ArevaEPRDCPEm Resource

From: WELLS Russell D (AREVA NP INC) [Russell.Wells@areva.com]
Sent: Monday, December 08, 2008 6:30 PM
To: Getachew Tesfaye
Cc: John Rycyna; Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 113, FSAR Ch 9
Attachments: RAI 113 Response US EPR DC.pdf

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 113 Response US EPR DC.pdf" provides technically correct and complete responses to six of the seven questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 113 Questions 09.03.02-2, 09.03.02-3, 09.03.02-5 and 09.03.02-7.

The following table indicates the respective pages in the response document, "RAI 113 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

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RAI 113 — 09.03.02-2	2	2
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A complete answer is not provided for one of the seven questions. The schedule for a technically correct and complete response to this question is provided below.

Question #	Response Date
RAI 113 — 09.03.02-8	February 27, 2009

Sincerely,

(Russ Wells on behalf of)
Ronda Pederson

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From: Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Thursday, November 06, 2008 10:02 AM
To: ZZ-DL-A-USEPR-DL
Cc: Jeffrey Poehler; David Terao; Sara Bernal; Timothy Frye; Peter Hearn; Joseph Colaccino; John Rycyna
Subject: U.S. EPR Design Certification Application RAI No. 113 (1284, 1455),FSAR Ch. 9

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on October 21, 2008, and discussed with your staff on November 5, 2008. Draft RAI Question 09.03.02-8 (4) was modified as a result of that discussion. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,
Getachew Tesfaye
Sr. Project Manager
NRO/DNRL/NARP
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Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 17

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Response to

Request for Additional Information No. 113 (1284, 1455), Revision 0

11/06/2008

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.03.02 - Process and Post-Accident Sampling Systems
Application Section: FSAR Ch. 9

QUESTIONS for Component Integrity, Performance, and Testing Branch 1 (AP1000/EPR Projects) (CIB1)
QUESTIONS for Health Physics Branch (CHPB)

Question 09.03.02-2:

GDCs 13 and 26 require sampling of the RCS to ensure adequate fission product control, conditions that maintain fuel, and reactor pressure boundary (RPB) integrity.

The NSS provides a means for monitoring RCS corrosion products radioactivity and contaminants that may challenge the RPB. FSAR Tier 2 Section 9.3.2.3 identifies “chlorides” as being analyzed by the NSS. However, Table 9.3.2-1 Primary Side Sampling Points identifies conductivity as the parameter being monitored by process instruments. Furthermore, the note in the table identifies specific properties of liquid and gaseous grab samples as being identified in the plant chemical handbook.

Identify the parameters are measured using process instruments at the primary sample sink for RCS, pressurizer, and CVCS.

Response to Question 09.03.02-2:

U.S. EPR FSAR Tier 2, Section 9.3.2.3 should identify “conductivity” as being analyzed by the nuclear sampling system (NSS) and not “chlorides.” This section will be revised to reflect this correction.

The parameters that are measured using process instruments at the primary sample sink for the reactor coolant system, pressurizer, and chemical and volume control system are specified in U.S. EPR FSAR Tier 2, Table 9.3.2-1—Primary Side Sampling Points.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 9.3.2.3 will be revised as described in the response and indicated on the enclosed markup.

Question 09.03.02-3:

GDC 41 requires reducing the concentration and quality of fission products released to the environment following a postulated accident. FSAR Section 9.3.2.1 bullets 7 and 8 state that the process sampling system is designed to “control fission products” and “reduce the concentration and quality of fission products released to the environment.” The figures associated with this section, describing the design of the NSS, do not show these design functions.

1. Provide additional details of these systems showing the control of fission products, and the reduction of fission products released.
2. Provide the mechanism for assessing the concentration of fission products, hydrogen and oxygen in the pressurizer gas phase, since no sample line for this portion of the RCS is shown in Figures 9.3.2-1 to 9.3.2-3.

Response to Question 09.03.02-3:

1. The process sampling systems do not directly “control” fission products, “reduce” the concentration and quality of fission products released to the environment, or “control” the release of radioactive materials in gaseous and liquid effluents. These systems provide sample information that can be considered when making accident management decisions to reduce doses to plant personal and the public. U.S. EPR FSAR Tier 2, Section 9.3.2.1 will be revised to reflect these details.

2. The pressurizer gas phase is not directly sampled by the process sampling system. U.S. EPR FSAR Tier 2, Section 5.4.10.2.1 states that the pressurizer gas is continuously vented. The vented gas is transferred to the reactor coolant drain tank (RCDT) in the nuclear island drain and vent system (NIDVS). U.S. EPR FSAR Tier 2, Figure 9.3.3.1—Nuclear Island Drain and Vent System, Sheet 4, shows the pressurizer relief discharge system venting to the NIDVS RCDT. This tank is then vented to the gaseous waste processing system (GWPS). As stated in U.S. EPR FSAR Tier 2, Section 9.3.2.2.1.1 under Gaseous Samples, the GWPS vent lines from the NIDVS RCDT are sampled by the nuclear sampling system (NSS).

FSAR Impact:

1. U.S. EPR FSAR Tier 2, Section 9.3.2.1 will be revised as described in the response and indicated on the enclosed markup.

2. The U.S. EPR FSAR will not be changed as a result of this question.

Question 09.03.02-4:

FSAR Tier 2 Section 9.3.2.2.1.3 identifies that the IRWST can be sampled via the SASS. It also identifies that the SASS is only operated during a severe accident. FSAR Tier 2 Section 16.0, Surveillance Requirements (SR) 3.5.4.2 and 3.5.4.3 are to be performed on the IRWST once every 7 days and 24 months, respectively. Technical Specification 3.4.14 identifies that during normal operation, if the containment radiation monitor is out-of-service, the limiting condition for operation (LCO) requires that grab samples are to be performed once per 24 hours. However, Figure 9.3.2-1 (all sheets) does not show how the IRWST or containment atmosphere can be sampled, except through use of the SASS. Provide additional details for obtaining samples from the IRWST per TS 3.5.4.2 and containment atmosphere per TS 3.4.14.

Response to Question 09.03.02-4:

During normal plant operation, the in-containment refueling water storage tank (IRWST) is not sampled via the severe accident sampling system (SASS). The IRWST is sampled via the low head safety injection (LHSI) system at a sample point downstream of the LHSI heat exchanger.

U.S. EPR FSAR Tier 2, Figure 9.3.2-1—Nuclear Sampling System, Sheet 1, shows the nuclear sampling system (NSS) sample line from the LHSI system. U.S. EPR FSAR Tier 2, Figure 6.3-2—Safety Injection/Residual Heat Removal System Train (Typical) shows the interface between the NSS, LHSI system, and IRWST system. The LHSI system operates when an NSS sample is needed (i.e., U.S. EPR FSAR Tier 2, Section 16.0, Surveillance Requirements (SR) 3.5.4.3 and 3.5.4.4 are performed every 7 days and 24 months, respectively).

During normal plant operation, the containment atmosphere is not sampled via the SASS. The containment atmosphere is continuously monitored by the radiation monitoring system (Refer to U.S. EPR FSAR Tier 2, Section 12.3.4.1); sampling activity monitoring system (Refer to U.S. EPR FSAR Tier 2, Section 12.3.4.2); and hydrogen monitoring system (Refer to U.S. EPR FSAR Tier 2, Section 6.2.5.2.2).

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 09.03.02-5:

GDCs 14 and 30 require that components that are part of the reactor coolant pressure boundary be tested to the highest quality standards. Steam generator tubes represent a RCPB that has corrosion concerns on both sides of the tube. The water quality standards for steam generator liquid (secondary side) are identified in EPRI PWR Secondary Water Chemistry Guidelines. The steam generator blowdown lines are essential for monitoring both radioactivity and contaminants in the secondary system. One acceptable way to ensure that these contaminant concentrations are being adequately monitored is to use the guidance of EPRI PWR Secondary Water Chemistry Guidelines (Chapter 7). No details of the SECSS describe the monitoring, sampling, and analysis of representative sampling to ensure integrity of the RCPB or radioactivity in the secondary system so that effluent releases can be accurately monitored.

1. Provide further details regarding the location of the sample lines from the steam generator blowdown line demonstrating that representative sampling for radionuclides and contaminants will be achieved.
2. Confirm that limits on secondary system contaminants will be in conformance with the EPRI PWR Secondary Water Chemistry Guidelines to ensure integrity of the RCPB (see NUREG-0800 10.4.6).

Response to Question 09.03.02-5:

1. The hot and cold blowdown legs of each steam generator (SG) upstream of the blowdown flash tank have sample points. These sample points are shown on U.S. EPR FSAR Tier 2, Figure 10.4.8-1—Steam Generator Blowdown System Discharge and Cooling, Sheet 1. The blowdown sampling system is denoted on the figure by the system designator “QUC.”

   Additional sampling points are provided directly off the secondary side of each SG, downstream of the blowdown cartridge filter, downstream of the cation exchanger, and downstream of the mixed bed exchanger for monitoring demineralization performance. These sampling points are shown on U.S. EPR FSAR Figure 5.1-4—RCS Piping and Instrumentation Diagram and Figure 10.4.8-2—Steam Generator Blowdown System Flow Diagram, Sheets 1, 2 and 3.

2. Allowable concentrations of blowdown contaminants will be in accordance with EPRI PWR Secondary Water Chemistry Guidelines (Refer to U.S. EPR FSAR Tier 2, Section 9.3.2.3). They are specified in U.S. EPR FSAR Tier 2, Table 10.3-7—Heatup/Hot Shutdown/Hot Standby - Blowdown Sample and Table 10.3-9—Power Operation (>25% Reactor Power) - Blowdown Sample.

   To clarify that the current revision of the EPRI PWR Secondary Water Chemistry Guidelines is the basis for the U.S. EPR secondary water chemistry program, the EPRI reference cited in U.S. EPR FSAR Tier 2, Section 9.3.2.3 will be revised accordingly.

FSAR Impact:

1. The U.S. EPR FSAR will not be changed as a result of this question.

2. U.S. EPR FSAR Tier 2, Section 9.3.2.3 and Section 9.3.2.6 will be revised as described in the response and indicated on the enclosed markup.

Question 09.03.02-6:

GDC 64 requires monitoring the containment atmosphere and plant environs for radioactivity and sampling and analyzing fission product gases. FSAR Tier 2 Section 9.3.2.3 identifies that one function of the SASS is to sample the containment atmosphere for gases, both hydrogen and radioactive. Although the hydrogen monitoring can be performed by the HMS, the mechanism for gas grab sampling or continuous monitoring during a severe accident for hydrogen and radioactive gases is not identified specifically in this section of the FSAR. Describe the sampling and analysis of the radioactive gas content of the containment building atmosphere in the post-accident condition.

Response to Question 09.03.02-6:

U.S. EPR FSAR Tier 2, Section 9.3.2.3 states that the severe accident sampling system (SASS) “analyzes gaseous samples from the containment atmosphere following a severe accident.” The SASS is described in U.S. EPR FSAR Tier 2, Figure 9.3.2-2—Severe Accident Sampling System. Grab samples are taken from the in-situ pool samplers (30KUL51/52BZ001) and transported to the gaseous sampling module and scrubbing liquid module, where the samples are conditioned. Conditioned samples are then transported to the sampling box where they are extracted for laboratory analysis to determine airborne radioactivity. Any excess samples in the sampling box are returned to the in-situ pool samplers in containment via the back feeding module. To maintain the gaseous samples at containment conditions, the sampling lines are designed with heat tracing.

FSAR Impact:

The U.S. EPR FSAR will not be changed as a result of this question.

Question 09.03.02-7:

The following editorial corrections should be made:

FSAR Tier 2 Section 9.3.2 Paragraph 1 - “The HMS is described in Section 6.2.5.” The correct notation should be: “…in Section 6.2.5.2.2”

In the Section 9.3.2.2.2 Paragraph 3 - “Table 3.2-1…” (doesn’t exist). The correct notation should be: “Section 3.2.2 Table 3.2.2-1…”

Response to Question 09.03.02-7:

U.S. EPR FSAR Tier 2, Section 9.3.2 will be revised to reflect the correct section notation.

U.S. EPR FSAR Tier 2, Section 9.3.2.2.2 will be revised to reflect the correct table notation.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 9.3.2 and Section 9.3.2.2.2 will be revised as described in the response and indicated on the enclosed markup.

Question 09.03.02-8:

10 CFR 20.1101 (b) states, in part, that the licensee shall use procedures and engineering controls based on sound radiation protection principles to achieve occupational doses that are as low as is reasonably achievable (ALARA). In FSAR Section 9.3.2, the applicant states that ALARA is considered in station layout and design and provides a description of several design features including: the use of sample (glove) boxes in the NSS, degassing one sample stream at a time, passive flow restrictions which limit the worker exposure to radiation sources, and flushing of lines to prevent plateout and minimize the buildup of crud in sampling piping lines.

However, Section 9.3.2 does not describe methodology for the design of the Process Sampling System (PSS) sample stations used to incorporate shielding and other design features described in RG 8.8 that minimize personnel doses and contamination, in accordance with 10 CFR 20.1406. Therefore, the staff requests the following additional information**:**

1. Verify that the PSS sampling stations have been designed to ensure that doses to personnel who must operate, service, or inspect these sampling stations will be ALARA by describing some of the ALARA design features (e.g., radiation shielding and other ALARA features described in RG 8.8) incorporated into these sample stations to minimize personnel doses and minimize contamination.
2. Describe some of the design features of the PSS sampling stations that will minimize contamination of the facility during the taking of samples, in accordance with the requirements of 10 CFR 20.1406.
3. The description of the secondary sampling system in Tier 2, FSAR Section 9.3.2.2.1.2, Secondary Sampling System, states that the steam generator blowdown system (SGBS) recycles samples upstream of its system processing equipment to allow regular treatment. However, the FSAR also states that “if the SGBS is unavailable, the liquids are directed to the drain and vent sump.” Provide more detail on which drain and vent sump will be used for disposal and how this disposal method will minimize contamination in accordance with 10 CFR 20.1406.
4. Section 9.3.2.2.3, System Operation, states that local sample stations will be provided for the demineralized water storage tank, circulating water cooling water basin make up, and the closed cooling water system. Past operating experience has shown that non radioactive systems, such as the three mentioned above, can become contaminated with low levels of radioactivity due to leakage, valving errors or other operating conditions in radioactive systems. For example, the demineralized distribution system description provided in FSAR Section 9.2.7, Seal Water Supply System, states that the seal water system pumps take suction from the demineralized water tanks which are located outside. Because the seal water system interfaces with systems containing radioactive liquids, there is a potential for the demineralized water storage tank to become contaminated, such as through check valve leakage.
   a. 10 CFR 20.1406, Minimization of Contamination, requires, in part, that all COL and DC applicants describe how they intend to minimize, to the extent practicable, the contamination of the facility, the contamination of the environment, and the generation of radioactive waste. Therefore, provide information on what provisions will be in place to contain any spills or leakage at the three sampling stations mentioned above in accordance with 10 CFR 20.1406.

b. It is not clear what the purpose of the closed cooling water system is. Please describe the function of the closed cooling water system, or provide a reference to the section of the FSAR where a description is provided.

Response to Question 09.03.02-8:

A response to this question will be provided by February 27, 2009.

U.S. EPR Final Safety Analysis Report Markups

9.3.2 Process Sampling Systems

The process sampling systems comprise the following:

- Nuclear sampling system (NSS).
- Secondary sampling system (SECSS).
- Severe accident sampling system (SASS).
- Hydrogen monitoring system (HMS).

09.03.02-7

The HMS is described in U.S. EPR FSAR Tier 2, Section 6.2.5.2.2. Section 6.2.5.

These process sampling systems provide centralized and local facilities for obtaining liquid and gaseous samples for the purpose of determining the physical and chemical characteristics and control parameters by measurements and analyses. Samples are obtained from the following:

- Primary and secondary coolant.
- Containment atmosphere.
- Liquid and gaseous waste treatment systems.
- In-containment refueling water storage tank (IRWST).

9.3.2.1 Design Bases

The processing sampling systems perform the following safety-related functions:

- Maintain containment isolation. Sample lines in the process sampling systems penetrating the containment are capable of isolation upon receipt of a containment isolation signal (CIS) from the reactor protection system.
- Maintain integrity of reactor coolant pressure boundary (RCPB). Motor-operated isolation valves in three NSS lines connected to the reactor coolant system (RCS) maintain RCPB integrity.

09.03.02-3

The process sampling systems have the following design basis requirements and criteria:

- The process sampling systems are designed to provide engineering controls information based upon sound radiation protection principles to achieve occupational doses and doses to members of the public as low as is reasonably achievable (ALARA) (10 CFR 20.1101(b)).

- Safety-related portions of the process sampling systems are designed, fabricated, erected and tested to quality standards commensurate with the importance of the safety functions to be performed (GDC 1).

- Safety-related portions of the process sampling systems are designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami and seiches without loss of capability to perform their safety functions (GDC 2).

- Non-safety-related portions of the process sampling systems are designed to monitor variables and systems over their anticipated ranges to assure adequate safety, including those variables and systems that can affect the fission process, the integrity of the reactor core and the RCPB (GDC 13).

- Non-safety-related portions of the process sampling systems are designed to maintain the integrity of the RCPB by sampling for chemical species that can affect the RCPB (GDC 14).

- Non-safety-related portions of the process sampling systems are designed to reliably control the rate of reactivity changes by sampling the boron concentration (GDC 26).

09.03.02-3

- Non-safety-related portions of the process sampling systems are designed to ~~control~~monitor fission products, hydrogen, oxygen and other substances that may be released into the reactor containment; and also, ~~reduce~~monitor the concentration and quality of fission products released to the environment following postulated accidents (GDC 41).

- Non-safety-related portions of the process sampling systems include means to suitably ~~control~~monitor the release of radioactive materials in gaseous and liquid effluents and to handle radioactive solid wastes produced during normal reactor operation, including anticipated operational occurrences (AOO) (GDC 60).

- Non-safety-related portions of the process sampling systems are designed to monitor the fuel storage and radioactive waste systems and detect conditions that may result in excessive radiation levels (GDC 63).

- Non-safety-related portions of the process sampling systems include means for monitoring the reactor containment atmosphere, spaces containing components for recirculation of loss-of-coolant accident (LOCA) fluids, effluent discharge paths and the plant environs for radioactivity that may be released from normal operations, including AOOs and postulated accidents (GDC 64).

- Non-safety-related portions of the process sampling systems are designed to have provisions for a leakage detection and control program to minimize the leakage from those portions of the process sampling systems outside of the containment that contain or may contain radioactive material following an accident (10 CFR 50.34(f)(2)(xxvi)).

The process sampling systems are designed to meet the following functional criteria:

9.3.2.2.2 Component Description

A list of processes or equipment that have sampling points, the number of sampling points, the type of sample (grab or continuous) and the process measurement to be performed at each location in the NSS and SECSS is provided in Table 9.3.2-1—Primary Side Sampling Points, and Table 9.3.2-2—Secondary Side Sampling Points, respectively.

09.03.02-7

A simplified diagram of the NSS and SASS is provided in Figure 9.3.2-1—Nuclear Sampling System, and Figure 9.3.2-2—Severe Accident Sampling System, respectively.

~~Table 3.2-1~~Table 3.2.2-1 provides the quality group and seismic design classification of components and equipment in the process sampling systems. Components are designed to the codes and standards applicable to their equipment classification.

9.3.2.2.3 System Operation

Nuclear Sampling System

The NSS is designed for manual operation on an intermittent basis (except for continuous sampling of reactor coolant) under all plant conditions ranging from plant start up, full power operation to hot and cold shutdown (as long as a normal power supply is available).

During normal plant operation, the sampling lines from hot leg 1, crossover leg 3 and the liquid phase of the pressurizer are continuously in operation. They permanently route samples from inside the RB to downstream cooling and online analyzers in the centralized laboratory. Liquid and gaseous grab samples are also taken intermittently during normal plant operation for laboratory analysis in order to control the quality of the fluids as specified in the plant chemical handbook.

During plant shutdown and refueling conditions while in the RHR mode, samples are taken from the RHRS and routed via the online boron measurement. During plant start up and shutdown conditions, the boric acid measurement for criticality monitoring is performed.

In a post accident condition, sampling of primary water remains a necessary function. Samples from the primary coolant can also be drawn during beyond design basis events as long as the primary circuit is pressurized to transport a sample in the sample lines to the centralized sample room in the NAB and normal power is available.

Secondary Sampling System

The SECSS is designed to operate during all modes of plant operation.

- Safety-related portions of the process sampling systems are designated Seismic Category I and designed to remain functional during and following a safe shutdown earthquake (SSE). Section 3.7 and Section 3.9 provide the design loading conditions that are considered.

- The design of safety-related components in the process sampling systems is consistent with the seismic design classifications given in RG 1.29.

The design of the processing sampling systems satisfies GDC 13 regarding monitoring variables and systems that can affect the fission process, the integrity of the reactor core and the RCPB.

- The NSS obtains and analyzes key chemistry parameters such as ~~chloride~~conductivity, and~~,~~ hydrogen~~,~~ and oxygen concentrations in the RCS during normal plant operation and after an accident, if normal power is available. The control of corrosive chemical attack increases plant safety by decreasing the probability that the RCPB is compromised due to degradation from corrosive chemical attack.

09.03.02-2

- The SASS obtains and analyzes gaseous and liquid samples from the containment atmosphere and IRWST following a severe accident.

- The only safety-related function of the SECSS is containment isolation. Refer to Section 6.2.4.

The design of the process sampling systems satisfies GDC 14 regarding maintaining the integrity of the RCPB by sampling for chemical species that can affect the RCPB.

- The NSS collects primary water chemistry data. Verification that key chemical parameters are within prescribed limits provides assurance that the RCPB and fuel cladding are not adversely affected by chemical attack.

- The portion of the NSS that includes the RCPB is designed, fabricated, erected and tested so as to have a low probability of abnormal leakage, rapidly propagating failure and gross rupture. Sampling for corrosion products is used to verify key chemistry parameters.

- The only safety-related function of the SECSS is containment isolation. Refer to Section 6.2.4.

09.03.02-5

- The U.S. EPR steam generator water and feedwater quality requirements are based on EPRI TR-10082242134 ~~R2~~ (Reference 1). Refer to Section 10.3. Meeting these EPRI guidelines is consistent with satisfying the guidelines in RG 1.21, Position C.2.

- The SASS does not serve as part of the RCPB. Therefore, GDC 14 is not applicable to the SASS.

The design of the process sampling systems satisfies GDC 26 regarding reliably controlling the of reactivity changes by sampling the boron concentration.

9.3.2.4 Inspection and Testing Requirements

Components in the process sampling systems are inspected and tested during plant startup. Refer to Section 14.2 (test abstract #071, #092, #100 and #204) for initial plant startup test program. The components are designed to permit periodic testing and inservice inspections during plant operation. System components are monitored during operation to demonstrate satisfactory functioning of the equipment. A description of the inservice testing program and inservice inspection program is provided in Section 3.9.6 and Section 6.6, respectively.

9.3.2.5 Instrumentation Requirements

During normal plant operation, continuous sampling of the reactor coolant and steam generator blowdown is performed by online monitors. These sample lines are automatically isolated on a CIS.

Normal plant process condition indication (e.g., pressure, temperature and flow) are used by plant operations personnel to verify system status before manual samples are taken.

9.3.2.6 References

1. EPRI Report TR-10082242134-R6, "Pressurized Water ReactorWR Secondary Water Chemistry Guidelines," Revision 6, Electric Power Research Institute, September 2004.

09.03.02-5