period; subsequent to the eight hours reinitialization requires a load from the appropriate computer with which the microprocessor is associated.

11.5.2.4 Process and Effluent Radiological Monitoring Systems

11.5.2.4.1 Effluent Radiological Monitoring System

11.5.2.4.1.1 Liquid Waste Management Liquid Monitor

The liquid waste discharge radiation monitor consists of that instrumentation required to provide alarm and indication of the gross gamma activity in the plant liquid effluent leaving the Liquid Waste Management System (LWMS). Contacts are provided to initiate control action. The monitor is located in the LWMS in a line to the discharge canal. The expected maximum radioisotopic content in this line varies depending on the component being discharged. Activities which can be discharged through this line are given in Table 12.2-11.

The detector assembly consists of a gamma scintillation crystal, photomultiplier tube and local amplifiers. The detector assembly is shielded against a typical 2.0 mr/hr external 1 MeV $\gamma$ background. The discharge is automatically terminated and an alarm is annunciated in the main control room when any one of the following is present:

a - high radiation signal is generated by the monitor

b - power supply to the monitor is cut-off

c - failure is detected in the monitor

d - flow of monitored fluid through the detector is decreased to less than the required minimum.

11.5.2.4.1.2 Gaseous Waste Management Monitor

The primary functions of the gaseous waste discharge radiation monitor are to provide indication, during discharge, of gross beta activity of the gaseous waste discharge effluent, and to initiate the closure of the gaseous waste discharge isolation valves in the event that the monitor's radiation setpoint is reached. The detection assembly consists of a scintillation crystal, photomultiplier sensor and local amplifier. Loss of instrument power or failure of the signal processing equipment constitutes instrument failure and also initiates valve closure. Contact outputs (for monitor Dryer Trouble, HI-RAD-and FAIL) are provided to the main plant annunciator. Local HI-RAD and FAIL lamps are provided on the remote readout/ alarm/control unit. The maximum activity content in the monitored line is shown in Table 12.2-11.

→ (DRN 99-2361)

11.5.2.4.1.3

← (DRN 99-2361)

11.5.2.4.1.4 Boron Management System Liquid Monitor

The primary functions of the boron management liquid discharge radiation monitor system are to provide indication, during discharge, of gross gamma activity of the Boron Management System liquid discharge effluent, and to initiate the closure of the Boron Management System discharge isolation valves in the event that the monitor's radiation setpoint is reached. The expected maximum activity in this line is given in Table 12.2-8.

The discharge is automatically terminated and an alarm is annunciated in the main control room when any one of the following is present:

a - high radiation signal is generated by the monitor

b - power supply to the monitor is cut-off

c - failure is detected in the monitor

d - flow of monitored fluid through the detector is decreased to less than the required minimum.

→ (DRN 99-2361)

Local HI-RAD and FAIL lamps are provided on the remote readout/alarm/control unit.

← (DRN 99-2361)

11.5.2.4.1.5 Condenser Vacuum Pumps Monitor

→ (DRN 99-2115)

The condenser vacuum pumps gas monitor measures noncondensable fission product gases in the condenser air ejector discharge. The presence of radioactivity in this line would indicate a primary to secondary leak in the steam generators. The predominant isotopes would be Kr-85 and Xe-133 with the presence of Iodine. The function of this monitor is to alarm in the event the alarm setpoint is reached or exceeded. The expected activity levels will be a fraction of the activities listed in Table 11.3-5 with the noble gases going to the condenser in their entirety, but only two percent of the halogens and one tenth of a percent of the remaining fission and corrosion products being transported to the condenser.

← (DRN 99-2115)

The sampler is shielded to give the required sensitivities and is of the type described in Subsection 11.5.2.1.5.2.

→(DRN 99-2115, R11)
High radiation alarms are indicated both locally and in the main control room.
←(DRN 99-2115, R11)
Additionally this monitor on the condenser vacuum pump exhaust provides for Regulatory Guide 1.97 Revision 3 conformance. A detailed description of the monitor can be found in FSAR Subsection 1.9.29.

11.5.2.4.1.6 Fuel Handling Building (FHB) Normal Exhaust Monitors

The FHB normal exhaust monitors provide an indication to operations personnel of the activity in the Fuel Pool Ventilation System serving the operating floor and spent fuel pools. Each of the two normal exhausts is monitored using the airborne particulate, iodine and noble gas monitor described in Subsection 11.5.2.1.6.2.

These monitors provide a high radiation alarm when concentration levels reach preset limits. The receipt of these alarms will alert the operators to the presence of low level leakage so that additional radiation surveys and sampling can be effected in order to locate the leakage source.

11.5.2.4.1.7 Fuel Handling Building (FHB) Emergency Exhaust Monitors
→(DRN 03-2065, R14)
These monitors are part of the monitoring system purchased for NUREG 0737 compliance and are described in Subsection 1.9.29.
←(DRN 03-2065, R14)

11.5.2.4.1.8 Plant Stack Radiation Monitor

The plant stack radiation monitor is designed to representatively sample, monitor, indicate and store the radioactivity levels in the plant effluent gases being discharged from the plant stack. It provides a continuous indication in the main control room of the activity levels of radioactive materials released to the environs so that determination of the total amount of activity release is possible.

A schematic diagram of the plant stack radiation monitor is shown on Figure 12.3-13.

The plant stack radiation monitor monitors the plant stack for particulates, iodine and noble gases at the point of release to the atmosphere. Its function is to confirm that releases of radioactivity do not exceed the predetermined limits set by the Offsite Dose Calculation Manual (ODCM).

The sample flow is withdrawn from the stack through an isokinetic nozzle located at a minimum of eight stack diameters from the last point of radioactivity entry. The nozzles are designed such that the sampling velocity is the same as that in the stack pipe so that preferential selection does not occur, i.e., so that the weights of the radioactive particles do not become a factor in obtaining a representative sample. The isokinetic sampling system is designed in accordance with ANSI N13.1-1969.

The particulate iodine and gaseous detectors used for each plant stack monitor are described in Subsections 11.5.2.1.5.4 and 11.5.2.1.5.2.
→(DRN 99-2361, R11)

11.5.2.4.1.9 Industrial Wastes Sump Turbine Building Radiation Monitors.
→(DRN 99-482, R11; 99-2361, R11; 03-215, R12-B)
All Turbine Building drainage is routed to two industrial waste sumps. Under normal conditions, industrial waste will be discharged through a radiation monitor to an oil separator located in the yard for separation of the oil. The water will then be pumped by the oil separator discharge pumps to the 40 arpent canal or the Circulating Water System discharge. In the event that the radiation monitor on the industrial waste discharge header detects a higher radiation level than the monitor setpoint, discharge flow is stopped. Following analysis, the water will be directed to the proper location. The monitor will also send a signal to sound an alarm in the main control room.
←(DRN 99-482, R11, 99-2361, R11; 03-215, R12-B)

→ (DRN 99-2361)

11.5.2.4.1.10 Dry Cooling Tower Sumps Radiation Monitors (1 & 2)

→ (DRN 99-2494)

Two monitors monitor dry cooling tower areas A and B sump discharge to either the Circulating Water System or to the 40 Arpent Canal. Upon detection of high radiation activity, the monitor will automatically stop the sump pumps and alarm in the Control Room. The operator can then align the discharge to the Waste Management System.

← (DRN 99-2494)

→ (DRN 99-0579)

If a loss of offsite power occurs during a discharge, both the pumps and monitors are de-energized. The operator can manually load the pumps onto the EDGs as described in Table 8.3-1. However, the monitor contacts remain in the “alarm” state and actuate a signal that locks out the pumps. A selector switch on the MCC cubicle of each sump pump allows the operator to bypass this condition until power is restored to the monitors.

← (DRN 99-0579)

11.5.2.4.1.11 Circulating Water Discharge Radiation Monitor (Blowdown and Blowdown Heat Exchanger and Auxiliary Component Cooling Water Pumps)

The circulating water discharge radiation monitor consists of one offline monitoring assembly. This device is located at a portion of the line prior to offsite discharge for the purpose of monitoring the radioactivity content of the liquid being discharged. This monitor monitors the discharge from the Steam Generator Blowdown (when directed to the Circulating Water System), the Steam Generator Blowdown Heat Exchanger, and the Auxiliary Component Cooling Water Pumps (when routed to the Circulating Water System). This monitor provides capability to initiate automatic closure of Steam Generator Blowdown Valve BD-303 upon receipt of a high radiation signal. The closure signal does not lock in, therefore, if the alarm clears prior to BD-303 fully closing, the valve will stop moving. In addition, during discharge from the Steam Generator Blowdown line automatic samples are obtained. These samples are collected into a composite sample.

← (DRN 99-2361)

11.5.2.4.2 Process Radiological Monitoring System

→ (DRN 99-2361)

11.5.2.4.2.1 Steam Generator Blowdown (SGB) Monitor

The primary function of the steam generator blowdown radiation monitor is to provide indication of the gross gamma activity of the steam generator blowdown whenever the blowdown system is in operation. It also provides audible and visual alarms in the event of instrument failure (loss of instrument power or signal high or low), or when the radiation setpoint is reached.

← (DRN 99-2361)

11.5.2.4.2.2 Component Cooling Water System Monitors

The component cooling water monitors provide an indication to operations personnel whenever the activity in the Component Cooling Water System reaches or exceeds a prestablished level. These monitors detect in leakage to the system from components that may contain radioactivity. Each of the two component cooling water loops is monitored.

The third component cooling water monitor is provided to monitor the return line from the reactor coolant pumps heat exchangers. The channels consist of an off-line sampler, a microprocessor, a $\gamma$ scintillation detector, a check source and power supply.

The monitors provide a high radiation alarm when concentration levels reach preset limits. The receipt of these alarms will alert the operator to the presence of leakage so that additional radiation surveys, sampling, and equipment isolation can be effected in order to locate and repair the leakage source.

→ (DRN 99-2361)

The activity levels are recorded in the main control room and announciated when activity levels exceed preestablished setpoints. The alarm setpoints are set at a radiation level slightly higher than that resulting from a 0.1 gpm continuous leak (a fraction of the activity listed in Table 11.1-3).

The leak is of course not expected to occur but is assumed arbitrarily for the purpose of setting the setpoint.

11.5.2.4.2.3

11.5.2.4.2.4

← (DRN 99-2361)

11.5.2.4.2.5 Reactor Building Sump Monitor

This monitor is of the offline type and it monitors the Reactor Building sumps before they discharge to the LWMS. This monitor is identical to that described in Subsection 11.5.2.4.2.3.

→ (DRN 99-2361)

11.5.2.4.2.6

11.5.2.5 <u>Calibration and Inspection</u>

A remotely or locally operated check source is provided with each detector assembly. The check source isotope has a half-life of greater than 10 years, with emission(s) in the energy range and of the same type as being monitored, and is usable as a convenient operational and gross calibration check of the associated detection and readout equipment. The check source controls are mounted on the channel indicator module in the control cabinets. These check sources can be activated automatically through the CRT keyboards in the main control room or the -4 Access Point office.

← (DRN 99-2361)

A burn-in test and isotopic calibration of the complete radiation monitoring system are performed at the factory. Field calibration sources, with their decay curves, are provided with the system hardware.

Further isotopic calibrations are not required, since the geometry cannot be altered significantly within the sampler. Calibration of samplers is then performed, based on a known correlation between the detector responses and field calibration standards.

This single-point calibration check confirms the detector sensitivity. The field calibration check is performed by removing the detector and placing the calibration source on the sensitive area of the detector.

The radiation monitoring channels are checked and inspected in accordance with the Technical Specifications. Some grab samples are collected for isotopic analysis weekly as described in the subsequent sections. Setpoint adjustment and functional setting are done on a routine basis, and calibration is performed every 18 months or indication of equipment malfunction. Instruments are serviced as required.

Field calibration of the indicated channels is performed following any equipment maintenance that can change the accuracy of the instrument indication. It is also done whenever the check source indicates instrument drift. Setpoints are also checked during equipment calibration.

11.5.2.6 Sampling for Radioactivity

To augment the information provided by the process and effluent monitors, samples are taken at specified intervals at selected locations in the process and effluent streams, and in the sampling room.

These samples are then taken to the radiochemistry laboratory for analysis. Although a number of the analyses are for other than radioactivity content, each sample can be analyzed for its isotope content or gross activity by use of instrumentation available in the counting room. This instrumentation consists of proportional counters, a liquid scintillation detector, and Ge(Li) or germanium semiconductor detector and associated data analysis computer.

The sensitivity of the liquid scintillation spectrometer and Ge(Li) semiconductor-detector spectrometer are sufficient to enable detection of the isotopes in the samples within the limits specified by the Technical Specifications.

There are two kinds of samples taken at the plant. A number of samples are taken directly in the sampling room. These samples are both primary system and secondary system components and streams. Table 11.5-2 identifies the primary system samples, and the type of sample that can be taken (either in a sample vessel or as a grab sample). Table 11.5-3 identifies the secondary system samples. For the latter in particular, radioactivity measurements are of lesser importance.

The frequency of sampling is dictated more by the need to identify proper water quality than activity. Procedures used to obtain samples allow for recirculation of the line prior to sample extraction to ensure a representative sample.

The location of the samples are chosen so that representative volumes can be obtained from well mixed streams, and the particular streams are chosen to provide indications of proper functionings of process equipment immediately upstream, or leaks in process equipment, etc.

The second kind of samples taken are local samples. Table 11.5-4 lists the local samples, and their location.

Where applicable, sampling points allow recirculation of the sample fluid for a period of time prior to actual sample extraction.

The activity concentrations and isotopic contents of the various samples (both local and in the sampling room) are given in the column so designated in Tables 11.5-2 through 11.5-4, by referral to Tables listed elsewhere in Chapters 11 and 12 of this document.

## 11.5.3 EFFLUENT RADIOLOGICAL MONITORING SYSTEM

### 11.5.3.1 Implementation of General Design Criterion 64

Subsections 11.5.1 and 11.5.2 contain a detailed description of the means which are provided for monitoring all effluent discharge paths for radioactivity that may be released for normal operations, including anticipated operational occurrences, and from postulated accidents.

Other systems which typically require monitoring are monitored through indirect means by the Waterford 3 Radiation Monitoring System. Specifically the following systems are monitored in addition to the system described in Subsections 11.5.1 and 11.5.2.

→ (DRN 99-2361)

| | Process System | Comment |
|---|---|---|
| 1. | Containment Purge System | Waterford 3 has no continuous containment system. The pre-entry purge system vents to the Plant Vent Stack which is monitored as described in Subsection 11.5.2.4.1.8. Additionally, containment airborne radiation levels are continuously monitored as described in Subsection 12.3.4.2.3.1. 11.5.15 |
| | ← (DRN 99-2361) | |
| 2. | Auxiliary Building Ventilation | The Auxiliary Building ventilation system is continuously monitored for radioactive Airborne Particulate Iodine and gas concentration as described in Subsection 12.3.4.2.5. Additionally, this system vents to the plant stack which is monitored as described in Subsection 11.5.2.4.1.8. |
| 3. | Radwaste Area Vent System | Waterford 3 has no specific Radwaste Area, but rather has the radwaste system dispersed throughout the RAB. Thus any effluents generated by Radwaste systems shall enter the RAB ventilation system and be monitored as described in item 2 above. |
| 4. | Turbine Gland Steam Condenser | This system vents to the discharge header from the main condenser vacuum pumps and is then monitored as described in Subsection 11.5.2.4.1.5. |
| | → (DRN 99-2361) | |
| 6. | Mechanical Vacuum Pump Exhaust (Hogging) System | This system vents to the discharge header from the main condenser vacuum pumps and is then monitored as described in Subsection 11.5.2.4.1.5. |
| | ← (DRN 99-2361) | |
| | →(DRN 00-1045) | |
| 7. | Deleted | |
| | ←(DRN 00-1045) | |
| 8. | Pretreatment Liquid Radwaste Tank Vent Gas System | This system vents through the Vent Gas Collection Header to the plant stack. |
| | → (DRN 99-2361; 00-696) | |
| 9. | Flash Tank Vent System* | This system vents to the Gas Surge Header. |
| | ← (DRN 99-2361) | |

* The Flash Tank has been made inactive per ER-W3-00-0225-00-00.

← (DRN 00-696)

| | Process System | Comment |
|---|---|---|
| 10. | Steam Generator Blowdown System | Heater number 4 from there goes to the VGCH and then to the stack. In the event of over-pressurization the system vents to the atmosphere through a relief valve. |
| 11. | Pressurizer Vent System | This system goes to the Gas decay tanks via the containment vent header and gas surge tank. The gas decay tank vent is monitored as described in Subsection 11.5.2.4.1.2 and is ultimately discharged through the plant stack. |
| 12. | Boron Recovery Vent System | This system is vented through the plant stack via the VGCH. |

## 11.5.4 PROCESS MONITORING AND SAMPLING

### 11.5.4.1 Implementation of General Design Criterion 60

Subsections 11.5.1 and 11.5.2 contain a detailed description of the means which are provided for automatic closure of isolation valves in gaseous and liquid effluent paths.

### 11.5.4.2 Implementation of General Design Criterion 63

Subsections 11.5.1 and 11.5.2 contain a detailed description of the means which are provided for monitoring of radiation levels in radioactive waste process systems.

PROCESS AND EFFLUENT RADIATION MONITORS

→ (DRN 05-575, R14)

| | MONITOR | QUANTITY | LOCATION | TYPE | FUNCTION | POWER SUPPLY | RANGE & JUSTI-FICATION $(\mu Ci)/cm^3$ | ALARM LOCATION | MAXIMUM ALARM SETPOINT $(\mu Ci)/cm^3$ |
|---|---|---|---|---|---|---|---|---|---|
| ← (DRN 05-575, R14) → (DRN 99-2115, R11) | | | | | | | | | |
| 1. | CONDENSER VACUUM PUMPS PRM-IR-0002 | 1 | Line 7AE 20-21 dwg. G-153 sh 1, K-14 | Off-Line Beta Scint. & Cadmium Teluride | Alarm | Instrumen-tation ac bus | $10^{-7}$-$10^{+5}$ Table 11.3-5 | Main Control Room | ** |
| ← (DRN 99-2115, R11) | | | | | | | | | |
| 2. | CCW MONITOR A/B (RE, CC, 5700) PRM-IR-5700 | 1 | 3CC10-154 A/B dwg. G-160 sh 1, F-4, G-184 sh 4, C-12 | Off-Line Gamma Scint. | Alarm | Instrumen-tation ac bus | $10^{-8}$-$10^{-2}$ Table 11.1-3 | Main Control Room & Locally | $10^{-4}$ |
| 3. | CCW MONITOR A (RE, EE 7050 A) CC PRM-IR-7050AS | 1 | 3CC20-2A dwg. G-160 sh 2, G-7 G-185 sh 4, G-13 | Off-Line Gamma Scint. | Alarm | Safety-related ac bus | $10^{-8}$-$10^{-2}$ Table 11.1-3 | Main Control Room & Locally | $10^{-4}$ |
| 4. | CCW MONITOR B (RE, CC, 7050 B) PRM-IR-7050BS | 1 | 3CC20-2B dwg. G-160 sh 2, G-11 G-285 sh 4, E-18 | Off-Line Gamma Scint. | Alarm | Safety-related ac bus | $10^{-8}$-$10^{-2}$ Table 11.1-3 | Main Control Room & Locally | $10^{-4}$ |
| →(DRN 00-1045, R11-A) | | | | | | | | | |
| 5. | SGB MONITOR (RT-670) PRM-IR-0100X | 1 | dwg. G-162 sh 4, J-6 | Off-Line Gamma Scint. | Alarm | Instrumen-tation ac bus | $10^{-6}$-$10^{-1}$ Table 11.2-11 | Main Control Room & Locally | $10^{-3}$ |
| ←(DRN 00-1045, R11-A) | | | | | | | | | |
| 6. | | | | | | | | | |
| →(DRN 05-1038, R14) | | | | | | | | | |
| 7. | LIQUID WASTE MANAGE-MENT (RRC-647) PRM-IR-0647 | 1 | 7 WM 2 1/2-91 G-170 sh 1, D-1 | Off-Line Gamma Scint. | Alarm and automatic termination of flow | Instrumen-tation ac bus | $10^{-6}$-$10^{-1}$ See Table 12.2-11* | Main Control Room | ** |
| ←(DRN 05-1038, R14) | | | | | | | | | |
| 8. | GASEOUS WASTE MANAGE-MENT (RRC-648) PRM-IR-0648 | 1 | 7 WMI-148 G-170 sh 4, B-12 | Off-Line Beta Scint. | Alarm and automatic termination of flow | Instrumen-tation ac bus | $4x10^{-4}$-$4x10^{+2}$ Table 12.2-11* delayed 90 days | Main Control Room | ** |

* Values of this table should be divided by approximately 10 for average condition.
**Setpoints determined in accordance with the Offsite Dose Calcualtion Manual.

PROCESS AND EFFLUENT RADIATION MONITORS

→(DRN 05-575, R14)

| | MONITOR | QUANTITY | LOCATION | TYPE | FUNCTION | POWER SUPPLY | RANGE & JUSTI-FICATION $(\mu Ci)/cm^3$ | ALARM LOCATION | MAXIMUM ALARM SETPOINT $(\mu Ci)/cm^3$ |
|---|---|---|---|---|---|---|---|---|---|
| ←(DRN 05-575, R14) →(DRN 00-1045, R11-A) | | | | | | | | | |
| 9. | BORON MANAGEMENT (RRC-627) PRM-IR-0627 | 1 | 7BM3-221 G-171 sh 2, A-3 | Off-Line Gamma Scint. | Alarm and automatic termination of flow | Instrumen-tation ac bus | $10^{-6}$-$10^{-1}$ Table 12.2-8* | Main Control Room (MCR) | ** |
| 10. | DRY COOLING TOWER SUMP #1 PRM-IR-6775 | 1 | 7 WM 6-254 G-173, B-3 | Off-Line Gamma Scint. | Alarm and automatic sump pump isolation | Instrumen-tation ac bus | $4.2x10^{-8}$-$4.2x10^{-2}$ Table 11.1-3 | MCR & Locally | ** |
| ←(DRN 00-1045, R11-A) | | | | | | | | | |
| 11. | REACTOR BLDG. SUMP PRM-IR-6777 | 1 | 7 WM 1 1/2-12 G-173, E-10 | Off-Line Gamma Scint. | Alarm | Instrumen-tation ac bus | $10^{-8}$-$10^{-2}$ Isotopic conc. is unknown | MCR & Locally | 0.05 |
| →(DRN 00-1045, R11-A) | | | | | | | | | |
| 12. | DRY COOLING TOWER SUMP #2 PRM-IR-6776 | 1 | 7 WM 6-255 G-173, B-15 | Off-Line Gamma Scint. | Alarm and automatic sump pump isolation | Instrumen-tation ac bus | $4.2x10^{-8}$-$4.2x10^{-2}$ Table 11.1-3 | MCR & Locally | ** |
| ←(DRN 00-1045, R11-A) | | | | | | | | | |
| 13. | INDUSTRIAL WASTE SUMP-TURBINE BUILDING PRM-IR-6778 | 1 | 7 WM 6-312 G 173, M-6 | Off-Line Gamma Scint. | Alarm | Instrumen-tation ac bus | $10^{-8}$-$10^{-2}$ | MCR & Locally | ** |
| | | | | | Upon high radiation signal closes valve 7WM-V186 and opens valve 7WM-V650. Upon emptying the sumps, operator to reestablish normal flow to oil separator manual. | | | | |
| →(DRN 00-1045, R11-A; EC-1629, R301) | | | | | | | | | |
| 14. | CIRCULATING WATER DISCHARGE PRM-IR-1900 | 1 | 7CW 16-55 G-164 sh 6 | Off-Line Gamma Scint. | Alarm and initiate automatic closure of blowdown flow | Instrumen-tation ac bus | $4.2x10^{-8}$-$4.2x10^{-2}$ Table 11.2-13 | MCR & Locally | ** |

←(DRN 00-1045, R11-A; EC-1629, R301)

**Setpoints determined in accordance with the Offsite Dose Calculation Manual.

PROCESS AND EFFLUENT RADIATION MONITORS

→ (DRN 05-575, R14)

| | MONITOR | QUANTITY | LOCATION | TYPE | FUNCTION | POWER SUPPLY | RANGE & JUSTI-FICATION $(\mu Ci)/cm^3$ | ALARM LOCATION | MAXIMUM ALARM SETPOINT $(\mu Ci)/cm^3$ |
|---|---|---|---|---|---|---|---|---|---|
| 15. | FHB Exhaust A<br>(RE-HV-5107-A)<br>PRM-IR-5107A | 1 | After fan at release point G-141 | Off-Line<br>Particulate<br>Iodine Gas | Alarm | Instrumen-tation ac bus | Part$10^{-11}$-$10^{-5}$<br>Iodine$10^{-9}$-$10^{-3}$<br>Gas $10^{-7}$-$10^{-1}$ | MCR & Locally | ** |
| 16. | FHB Exhaust B<br>(RE-HV-5107B)<br>PRM-IR-5107B | 1 | After fan at release point G-141 | Off-Line<br>Particulate<br>Iodine Gas | Alarm | Instrumen-tation ac bus | Part$10^{-11}$-$10^{-5}$<br>Iodine$10^{-9}$-$10^{-3}$<br>Gas $10^{-7}$-$10^{-1}$ | MCR & Locally | ** |
| 17. | Plant Stack<br>(RE-HV-0100.1S)<br>PRM-IR-0100.1S<br>(RE-HV-0100.2S)<br>PRM-IR-0100.2S | 2 | Probe<br>In plant stack elevation +111 monitor on | Off-Line<br>Particulate<br>Iodine Gas | Alarm and automatic termination of containment purge | Instrumen-tation ac bus | Part$10^{-11}$-$10^{-5}$<br>Iodine$10^{-9}$-$10^{-3}$<br>Gas $10^{-7}$-$10^{-1}$ | MCR & Locally | ** |

← (DRN 05-575, R14)

**Setpoints determined in accordance with the Offsite Dose Calculation Manual.

TABLE 11.5-2 Revision 11-A (02/02)

PRIMARY SAMPLE POINTS

| Sample Points | Source | Analytical Components | Expected Activity Concentration (see Table) |
|---|---|---|---|
| P1 | Primary Coolant | Grab Sample, Sample Vessel | 11.1-3 |
| →(DRN 00-1045) | | | |
| P2 | Pressurizer Surge Line | Grab Sample | 11.1-3 |
| ←(DRN 00-1045) | | | |
| P3 | Pressurized Steam Space | Grab Sample, Sample Vessel | 12.2-6* |
| P4A & P4B | Shutdown Cooling Suction Line | Grab Sample | 12.2-10* |
| P5A P5B | High Pressure Safety Injection Pump Mini Flow Line | Grab Sample | None |
| →(DRN 00-1045) | | | |
| P6 | Purification Filter Inlet | Grab Sample | 11.1-3* |
| P7 | Purification Filter - Ion Exchanger Inlet | Grab Sample | 11.1-3*+ |
| P8 | Ion Exchanger Outlet | Grab Sample | (VCT) 12.2-7* |
| P9 | Volume Control Tank | Grab Sample | 12.2-7* |
| ←(DRN 00-1045) | | | |
| P21 | Steam Generator Blowdown 1 | Grab Sample | 11.2-11 |
| P22 | Steam Generator Blowdown 2 | Grab Sample | 11.2-11 |
| P23 | Steam Generator Blowdown Demineralizer Effluent | Grab Sample | 11.2-11** |
| P10 | Primary Water Storage Tank | Grab Sample | None |

* This is the maximum expected. The average will be approximately 1/10.

\+ Common products removed.

** This stream would contain approximately 1/100 of the values in Table 11.2-11.

TABLE 11.5-3

SECONDARY SAMPLE POINTS

| Sample Points | Source | Analytical Components | Expected Activity Concentration (see Table) |
|---|---|---|---|
| S1 | Main Steam No. 1 | Grab Sample | 11.3-5* |
| S2 | Main Steam No. 2 | Grab Sample | 11.3-5* |
| S3A | Condenser Hotwell 1A | Grab Sample | 11.3-5+ |
| S3B | Condenser Hotwell 2A | Grab Sample | 11.3-5+ |
| S4A | Condenser Hotwell 1B | Grab Sample | 11.3-5+ |
| S4B | Condenser Hotwell 2B | Grab Sample | 11.3-5+ |
| S5A | Condenser Hotwell 1C | Grab Sample | 11.3-5+ |
| S5B | Condenser Hotwell 2C | Grab Sample | 11.3-5+ |
| S6 | Condenser Pump Discharge | Grab Sample | 11.3-5+ |
| S7 | Combined Heater Drain Pump Discharge | Grab Sample | 11.3-5+ |
| S7A | Drain Collector Tank 1A | Grab Sample | 11.3-5+ |
| S7B | Drain Collector Tank 2A | Grab Sample | 11.3-5+ |
| S7C | Drain Collector Tank 1B | Grab Sample | 11.3-5+ |
| S7D | Drain Collector Tank 2B | Grab Sample | 11.3-5+ |
| S8 | Combined Heater Outlet | Grab Sample | 11.3-5+ |
| S8A | Moisture Separator Drain Tank 1A | Grab Sample | 11.3-5+ |
| S8B | Moisture Separator Drain Tank 2A | Grab Sample | 11.3-5+ |
| S8C | Moisture Separator Drain Tank 1B | Grab Sample | 11.3-5+ |
| S8D | Moisture Separator Drain Tank 2B | Grab Sample | 11.3-5+ |
| S8E | Feedwater Pumps Suction | Grab Sample | 11.3-5+ |
| S9A | Makeup Demineralizer Effluent | Grab Sample | None |
| S9B | Condensate Transfer Pump Discharge | Grab Sample | None |

* All NG and 2% of the halogens in secondary side activity.
\+ Only halogens would be present with approximately a 2% carryover factor.

TABLE 11.5-4 (Sheet 1 of 4) Revision 12-B (04/03)

LOCAL SAMPLES

| SAMPLE POINT | VALVE | SOURCE | FIGURE | EXPECTED ACTIVITY (See Table) |
|---|---|---|---|---|
| SI-1 | SI-471 | Shutdown Cooling Heat Exchanger A | Dwg. G167, Sht. 1 | 12.2-10* |
| SI-2 | SI-492 | Shutdown Cooling Heat Exchanger B | Dwg. G167, Sht. 1 | 12.2-10* |
| SI-3 | SI-462 | Safety Injection Tanks | Dwg. G167, Sht. 1 | None+ |
| SI-4 | SI-234 | Safety Injection Tank 2-A | 6.3-1 SH.2 | None+ |
| SI-5 | SI-214 | Safety Injection Tank 1-A | 6.3-1 SH.2 | None+ |
| SI-6 | SI-224 | Safety Injection Tank I-B | 6.3-1 SH.2 | None + |
| ST-7 | SI-244 | Safety Injection Tank 2-B | 6.3-1 SH.2 | None + |
| →(DRN 03-276, R12-B) | | | | |
| CH-2 | CH-120 | Boric Acid Batching Tank Outlet | Dwg. G168, Sht. 2 | 12.2-7* (BKT) |
| CH-3 | CH-128 | Boric Acid Makeup Tank - A Outlet | Dwg. G168, Sht. 2 | 12.2-7* (BMT) |
| CH-4 | CH-139 | Boric Acid Makeup Tank - B Outlet | Dwg. G168, Sht. 2 | 12.2-7* (BMT) |
| CH-5 | CH-189 | Boric Acid Makeup Tanks Combine Header | Dwg. G168, Sht. 2 | 12.2-7* (BMT) |
| CH-6 | CH-176 | Boric Acid Pump Discharge Headers | Dwg. G168, Sht. 2 | 12.2-7* (BMT) |
| CH-7 | CH-185 | Boric Acid Makeup Line | Dwg. G168, Sht. 2 | 12.2-8* (BAC) |
| ←(DRN 03-276, R12-B) | | | | |
| FP-1 | FP-247 | Fuel Pool Ion Exchanger Upstream of Strainer | Dwg. G169 | 12.2-9 |
| FP-2 | FP-235 | Fuel Pool Ion Exchanger Downstream of Filter | Dwg. G169 | 12.2-9 |
| FP-2 | FP-227 | Fuel Pool Purification Pump Discharge | Dwg. G169 | 12.2-9 |

* This is the maximum expected. Average will be approximately 1/10.
\+ If valve leaks then activity could be a fraction of that given in 11.1-3

TABLE 11.5-4 (Sheet 2 of 4)

LOCAL SAMPLES

| SAMPLE POINT | VALVE | SOURCE | FIGURE | EXPECTED ACTIVITY (See Table) |
|---|---|---|---|---|
| WM-1 | WM-461 | Recirculation to Waste Tank A | 11.2-2 | 12.2-11* (WET) |
| WM-2 | WM-473 | Recirculation to Waste Tank B | 11.2-2 | 12.2-11* (WET) |
| WM-3 | WM-412 | Recirculation to Laundry Tank A | 11.2-2 | 12.2-11* (LT) |
| WM-4 | WM-428 | Recirculation to Laundry Tank B | 11.2-2 | 12.2-11* (LT) |
| WM-5 | WM-510 | Waste Condensate Ion-Exchanger Outlet Downstream of Strainer | 11.2-2 | 12.2-11* (WCT) |
| WM-6 | WM-536 | Recirculation to Waste Condensate Tank A | 11.2-2 | 12.2-11* (WCT) |
| WM-7 | WM-525 | Recirculation to Waste Condensate Tank B | 11.2-2 | 12.2-11* (WCT) |
| WM-8 | WM-704 | Containment Vent Header | 11.3-1 | 11.3-4 |
| WM-9 | WM-791 | Gas Surge Tank and Gas Decay Tanks - Combine Header | 11.3-1 | 12.2-11* (GDT,GST) |
| WM-10 | NA | Waste Concentrate Storage Tank | 11.3-1 | 11.4-2 (SRT) |
| WM-11 | NA | Dewatering Tank | 11.3-1 | 11.4-3 (WC) |
| WM-12 | WM-597 | Circulating Water Discharge | 11.2-2 | 12.2-11* (LT) |
| BM-1 | BM-247 | Pre-concentrator Ion Exchanger Strainer A Outlet | 11.2-1 SH.2 | 12.2-7* (LHX) |
| BM-2 | BM-248 | Pre-concentrator Ion Exchanger Strainer B Outlet | 11.2-1 SH.2 | 12.2-7* (LHX) |

* This is the maximum expected. Average will be approximately 1/10.

TABLE 11.5-4 (Sheet 3 of 4) Revision 11 (05/01)

LOCAL SAMPLES

| SAMPLE POINT | VALVE | SOURCE | FIGURE | EXPECTED ACTIVITY (See Table) |
|---|---|---|---|---|
| BM-3 | BM-219 | Boric Acid Pre-concentrator Filter B Outlet | 11.2-1 SH.2 | 12.2-7** (VCT) |
| BM-4 | BM-199 | Boric Acid Pre-concentrator Filter A Inlet | 11.2-1 SH.2 | 12.2-7** (VCT) |
| BM-5 | BM-202 | Boric Acid Pre-concentrator Filter B Inlet | 11.2-1 SH.2 | 12.2-7** (VCT) |
| BM-6 | BM-222 | Boric Acid Pre-concentrator Filter B Outlet | 11.2-1 SH.2 | 12.2-7** (VCT) |
| BM-7 | BM-443 | Boric Acid Concentrator A Discharge | 11.2-1 SH.1 | 12.2-8* (BAC) |
| BM-8 | BM-258 | Boric Acid Concentrator Combine Header | 11.2-1 SH.1 | 12.2-8* (BAC) |
| BM-9 | BM-289 | Boric Acid Condensate Strainer | 11.2-1 SH.1 | 12.2-8* (BAC) |
| BM-10 | BM-294 | Recirculation to Boric Acid Condensate Tank A | 11.2-1 SH.1 | 12.2-8* (BACT) |
| BM-11 | BM-402 | Recirculation to Boric Acid Condensate Tank B | 11.2-1 SH.1 | 12.2-8* (BACT) |
| BM-12 | BM-515 | Recirculation to Boric Acid Condensate Tank C | 11.2-1 SH.1 | 12.2-8* (BACT) |
| BM-13 | BM-516 | Recirculation to Boric Acid Condensate Tank D | 11.2-1 SH.1 | 12.2-8* (BACT) |
| BM-14 | BM-521 | Circulating Water Discharge | 11.2-1 SH.1 | 11.2-13 |
| BM-15 | BM-417 | Circulating Water Discharge | 11.2-1 SH.1 | 11.2-13 |

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* This is the maximum expected. Average will be approximately 1/10.

** Outlet will be less than inlet by common products.

TABLE 11.5-4 (Sheet 4 of 4) Revision 11 (05/01)

LOCAL SAMPLES

| SAMPLE POINT | VALVE | SOURCE | FIGURE | EXPECTED ACTIVITY (See Table) |
|---|---|---|---|---|
| BM-16 | NA | Circulating Water Discharge | 11.2-1 SH.1 | 11.2-13 |
| BM-17 | NA | Boric Acid Concentrator B Discharge | 11.2-1 SH.1 | 12.2-8* (BAC) |
| → (DRN 99-2361) | | | | |
| P21 | SSL 8018A | Steam Generator Blowdown 1 | NA | 11.2-11 |
| P22 | SSL 8018B | Steam Generator Blowdown 2 | NA | 11.2-11 |
| P23 | SSL 9007 | Steam Generator Blowdown Demineralizer Effluent | NA | 11.2-11*** |
| ← (DRN 99-2361) | | | | |

* This is the maximum expected. Average will be approximately 1/10.

** Outlet will be less than inlet by common products.

*** This stream would contain approximately 1/100 of the values in Table 11.2-11.