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March 31, 2010

Subject: AP1000 Response to Request for Additional Information (SRP 11)

Westinghouse is submitting a response to the NRC request for additional information (RAI) on SRP Section 11. This RAI response is submitted in support of the AP1000 Design Certification Amendment Application (Docket No. 52-006). The information included in this response is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification and the AP1000 Design Certification Amendment Application.

Enclosure 1 provides the response for the following RAI(s):

RAI-SRP11.5-CHPB-05

Questions or requests for additional information related to the content and preparation of this response should be directed to Westinghouse. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of this letter.

Very truly yours,

Robert Sisk, Manager
Licensing and Customer Interface
Regulatory Affairs and Standardization

/Enclosure

1. Response to Request for Additional Information on SRP Section 11

DD63
NRO

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ENCLOSURE 1

Response to Request for Additional Information on SRP Section 11

RAI Response Number: RAI-SRP11.5-CHPB-05
Revision: 0

Question:

Staff review of Change Number 45 to DCD Tier 2 (Rev 18) Appendix1A, sections 3.1.4, 3.6.3.3, 5.2.5.3.3, and 11.5.2.3.1, and LCO 3.4.9 sections B.3.4.7 and 3.4.9 indicate that the applicant provided insufficient information in regards to the new containment particulate radiation monitor (PSS-JE-RE027) sensitivity to satisfy the reactor coolant system (RCS) leakage rate technical basis. The technical basis for the RCS leakage detection instruments and RG 1.45 (Rev1) establish radiation monitor sensitivity requirements for leakage detection increase of 1 gpm within 1 hour using a realistic primary coolant concentration. Although Change Number 45 specifies the radiation monitor sensitivity for particulate radioactivity, the change does not provide an analysis to demonstrate that the specified monitor sensitivity is capable of satisfying the technical basis using realistic radioactive concentrations in the RCS.

Please provide an analysis to demonstrate that the particulate radiation monitor sensitivity is capable of satisfying the technical basis for the RCS leakage using a realistic radioactive concentration in the RCS. Include in this analysis all models, modeling assumptions and their basis, parameter values and their basis, and any references.

Westinghouse Response:

Introduction

The AP1000 credits two methods in the technical specification for RCS leak detection inside containment: the containment sump level monitors and radioactivity measurements of the containment atmosphere. This discussion will focus on the containment atmosphere radiation monitor.

Reg Guide 1.45 Revision 0 (May 1973) requires a leakage monitoring system capable of detecting a 1 gpm leak in 1 hour or less. The AP1000 is licensed as a leak-before-break plant and is committed to detecting a leak of 0.5 gpm in 1 hour.

Nitrogen-13 (N-13) and Fluorine-18 (F-18) are two of the more significant radioisotopes in the primary coolant that might be used for RCS leakage detection. The concentrations of these isotopes in the primary coolant vary linearly with power level and are independent of fuel defect percentage. This is the reason that N-13 and F-18 isotopes are the focus for the leakage monitoring system for the AP1000.

Originally, the containment RCS air sampling system included an N-13/F-18 gas monitor and a separate noble gas (Xenon/Krypton) monitor that provides backup information. Only the N-13/F-18 gas monitor was credited in the Tech Specs as the RCS leakage detection Reg Guide 1.45 monitor. A design change was made to replace the N-13/F-18 gas monitor with an F-18 particulate monitor. No changes to the noble gas monitor were made.

Based on review of the design, consultations with RMS vendors, review of industry documents, review of plant operating experience and discussions industry aerosol experts in leakage detection, it was determined that an N-13/F-18 gas monitor could not provide adequate sensitivity to detect a 0.5 gpm leak in 1 hour with a high confidence level for the following reasons:

a. The half-life of N-13 is only 10 minutes, with the consequence that the accumulation of N-13 concentration in the containment atmosphere is rather limited.
b. The half-life of F-18 is 110 minutes; the accumulation of F-18 activity in the containment atmosphere is more significant compared to N-13. However, fluorine will most likely attach to dust particles or be embedded in dried-out boron acid crystals and can be detected as a particulate more readily compared to the gaseous form. In addition, there has been experience in operating plants that F-18 has been observed and measured in particulate form.

<u>Analysis of N-13 Gas</u>

Westinghouse performed an analysis to estimate the concentrations of N-13 gas inside containment assuming ideal mixing. The analysis showed that a conservative estimate of the concentration of N-13 is 2.84E-8 μCi/cc one (1) hour after initiation of a 0.5 gpm leak. Typical gas monitors have a lower measurement limit on the order of 1E-7 to 1E-8 μCi/cc. Therefore, measurement of N-13 in gas form as an indication of an RCS leak is not feasible because the estimated concentration for a 0.5 gpm leak in 1 hour is below the minimum detectable concentration for commercially available gas detectors.

A detailed analysis of F-18 concentrations in gaseous form for a 0.5 gpm leak was not performed because it was judged that F-18 will most likely attach to dust particles and take the form of particulates.

<u>Analysis of F-18 Particulate</u>

The isotope F-18 in particulate form was further analyzed for use in RCS leakage detection. A relatively small part of the non-flash leakage is expected to become aerosol (small water droplets suspended in air) while the rest will remain in the liquid phase and be collected in the containment sump or the leakage collection system. The major constituent in the aerosol due to RCS leakage is boric acid (200-2000 ppm in RCS). After evaporation of the water, the liquid aerosol inside containment becomes fine boric acid crystal and F-18 (most likely in the chemical form of LiF) is embedded in boric acid crystal or is attached to dust. Therefore, it is expected that the majority of the F-18 activity in the containment atmosphere will be present in particulate form. Most of the surviving F-18 particulates will be of smaller sizes (less than 3 microns in diameter after dried-out) because the larger sizes will become trapped in the tortuous path from the RCS through the piping insulation or be removed due to impingement on nearby structures.

Based on discussions with industry aerosol experts, it was concluded that a conservative estimate of 3% is the fraction of the F-18 activity from the RCS leakage that will enter the containment atmosphere in particulate form.

Westinghouse performed an evaluation to estimate the concentrations of F-18 particulates inside containment. The evaluation provided a conservative estimate (assuming a 0.5 gpm leak and 3% fraction entering containment atmosphere) of the concentration of F-18 particulates is 2.84E-9 µCi/cc one (1) hour after initiation of the leak at 100% power.

An RMS vendor was contacted to determine if detecting F-18 concentrations of 2.84E-9 µCi/cc was feasible. The conclusion is that a beta scintillation detector in conjunction with a moving filter provides sufficient sensitivity to detect the 0.5 gpm leak in one hour. At a sample flow rate of 2 ft^3/minute, the filter collects approximately 3.4E+6 cc of activity in 1 hour. The moving filter is sensitive to about 80% of the deposited activity in this case. The activity viewed by the detector at 1 hour is approximately 80% x 3.4E+6 cc x (1/2[1] x 2.84E-9 µCi/cc) = 0.004 µCi. At the detector sensitivity of about 7 x 10^4 cpm/µCi, the calculated raw signal from F-18 at 1 hour is about 280 cpm. The background is approximately 100 cpm for the detector in a lead shield, and the calculated minimum detectable signal at 95% confidence level is about 5 cpm, for a response time of 9 minutes. Since the calculated raw signal above background is 280 cpm, the smoothed signal that is delayed by the response time remains significantly greater than the 5 cpm minimum detectable signal. At 20% power, the count rate is 56 cpm (0.20 x 280 cpm = 56 cpm) which is approximately 10 times greater than 5 cpm and can also be detected with high confidence. Therefore, this moving filter detector provides for detection of the 0.5 gpm leak in 1 hour with high confidence (much greater than 95% confidence level) and is considered acceptable for the AP1000 design.

A deposition analysis for the sample lines will be performed at a later date during the detailed design. The deposition analysis will be used to quantify the deposition losses for the specific sample line configuration and to determine if correction factors are required to account deposition losses. Since only small particles (less than 3 microns) are expected to be the prevalent particle sizes inside containment, the small particles can be transported longer distances with less deposition losses compared to larger particles.

Note 1: The time dependence of the buildup in F-18 concentration in containment is conservatively approximated as a linear ramp. The activity deposited on the filter is proportional to the average value of the F-18 concentration in the 1 hour time interval. Based on this approximation, the average value is equal to one-half the value at the end of the time interval.

Industry Experience

Argonne national Laboratory Report NUREG/CR-6861, "Barrier Integrity Research Program" performed a study of the various methods for RCS leak detection. The report concluded airborne gaseous radioactivity monitoring is inherently less sensitive compared to particulate monitoring. The value of monitoring gaseous radioactivity for leakage detection is diminished because the primary systems have less contamination resulting from improvements in fuel cladding and RCS chemistry controls.

The NRC has recognized the limitations of gaseous radioactivity monitors in Regulatory Issue Summary 2009-02, Revision 1 for operating plants. Operating plant gaseous radioactivity monitors were designed and licensed many years ago when there were more occurrences of fuel cladding defects. Today, with lower fuel cladding defects, the effectiveness of these gaseous radioactivity monitors has diminished and may not provide accurate measurements and may require longer response times. This NRC RIS has no impact on the AP1000 design because the noble gas monitor is not being credited in the AP1000 technical specifications for meeting Reg Guide 1.45.

Recently, Westinghouse was made aware of an RCS leak at Catawba. The plant was using a fixed-filter particulate monitor and a gaseous monitor for RCS leak detection. The plant observed the counts per minute on the particulate monitor increased and triggered an alarm. The filter paper was removed, analyzed and the presence of F-18 was observed and was indicative of an RCS leak. The leak was not detected by the noble gas monitor. The leak was also confirmed by the containment sump levels. The containment sumps were estimated to be filling at a rate of approximately 1 gallon per hour or 0.02 gallon per minute. This data demonstrates in practice that a particulate monitor has adequate sensitivity to detect a leak that is approximately ten times lower than AP1000 requirement of 0.5 gpm.

Therefore, based on industry experience and the evaluation above, it is concluded that the RCS leak detection radiation particulate monitor is capable of detecting a 0.5 gpm leak in 1 hour using conservative estimates for the expected F-18 concentrations inside containment.

Design Control Document (DCD) Revision:

See attached mark-ups

Appendix 1A

Reg. Guide 1.45, Rev. 0, 5/73 – Reactor Coolant Pressure Boundary Leakage Detection Systems

C.1	Conforms	
C.2	Conforms	
C.3	Exception	~~The AP1000 reactor coolant pressure boundary leakage detection methods are selected and designed in accordance with the guidelines of this regulatory guide. No credit is taken for airborne particulate radiation measurement in quantifying the leak rate.~~The AP1000 uses two methods for leak detection including sump level and flow monitoring, and airborne particulate radioactivity monitoring.
C.4	Conforms	
C.5	Conforms	
C.6	~~Exception~~Conforms	~~Airborne particulate radioactivity monitoring is not used to determine reactor coolant pressure boundary leakage.~~
C.7	Conforms	
C.8	Conforms	
C.9	Conforms	

3.1.4 Fluid System

Criterion 30 – Quality of Reactor Coolant Pressure Boundary

{Last paragraph has only change}

Leakage from the reactor coolant pressure boundary will result in an increase in the radioactivity levels inside containment. The containment atmosphere is monitored for airborne gaseous radioactivity and ~~N13/~~F_{18} Particulate. From the concentration of ~~N13/~~F_{18} Particulate and the power level, reactor coolant pressure boundary leakage can be estimated.

3.6.3.3 Analysis Methods and Criteria

{Leakage Flaw Section has only change}

Leakage Flaw

Through-wall flaws in candidate leak-before break piping systems are postulated. [*The size of the postulated flaws are large enough so that the leakage is detectable with adequate margin, using 10 times the minimum installed leak detection capability when the pipes are subjected to normal operational loads combining by algebraic sum method.*]* That is, the size of the leakage flaw postulated would be expected to have a leak rate 10 times the size of the rated leak rate detection capability.

As noted in subsection 5.2.5, the rated capability of the leak detection systems for the primary coolant inside containment is 0.5 gpm ~~in one hour~~. The methods used to detect leakage are described in subsection 5.2.5.3. The methods used for primary coolant are the containment sump level, inventory balance, and containment atmosphere radiation. The method used to detect leakage from the main steam line inside containment is the containment sump level. Containment air cooler condensate flow, and containment atmosphere pressure, temperature, and humidity also provide an indication of possible leakage.

5.2.5.3.3 Containment Atmosphere Radioactivity Monitor

Leakage from the reactor coolant pressure boundary will result in an increase in the radioactivity levels inside containment. The containment atmosphere is continuously monitored for airborne ~~gaseous~~ particulate radioactivity. Air flow through the monitor is provided by the suction created by a vacuum pump. ~~Gaseous N_{13}/F_{18} concentration monitors indicate~~An F_{18} particulate concentration monitor indicates radiation concentrations in the containment atmosphere.

~~N_{13} and~~ F_{18} ~~are neutron activation products which are~~particulate is a neutron activated product, which is proportional to power levels. An increase in activity inside containment would therefore indicate a leakage from the reactor coolant pressure boundary. Based on the concentration of ~~N_{13}/~~F_{18} in particulate form and the power level, reactor coolant pressure boundary leakage can be estimated.

The ~~N_{13}/~~F_{18} particulate monitor is seismic Category I. Conformance with the position 6 guidance of Regulatory Guide 1.45 that leak detection should be provided following seismic events that do not require plant shutdown is provided by the seismic Category I classification. Safety-related Class 1E power is not required since loss of power to the radiation monitor is not consistent with continuing operation following an earthquake.

The ~~N_{13}/~~F_{18} particulate monitor is operable when the plant is above 20-percent power, and can detect a 0.5 gpm leak within 1 hour when the plant is at full power.

Radioactivity concentration indication and alarms for loss of sample flow, high radiation, and loss of indication are provided. Sample collection connections permit sample collection for laboratory analysis. The radiation monitor can be calibrated during power operation.

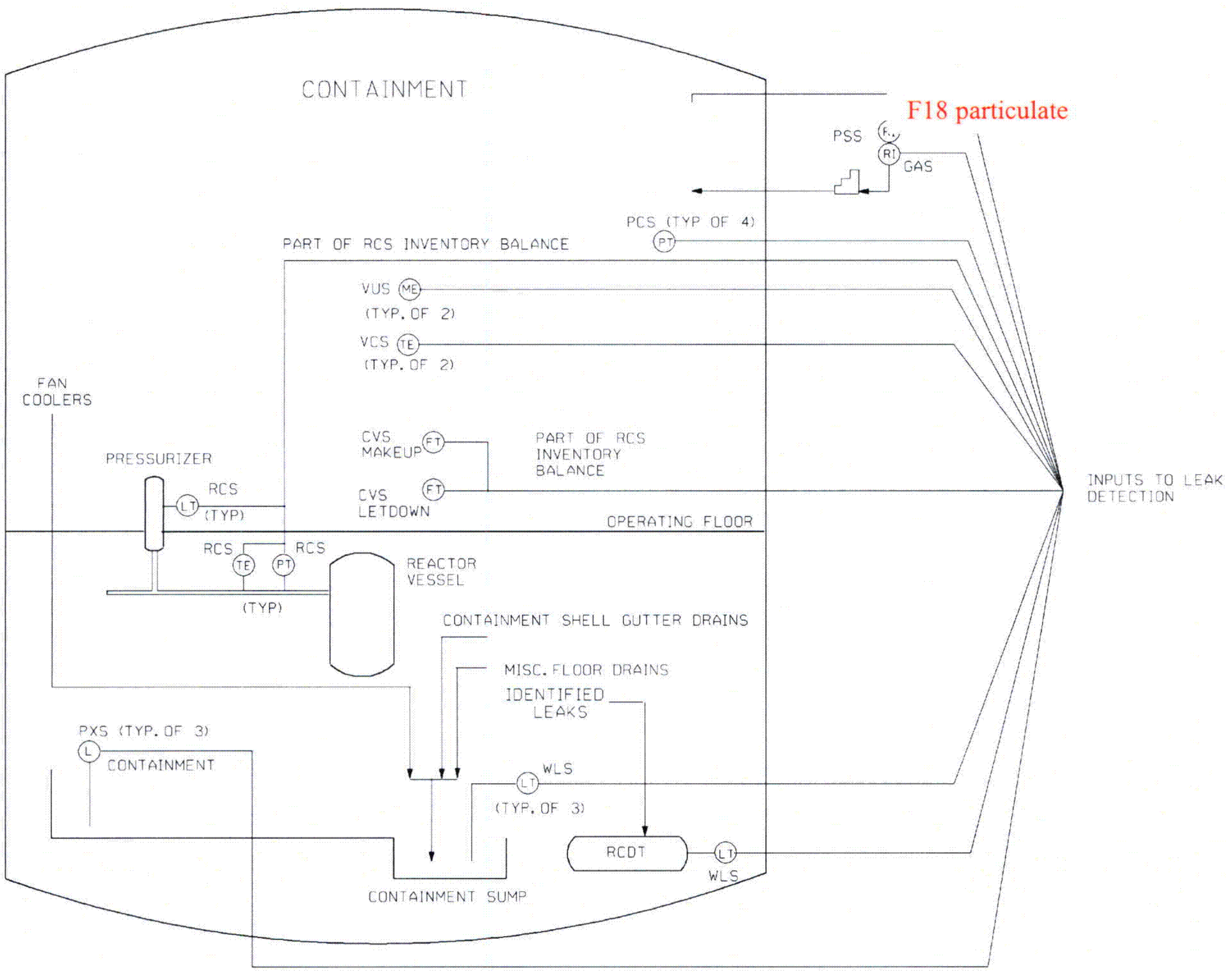

Figure 5.2-1

Leak Detection Approach

11.5.2.3.1 Fluid Process Monitors

{Rest of Section unchanged by this RAI}

Containment Atmosphere Radiation Monitor

The containment atmosphere radiation monitor measures the radioactive gaseous (PSS-JE-RE026) and ~~N^{13}/~~F^{18} particulate (PSS-JE-RE027) concentrations in the containment atmosphere. The containment atmosphere radiation monitor is a part of the reactor coolant pressure boundary leak detection system described in subsection 5.2.5. The presence of gaseous or ~~N^{13}~~-F18 radioactivity in the containment atmosphere is an indication of reactor coolant pressure boundary leakage. Refer to subsection 5.2.5 for further details. Conformance with Regulatory Guide 1.45 is discussed in Appendix 1A.

The containment atmosphere radiation monitor accepts analog signal inputs for sample flow and temperature. These signals are used to calculate concentrations at standard conditions.

The radiogas detector is a beta-sensitive scintillation detector. The ~~N^{13}/~~F^{18} ~~detector is a gamma-sensitive, thallium-activated, sodium iodide scintillation detector with a window at the N^{13}/F^{18} 0.511 MeV decay energy~~particulate detector is also a beta-sensitive scintillation detector. The ranges and principal isotopes are listed in Table 11.5-1.

The arrangement for the containment atmosphere radiation monitor is shown in Figure 11.5-3.

Table 11.5-1 (Sheet 1 of 2) **RADIATION MONITOR DETECTOR PARAMETERS**				
Detector	**Type**	**Service**	**Isotopes**	**Nominal Range**
BDS-JE-RE010	γ	Steam Generator Blowdown Electrodeionization Effluent	Cs-137	1.0E-7 to 1.0E-2 μCi/cc
BDS-JE-RE011	γ	Steam Generator Blowdown Electrodeionization Brine	Cs-137	1.0E-7 to 1.0E-2 μCi/cc
CCS-JE-RE001	γ	Component Cooling Water System	Cs-137	1.0E-7 to 1.0E-2 μCi/cc
VFS-JE-RE101	β	Plant Vent Particulate	Sr-90 Cs-137	1.0E-12 to 1.0E-7 μCi/cc
VFS-JE-RE102	γ	Plant Vent Iodine	I-131	1.0E-11 to 1.0E-6 μCi/cc
VFS-JE-RE103	β	Plant Vent Gas (Normal Range)	Kr-85 Xe-133	1.0E-7 to 1.0E-2 μCi/cc
VFS-JE-RE104A	β/γ	P.V. Extended Range Gas (Accident Mid Range)	Kr-85 Xe-133	1.0E-4 to 1.0E+2 μCi/cc
VFS-JE-RE104B	β/γ	P.V. Extended Range Gas (Accident High Range)	Kr-85 Xe-133	1.0E-1 to 1.0E+5 μCi/cc
PSS-JE-RE026	β	Containment Atmosphere Gas (Note 2)	Kr-85 Xe-133 Ar-41 N-13	1.0E-7 to 1.0E-2 μCi/cc
PSS-JE-RE027	β~~γ~~	Containment Atmosphere ~~N^{13}/~~F^{18} particulate(Note 2)	~~N-13~~ F-18	1.0E-~~7~~10 to 1.0E-~~2~~5 μCi/cc
PSS-JE-050	γ	Primary Sampling Liquid	I-131 Cs-137	1.0E-4 to 1.0E+2 μCi/cc
PSS-JE-052	γ	Primary Sampling Gaseous	Kr-85 Xe-133	1.0E-7 to 1.0E-2 μCi/cc
SGS-JE-RE026A	γ	Main Steam Line	Kr, Xe, I	1.0E-1 to 1.0E+3 μCi/cc
SGS-JE-RE026B	γ	Main Steam Line	N-16	30 to 200 gallons per day
SGS-JE-RE027A	γ	Main Steam Line	Kr, Xe, I	1.0E-1 to 1.0E+3 μCi/cc
SGS-JE-RE027B	γ	Main Steam Line	N-16	30 to 200 gallons per day
SWS-JE-RE008	γ	Service Water Blowdown	Cs-137	1.0E-7 to 1.0E-2 μCi/cc

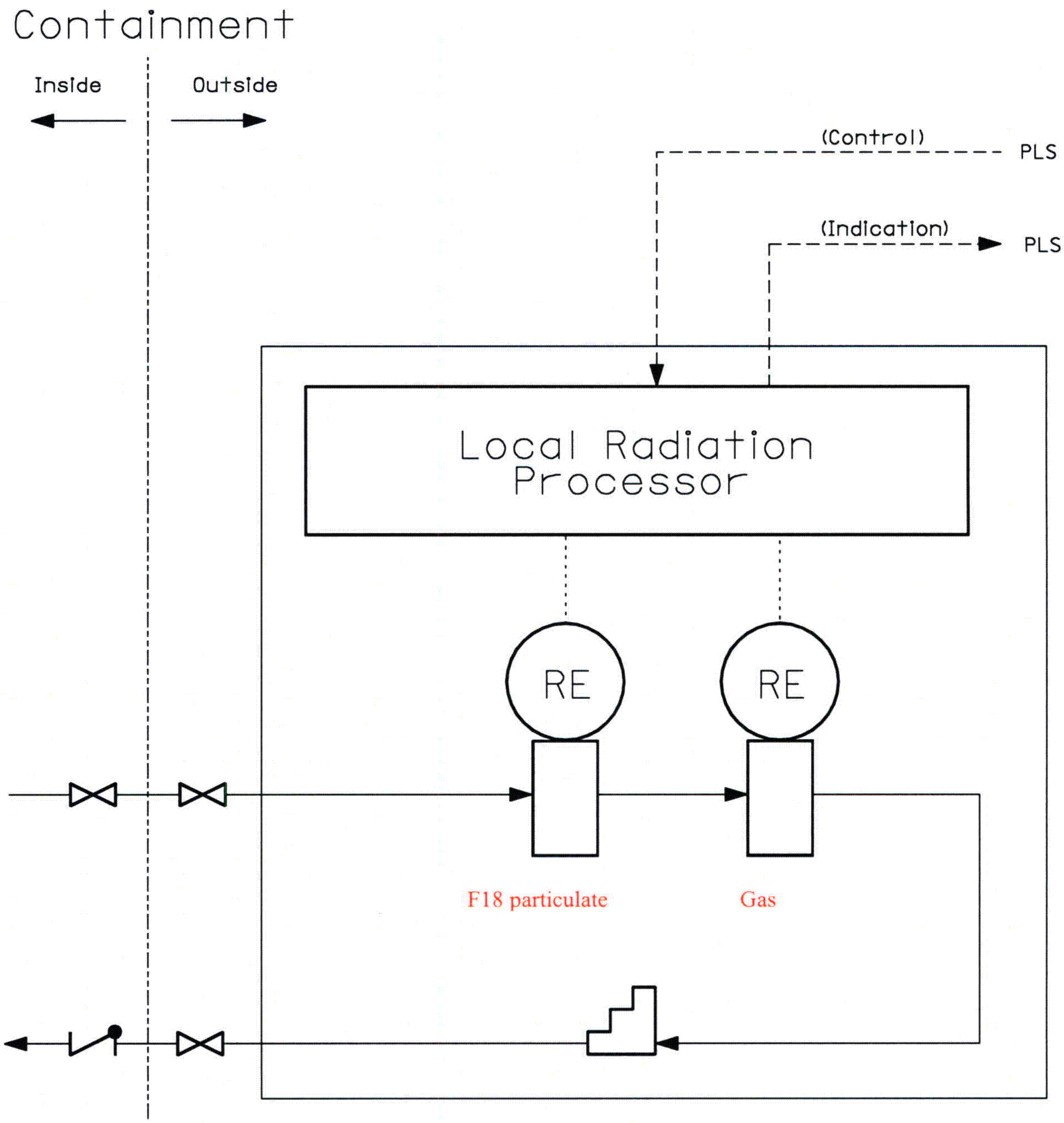

Figure 11.5-3
Containment Atmosphere Radiation Monitor

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.9 RCS Leakage Detection Instrumentation

LCO 3.4.9 The following RCS leakage detection instrumentation shall be OPERABLE:

a. Two containment sump level channels;

b. One containment atmosphere radioactivity monitor (~~gaseous N13/F18~~F18 particulate).

APPLICABILITY: MODES 1, 2, 3, and 4.

- NOTES -

1. The ~~N13/F18~~F18 particulate containment atmosphere radioactivity monitor is only required to be OPERABLE in MODE 1 with RTP > 20%.

2. Containment sump level measurements cannot be used for leak detection if leakage is prevented from draining to the sump such as by redirection to the IRWST by the containment shell gutter drains.

LCO

RCS operation LEAKAGE shall be limited to:

a. Pressure Boundary LEAKAGE

No pressure boundary LEAKAGE is allowed, being indicative of material deterioration. LEAKAGE of this type is unacceptable as the leak itself could cause further deterioration, resulting in higher LEAKAGE. Violation of this LCO could result in continued degradation of the RCPB. LEAKAGE past seals and gaskets are not pressure boundary LEAKAGE.

b. Unidentified LEAKAGE

0.5 gpm of unidentified LEAKAGE is allowed as a reasonable minimum detectable amount that the containment air ~~N13/~~F18 particulate radioactivity monitoring and containment sump level monitoring equipment, can detect within a reasonable time period. This leak rate supports leak before break (LBB) criteria. Violation of this LCO could result in continued degradation of the RCPB, if the LEAKAGE is from the pressure boundary.

SURVEILLANCE REQUIREMENTS (continued)

The RCS water inventory balance must be met with the reactor at steady state operating conditions. The Surveillance is modified by two Notes. Note 1 states that this SR is not required to be performed until 12 hours after establishing steady state operation. The 12 hour allowance provides sufficient time to collect and process all necessary data after stable plant conditions are established.

Steady state operation is required to perform a proper inventory balance since calculations during maneuvering are not useful. For RCS operational LEAKAGE determination by inventory balance, steady state is defined as stable RCS pressure, temperature, power level, pressurizer and makeup tank levels, and with no makeup or letdown.

An early warning of pressure boundary LEAKAGE or unidentified LEAKAGE is provided by the automatic systems that monitor the containment atmosphere ~~N13/~~F18 particulate radioactivity and the containment sump level. It should be noted that LEAKAGE past seals and gaskets is not pressure boundary LEAKAGE. These LEAKAGE detection systems are specified in LCO 3.4.9, "RCS LEAKAGE Detection Instrumentation."

Note 2 states that this SR is not applicable to primary to secondary LEAKAGE because LEAKAGE of 150 gallons per day cannot be measured accurately by an RCS water inventory balance.

The containment atmosphere ~~N13/~~F18 particulate radioactivity LEAKAGE measurement is valid only for plant power > 20% RTP.

The containment atmosphere ~~N13/~~F18 particulate radioactivity LEAKAGE measurement during MODE 1 is not valid while containment purge occurs or within 2 hours after the end of containment purge.

The containment sump level change method of detecting leaks during MODES 1, 2, 3, and 4 is not valid while containment purge occurs or within 2 hours after the end of containment purge.

The containment sump level change method of detecting leaks during MODES 1, 2, 3, and 4 is not valid during extremely cold outside ambient conditions when frost is forming in the interior of the containment vessel.

The 72-hour Frequency is a reasonable interval to trend LEAKAGE and recognizes the importance of early leakage detection in the prevention of accidents.

APPLICABLE SAFETY ANALYSES (continued)

The safety significance of RCS LEAKAGE varies widely depending on its source, rate, and duration. Therefore, detecting and monitoring RCS LEAKAGE into the containment area is necessary. Quickly separating the identified LEAKAGE from the unidentified LEAKAGE provides quantitative information to the operators, allowing them to take corrective action should a leak occur.

RCS LEAKAGE detection instrumentation satisfies Criterion 1 of 10 CFR 50.36(c)(2)(ii).

LCO

One method of protecting against large RCS LEAKAGE derives from the ability of instruments to rapidly detect extremely small leaks. This LCO requires instruments of diverse monitoring principles to be OPERABLE to provide a high degree of confidence that small leaks are detected in time to allow actions to place the plant in a safe condition, when RCS LEAKAGE indicates possible RCPB degradation.

The LCO is satisfied when monitors of diverse measurement means are available. Thus, the containment sump level monitor, in combination with an ~~N13/F18 gaseous activity~~the F18 particulate radioactivity monitor, provides an acceptable minimum. Containment sump level monitoring is performed by three redundant, seismically qualified level instruments. The LCO note clarifies that if LEAKAGE is prevented from draining to the sump, its level change measurements made by OPERABLE sump level instruments will not be valid for quantifying the LEAKAGE.

APPLICABILITY

Because of elevated RCS temperature and pressure in MODES 1, 2, 3, and 4, RCS LEAKAGE detection instrumentation is required to be OPERABLE.

In MODE 5 or 6, the temperature is ≤200°F and pressure is maintained low or at atmospheric pressure. Since the temperatures and pressures are lower than those for MODES 1, 2, 3, and 4, the likelihood of LEAKAGE and crack propagation are much smaller. Therefore, the requirements of this LCO are not applicable in MODES 5 and 6.

Containment sump level monitoring is a valid method for detecting LEAKAGE in MODES 1, 2, 3, and 4. The containment atmosphere ~~N13/~~F18 particulate radioactivity LEAKAGE measurement during MODE 1 is valid only for reactor power > 20% RTP. RCS inventory monitoring via the pressurizer level changes is valid in MODES 1, 2, 3, and 4 only when RCS conditions are stable, i.e., temperature is constant, pressure is constant, no makeup and no letdown.

APPLICABILITY (continued)

The containment sump level change method of detecting leaks during MODES 1, 2, 3, and 4 is not valid while containment purge occurs or within 2 hours after the end of containment purge.

The containment atmosphere ~~N13/~~F18 particulate radioactivity LEAKAGE measurement during MODE 1 is not valid while containment purge occurs or within 2 hours after the end of containment purge.

The containment sump level change method of detecting leaks during MODES 1, 2, 3, and 4 is not valid during extremely cold outside ambient conditions when frost is forming on the interior of the containment vessel.

ACTIONS

The actions are modified by a Note that indicates that the provisions of LCO 3.0.4 are not applicable. As a result, a MODE change is allowed when leakage detection channels are inoperable. This allowance is provided because in each condition other instrumentation is available to monitor for RCS LEAKAGE.

A.1 and A.2

With one of the two required containment sump level channels inoperable, the one remaining operable channel is sufficient for RCS leakage monitoring since the containment radiation provides a method to monitor RCS leakage. However, that is not the case for the steam line leakage monitoring. The remaining operable sump level monitor is adequate as long as it continues to operate properly. Continuing plant operation is expected to result in containment sump level indication increases and in periodic operation of the containment sump pump. Therefore, proper operation of the one remaining sump level sensor is verified by the operators checking the volume input to the sump (as determined by the sump level changes and discharges from the containment) to determine that it does not change significantly. A significant change is considered to be ±10 gallons per day or 33% (whichever is greater) of the volume input for the first 24 hours after this Condition is entered. The containment sump level instruments are capable of detecting a volume change of less than 2 gallons. The containment water level sensors also provide a diverse backup that can detect a 0.5 gpm leak within 3.5 days.

Restoration of two sump channels to OPERABLE status is required to regain the function in a Completion Time of 14 days after the monitor's failure. This time is acceptable, considering the frequency and adequacy of the monitoring of the change in integrated sump discharge required by Action A.1.

ACTIONS (continued)

B.1 and B.2

With two of the two required containment sump level channels inoperable, no other form of sampling can provide the equivalent information; however, the containment atmosphere ~~N13/~~F18 particulate radioactivity monitor will provide indications of changes in LEAKAGE. Together with the atmosphere monitor, the periodic surveillance for RCS inventory balance, SR 3.4.7.1, must be performed at an increased frequency of 24 hours to provide information that is adequate to detect LEAKAGE. A Note is added allowing that SR 3.4.7.1 is not required to be performed until 12 hours after establishing steady state operation (stable temperature, power level, pressurizer and makeup tank levels, makeup and letdown). The 12 hour allowance provides sufficient time to collect and process all necessary data after stable plant conditions are established.

Restoration of one sump channel to OPERABLE status is required to regain the function in a Completion Time of 72 hours after the monitor's failure. This time is acceptable, considering the frequency and adequacy of the RCS inventory balance required by Action A.1.

C.1.1, C.1.2, and C.2

With ~~one gaseous N13/~~F18 particulate containment atmosphere radioactivity-monitoring instrumentation channel inoperable, alternative action is required. Either grab samples of the containment atmosphere must be taken and analyzed or RCS inventory balanced, in accordance with SR 3.4.7.1, to provide alternate periodic information.

With a sample obtained and analyzed or an RCS inventory balance performed every 24 hours, the reactor may be operated for up to 30 days to allow restoration of the radioactivity monitor.

The 24 hours interval for grab samples or RCS inventory balance provides periodic information that is adequate to detect LEAKAGE. A Note is added allowing that SR 3.4.7.1 is not required to be performed until 12 hours after establishing steady state operation (stable temperature, power level, pressurizer and makeup tank levels, and makeup and letdown). The 12 hour allowance provides sufficient time to collect and process all necessary data after stable plant conditions are established. The 30 day Completion Time recognizes at least one other form of leak detection is available.

ACTIONS (continued)

D.1 and D.2

If a Required Action of Condition A, B or C cannot be met within the required Completion Time, the reactor must be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to at least MODE 3 within 6 hours and to MODE 5 within 36 hours. The allowed Completion Times are reasonable, based on operating experience, to reach the required plant conditions from full power conditions in an orderly manner without challenging plant systems.

E.1

With all required monitors inoperable, no automatic means of monitoring leakage is available and plant shutdown in accordance with LCO 3.0.3 is required.

SURVEILLANCE REQUIREMENTS

SR 3.4.9.1

SR 3.4.9.1 requires the performance of a CHANNEL CHECK of the containment atmosphere ~~N13/~~F18 particulate radioactivity monitor. The check gives reasonable confidence that the channel is operating properly. The Frequency of 12 hours is based on instrument reliability and risk and is reasonable for detecting off normal conditions.

SR 3.4.9.2

SR 3.4.9.2 requires the performance of a CHANNEL OPERATIONAL TEST (COT) on the atmosphere ~~N13/~~F18 particulate radioactivity monitor. The test ensures that the monitor can perform its function in the desired manner. The test verifies the alarm setpoint and relative accuracy of the instrument string. The Frequency of 92 days considers risks and instrument reliability, and operating experience has shown that it is proper for detecting degradation.

SR 3.4.9.3 and SR 3.4.9.4

These SRs require the performance of a CHANNEL CALIBRATION for each of the RCS Leakage detection instrumentation channels. The calibration verifies the accuracy of the instrument string, including the instruments located inside containment. The Frequency of 24 months is a typical refueling cycle and considers channel reliability. Again, operating experience has proven that this Frequency is acceptable.

PRA Revision:
None

Technical Report (TR) Revision:
None