November 14, 2002

Mr. James Mallay
Director, Regulatory Affairs
Framatome ANP
3815 Old Forest Road
Lynchburg, VA 24501

SUBJECT: SAFETY EVALUATION RELATED TO TOPICAL REPORT BAW-2387, "JUSTIFICATION FOR THE ELIMINATION OF THE POST ACCIDENT SAMPLING SYSTEM FROM THE LICENSING BASES OF BABCOCK AND WILCOX-DESIGNED PLANTS" (TAC NO. MB2354)

Dear Mr. Mallay:

By letter dated June 25, 2001, the Babcock and Wilcox Owners Group (B&WOG) submitted Topical Report BAW-2387, "Justification for the Elimination of the Post Accident Sampling System [PASS] from the Licensing Bases of Babcock and Wilcox-Designed Plants," for NRC staff review.

The enclosed safety evaluation (SE) addresses the staff's review of BAW-2387 for Babcock and Wilcox nuclear power plants. The staff concluded that the topical report provided a basis to eliminate the PASS as a required system for sampling the 15 parameters that are listed in Section 4 of the SE. In doing this, the staff also identified five licensee required actions (LRAs) (listed in Section 4.1 of the SE), that must be fulfilled by a licensee of a Babcock and Wilcox nuclear power plant that would eliminate PASS in accordance with BAW-2387 and the SE.

Because some licensees have the PASS in their emergency plans (EP) and may want to remove the system from the plan, the third LRA concerns the licensee's determination of the effect of eliminating PASS on the effectiveness of the EP. Based on the SE, the staff concludes that eliminating the PASS for sampling the 15 parameters listed in the SE should not decrease the effectiveness of the EP; however, the licensee must make its own independent determination as to the effect of eliminating the PASS on the effectiveness of its plant-specific EP before the system may be removed from the plan. If a licensee should determine that the effectiveness of the EP is not decreased, then the removal of the PASS would not require staff approval in accordance with 10 CFR 50.54(q).

As stated in the safety evaluation, the staff concludes, based upon the justification provided in BAW-2387, that there is reasonable assurance that the health and safety of the public will not be endangered by operation of Babcock and Wilcox nuclear power plants without PASS. Therefore, it is acceptable to eliminate PASS from the licensing basis for the Babcock and Wilcox nuclear power plants.

The NRC requests that the B&WOG publish an accepted version of the revised BAW-2387 within 3 months of receipt of this letter. The accepted version shall incorporate this letter and the enclosed safety evaluation between the title page and the abstract, and add a -A (designating accepted) following the report identification number (i.e., BAW-2387-A). The accepted version shall also incorporate the expanded paragraph on containment sump pH in Section 3.13 of the SE.

If the NRC's criteria or regulations change so that its conclusion in this letter, that the topical report is acceptable, is invalidated, the B&WOG and/or the applicant referencing the topical report will be expected to revise and resubmit its respective documentation, or submit justification for the continued applicability of the topical report without revision of the respective documentation.

Sincerely,

/RA/

William H. Ruland, Director
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Project No. 693

Enclosure: Safety Evaluation

cc w/encl: See next page

The NRC requests that the B&WOG publish an accepted version of the revised BAW-2387 within 3 months of receipt of this letter. The accepted version shall incorporate this letter and the enclosed safety evaluation between the title page and the abstract, and add a -A (designating accepted) following the report identification number (i.e., BAW-2387-A). The accepted version shall also incorporate the expanded paragraph on containment sump pH in Section 3.13 of the SE.

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Sincerely,
/**RA/**
William H. Ruland, Director
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Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Project No. 693

Enclosure: Safety Evaluation

cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

BAW-2387, "JUSTIFICATION FOR THE ELIMINATION OF THE POST ACCIDENT SAMPLING SYSTEM FROM THE LICENSING BASES OF BABCOCK AND WILCOX-DESIGNED PLANTS"

BABCOCK AND WILCOX OWNERS GROUP

PROJECT NO. 693

1.0 INTRODUCTION

In its letter dated June 25, 2001, the Babcock and Wilcox Owners Group (B&WOG) submitted Topical Report BAW-2387, "Justification for the Elimination of the Post Accident Sampling System from the Licensing Bases of Babcock and Wilcox-Designed Plants," to be reviewed by the NRC staff for eliminating post accident sampling system (PASS) requirements from Babcock and Wilcox (B&W) pressurized water reactor (PWR) nuclear power plants (NPPs).

BAW-2387 evaluated the PASS requirements to determine their contribution to plant safety and accident recovery. The topical report considered the progression and consequences of core damage accidents and assessed the accident progression with respect to plant abnormal and emergency operating procedures, severe accident management guidance, and emergency plans. BAW-2387 concluded that many of the current PASS samples specified in NUREG-0737, "Clarification of TMI Action Plan Requirements," may be eliminated (i.e., remove the requirements to perform the sampling from the licensing basis), or the time for taking and analyzing the sample may be changed. For some sample types, the B&WOG recommended that the capability be maintained for long term recovery purposes, but with the PASS not being required within the licensing basis of the B&W NPP. With the PASS outside the licensing basis, there would be no requirements on the licensees to maintain and use the PASS; however, the licensee may elect to keep the PASS in the plant and use the system as long as it does not adversely affect safety-related systems.

Specifically, the B&WOG recommended in BAW-2387 the following:

- Eliminate PASS sampling of reactor coolant system (RCS) dissolved gases.
- Eliminate PASS sampling of RCS hydrogen.
- Eliminate PASS sampling of RCS oxygen.
- Eliminate PASS sampling of RCS pH.
- Eliminate PASS sampling of RCS chlorides.
- Eliminate PASS sampling of RCS boron.
- Eliminate PASS sampling of RCS conductivity.
- Eliminate PASS sampling of radionuclides in the RCS.

- Eliminate PASS sampling of containment hydrogen.
- Eliminate PASS sampling of containment oxygen.
- Eliminate PASS sampling of radionuclides in the containment atmosphere.
- Eliminate PASS sampling of containment sump pH.
- Eliminate PASS sampling of chlorides in the containment sump.
- Eliminate PASS sampling of boron in the containment sump.
- Eliminate PASS sampling of radionuclides in the containment sump.

2.0 BACKGROUND

The need for a PASS was one of the findings endorsed by the NRC following the accident at the Three Mile Island (TMI) plant. The NRC specified that all licensed plants have the capability of obtaining and analyzing post-accident samples of the reactor coolant and containment atmosphere within specified times, without causing a radiation exposure to any individual that exceeds 5 Rem to the whole body or 75 Rem to the extremities. Detailed criteria for the PASS are specified in Section II.B.3 of NUREG-0737 including the following:

> The licensee and applicant shall establish an onsite radiological and chemical analysis capability to provide, within a three-hour time frame, quantification of the following:
>
> a) Certain radionuclides in the reactor coolant and containment atmosphere
>
> b) Hydrogen levels in the containment atmosphere
>
> c) Dissolved gases (e.g., hydrogen), chloride, and boron concentration of liquids

The TMI-related recommendations specified in NUREG-0737 were subsequently incorporated into 10 CFR 50.34(f)(2)(viii). However, this rule applied only to applications pending at that time (i.e., Perkins Nuclear Station, Units 1, 2, and 3; Allens Creek Nuclear Generating Station, Unit 1; Pebble Springs Nuclear Plant, Units 1 and 2; Black Fox Station, Units 1 and 2; Skagit/Hanford Nuclear Power Project, Units 1 and 2; and Offshore Power Systems).

On March 17, 1982, the NRC issued Generic Letter (GL) 82-05, "Post-TMI Requirements," in which the NRC requested that licensees establish a firm schedule for implementing post-accident sampling. On November 1, 1983, the NRC issued GL 83-36 and GL 83-37, "NUREG-0737 Technical Specifications," which provided guidance on how to address post-accident sampling in the technical specifications for boiling-water reactors (BWRs) and PWRs, respectively. In GL 83-36 and GL 83-37, the NRC indicated that all licensees should establish, implement, and maintain an administrative program that would include training of personnel, procedures for sampling and analyses, and provisions for sampling and analysis equipment. The licensees could elect to reference this program in the administrative controls section of the technical specifications and include its detailed description in the plant operation manuals. However, the recommendations described in Section II.B.3 of NUREG-0737 were imposed as requirements for the majority of operating plants through license conditions or by orders.

Regulatory Guide (RG) 1.97, "Instrumentation for Light Water Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident" (Revision 3, 1983), described acceptable means for licensees to comply with the NRC's regulations (Criteria 13, 19, and 64 of Appendix A to 10 CFR Part 50) to provide instrumentation to monitor plant variables and systems during and following an accident. RG 1.97 included a list of variables to be monitored which included the samples specified in NUREG-0737 and the following additional samples:

- pH in the RCS
- Boron, pH, chlorides, and radionuclides in the containment sump

Since these criteria for PASS have been issued, the NRC has performed three generic evaluations pertinent to the staff's evaluation of BAW-2387, which are discussed below.

In the mid 1980s, the staff had a contractor review regulatory requirements that might have had marginal importance to risk. One of the issues reviewed was the NUREG-0737 criteria for PASS. The conclusion reported in NUREG/CR-4330, "Review of Light Water Reactor Regulatory Requirements" (dated May 1987), was that several of the PASS criteria could be relaxed without impacting safety; however, the staff did not take action to modify the PASS criteria based upon the contractor's conclusions.

In 1993, during its review of licensing issues pertaining to evolutionary and advanced light water reactors, the staff evaluated requirements for PASS specified in 10 CFR 50.34(f)(2)(viii). The staff recommended to the Commission in SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-water Reactor (AWLR) Designs," (dated April 2, 1993), that: (1) elimination of hydrogen analysis of containment atmosphere samples is appropriate, given that safety-grade hydrogen monitoring instrumentation will be installed; (2) relaxation of dissolved gas (including dissolved hydrogen) sampling time to 24 hours is appropriate; (3) elimination of the mandatory requirement for chloride samples is appropriate; (4) relaxation of the boron sampling time to 8 hours after an accident is appropriate; and (5) relaxation of the sampling time for radionuclides (used to determine the degree of core damage) to 24 hours is appropriate.

In addition, in 1993, the staff evaluated the Combustion Engineering Owners Group (CEOG) Topical Report CEN-415, "Modifications of Post Accident Sampling System Requirements," (Revision 1, December 1991). In a letter dated April 12, 1993, to the CEOG the NRC approved: (1) deletion of pH measurement in the containment sump, (2) deletion of hydrogen sampling of the containment atmosphere, (3) deletion of sampling for iodine (if core damage assessment procedures are based on samples of xenon or krypton activities), and (4) deletion of oxygen analysis of reactor coolant.

Finally, in parallel with review of WCAP-14986, Revision 1, "Westinghouse Owners Group Post Accident Sampling System Requirements" (approved by the staff June 14, 2000), the staff also reviewed a CEOG topical report (CE NPSD-1157, "Technical Justification for the Elimination of the Post-Accident Sampling System from the Plant Design and Licensing Bases for CEOG Utilities" [approved by the staff May 16, 2000]), which requested similar changes to PASS requirements for Combustion Engineering PWRs.

The staff considered the conclusions (and the basis for the conclusions) from these generic evaluations as part of its review of BAW-2387.

3.0 EVALUATION

The NRC staff's review of the technical basis for each of the changes to PASS proposed in BAW-2387 is discussed below.

3.1 Eliminate Pass Sampling of RCS Dissolved Gases

Dissolved gas sampling is specified in NUREG-0737 and RG 1.97; however, NUREG/CR-4330 suggests that it could be eliminated provided that vessel head gas vents and a reactor vessel level instrumentation system (RVLIS) are installed.

The main purpose of sampling for dissolved gases is to identify the potential of void formation in the vessel dome and at the top of the reactor coolant hot legs from dissolved gases when depressurizing, or even uncovering the core in case natural circulation needs to be used for decay heat removal.

Knowing the content of dissolved gas in reactor coolant would not eliminate void formation or aid in removing the void once formed. The existence of voids in the RCS will prevent or degrade core cooling. The RCS highpoint vent system will eliminate this condition. Procedures and training will be instituted at specific sites for void detection and removal.

B&W plants either have an automatic gas sampling system or manually obtain samples. In either case, receipt of sampling results is not timely. In addition, these samples are not accurate due to their small sizes. Sample sizes are minimized to reduce personnel exposure. These sampling practices provide no real benefit in accident monitoring or in accident management.

Following a reactor accident, sampling for dissolved gases in reactor coolant is not required to manage the accident and recover plant conditions. Based on the above, the staff concludes that the proposal to eliminate PASS sampling of RCS dissolved gases is acceptable.

3.2 Eliminate PASS Sampling of RCS Hydrogen

PASS sampling of the reactor coolant for measurement of dissolved hydrogen is specified in NUREG-0737 and RG 1.97.

The main purpose of hydrogen sampling is to identify the potential of void formation in the vessel dome and the top of the RCS hot legs or even uncovering the core when depressurizing. In addition, the amount of the dissolved hydrogen could act as a surrogate indicator for dissolved fission product and non-condensible gases. As in the case of dissolved gases, the vessel head vent and the RVLIS system can be used to both identify and vent non-condensible gases from the RCS when depressurizing to establish natural circulation in the RCS. Dissolved hydrogen can be a leading indicator of dissolved fission products and non-condensible gases following fuel cladding failure during an accident. The installation of certain systems in B&W plants will enable the detection of RCS void formation during an accident. Such systems include hot leg level instrumentation, RVLIS, continuous head to hot leg vent line, or high point vents. Knowing the RCS hydrogen concentration will not aid in preventing or eliminating voids in the system. Training will be provided at those sites having the RVLIS system to detect voids and to enable continued cooling in the natural circulation mode following depressurization. In the case of plants with the head-to-hot leg vent line, void formation in the vessel dome is eliminated by design.

The determination of RCS hydrogen concentration is not required for the management and recovery from an accident. Based on the above, the staff concludes that the proposal to eliminate PASS sampling of RCS hydrogen is acceptable.

3.3 Eliminate PASS Sampling of RCS Oxygen

PASS sampling of the reactor coolant for measurement of oxygen is only recommended in NUREG-0737, but is specified in RG 1.97, whenever the RCS concentration of chlorides exceeds 1.5 ppm.

High concentrations of oxygen in the RCS can enhance stress corrosion cracking of stainless steel components caused by the presence of chlorides. However, the pH of the reactor coolant is usually adjusted by the automatic addition of a buffering solution to where stress corrosion cracking cannot occur, even with the dissolved oxygen present. The buffering is done by the addition of pH control through containment spray or by the addition of trisodium phosphate in the containment sump and the recirculation of water from the containment into the reactor coolant. Sampling for oxygen is not a way of controlling pH. The other methods mentioned are more effective in controlling pH. Knowing oxygen concentrations will not contribute to accident management or recovery.

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of RCS oxygen is acceptable.

3.4 Eliminate PASS Sampling of RCS Chlorides

PASS sampling of chlorides in the RCS is specified in NUREG-0737 and RG 1.97.

High concentrations of chlorides in the reactor coolant can cause stress corrosion cracking of stainless steel components in contact with the coolant. Chlorides are introduced into the RCS by the incoming water from external sources containing chlorides. For plants which use cooling water containing chlorides, the operators are aware when the ingress of contaminated water occurs and can take appropriate corrective actions to prevent corrosion damage. It is desired to prevent stress corrosion cracking of reactor coolant piping in the long term.

The introduction of external sources of water is controlled by the operator. For this reason chloride concentrations may be estimated and adjusted by controlling pH through the introduction of buffering solutions into the RCS. In addition, the buffering solutions (sodium hydroxide or trisodium phosphate) do not require determination of chloride concentration to make the appropriate buffering solution addition. The addition of buffering solution is determined based on predetermined pH values obtained from conservatively analyzed reactor coolant conditions and coolant composition.

It is not necessary to know reactor coolant chloride concentration to mitigate an accident, or to manage and recover from an accident. For this reason, PASS capabilities for determining the RCS chloride concentration are not required and can be eliminated from all B&W plants.

3.5 Eliminate PASS Sampling of RCS pH

The measurement of the reactor coolant pH using PASS is specified in RG 1.97.

It is important to control the RCS pH in order to prevent long term chloride stress corrosion cracking in reactor coolant piping when chlorides are present in the RCS water. Stress corrosion cracking may occur when chlorides are present along with acidic pH conditions. However, sampling of the RCS pH following an accident is not needed since in the post-accident environment of the B&W PWR, the pH of the reactor coolant and the containment sump are usually adjusted by the automatic addition of a buffering solution via the containment spray system (sodium hydroxide) or by adding trisodium phosphate to the sump that is circulated back to the reactor. In both cases, recirculation of the chemically-treated reactor coolant back to the reactor is assured and RCS pH can be satisfactorily estimated by calculations.

Mitigation of accident conditions, or management and recovery from an accident do not require the measurement of the RCS pH. Based on the above, the staff concludes that the proposal to eliminate PASS sampling of the RCS pH from B&W PWRs is acceptable.

3.6 Elimination of RCS Boron Concentration Determination Using PASS

The shutdown reactivity margin for the reactor can be determined by knowing boron concentration. It is important that there is no possibility of the reactor returning to criticality during the process of achieving cold shutdown conditions. PASS sampling of the reactor coolant for measurement of boron is specified in NUREG-0737 and RG 1.97. In addition, the staff recommended in SECY 93-087 that the capability to obtain PASS samples of the RCS boron within 8 hours of accident initiation (after the plant reaches a stable state) be maintained for advanced light water reactors.

The emergency operating procedures (EOPs) for B&W PWRs do not rely on measuring boron concentration to maintain shutdown margin. Adequate measures for boration during accident mitigation and recovery are provided by the EOPs. No reliance is placed on PASS boron concentration measurement capability. Various systems also provide an alternate means of verifying shutdown margin. These systems/indicators are control rod drive position indication, reactor power indication, negative startup rate indication and concentrated boron addition indication.

Based on the above, the staff concludes that the boron concentration measurement capability of PASS is not required. The proposal to eliminate PASS sampling for RCS boron is acceptable.

3.7 Eliminate PASS Sampling of RCS Conductivity

The PASS sampling of the reactor coolant for measuring conductivity of the coolant is not specified in NUREG-0737, nor RG 1.97.

The measurement of reactor coolant conductivity is for verifying pH measurements. Conductivity determination was never required by the NRC. Therefore, the staff concludes that the proposal to eliminate PASS sampling for RCS conductivity is acceptable.

The B&WOG has determined that the conductivity parameter is not required by EOPs or accident management guidelines. The RCS conductivity is not required for accident mitigation, management or recovery. The PASS conductivity monitoring capability can be eliminated from B&W PWRs.

3.8 Eliminate PASS Sampling of RCS Radionuclides

PASS sampling of the reactor coolant for measurement of radionuclides is specified in NUREG-0737 and RG 1.97. NUREG-0737 specifies that the PASS has the capability to promptly (i.e., within 3 hours) quantify certain radionuclides that are indicators of the degree of core damage. RG 1.97 specifies that the isotopic analysis serves the purpose of accident release assessment.

Radionuclide determination enables the categorization of accident classification. Going beyond a predetermined limit of 300 microcuries per cubic centimeter (equivalent iodine-131) RCS iodine concentration would be indicative of 5 to 10 percent fuel cladding failure. There are additional indications of fuel cladding failure that consist of high core exit temperature, low core level indication, RCS letdown radiation level, high containment radiation level, loss of subcriticality, and loss of RCS subcooling margin. Use of these indicators would provide the operator an early warning of core damage and/or information needed to escalate or reduce the emergency classification.

There may be situations where the above methods will not provide an indication of fuel failure. An example of this would be debris-induced mechanical damage. In this case, the normal sample system can be used for emergency action level (EAL) determinations for conditions up to and including 300 microcuries per cubic centimeter of reactor coolant. In the event that dose rates are so significant that the normal sampling system cannot be used, then the minimum of an Alert classification can be chosen.

Using the alternate methods described above will result in a more conservative EAL determination. PASS radionuclide samples require more time and personnel dose to obtain.

Based on the explanations above and the availability of alternate methods to determine EALs, it is acceptable to eliminate PASS radionuclide sampling capability from all B&W PWRs.

3.9 Eliminate PASS Sampling of Containment Atmosphere Hydrogen Concentration

PASS sampling of the containment atmosphere for hydrogen measurement is specified in NUREG-0737 and RG 1.97. NUREG-0737 requires that the capability to obtain and analyze hydrogen samples from containment be within 3 hours. The reason for knowing hydrogen concentration is to assess the degree of core damage during a beyond design basis accident and support severe accident management guidelines.

The requirements for containment hydrogen concentration monitors exist in 10 CFR 50.44(b)(1), NUREG-0737 and RG 1.97. These instruments are generally relied upon to meet the data reporting requirements of 10 CFR Part 50, Appendix E. A requirement exists for these instruments to be operable within 30 minutes after the start of safety injection. They must be able to detect up to 10 percent hydrogen by volume in the containment. Some B&W PWR licensees have obtained relief from the 30 minute time requirement by requesting a functional requirement via order. In these cases, a requirement for determining when it is necessary to provide hydrogen indication for containment exists. The continuous monitors will provide indication of hydrogen concentration more quickly than by obtaining samples from PASS.

The staff notes that containment hydrogen concentration monitors required by 10 CFR 50.44(b)(1), are addressed in NUREG-0737 Item II.F.1 and Regulatory Guide 1.97, and are relied upon to meet the data reporting requirements of 10 CFR Part 50, Appendix E, Section VI.2.a.(i)(4). The staff concludes that during the early phases of an accident, the continuous hydrogen monitors provide an adequate capability for monitoring containment hydrogen concentration. The staff sees value in maintaining the capability to obtain grab samples for complementing the information from the hydrogen monitors in the long term (i.e., by confirming the indications from the monitors and providing hydrogen measurements for concentrations outside the range of the monitors). The licensee's contingency plan for obtaining highly radioactive samples will include sampling of the containment atmosphere and may, if deemed necessary and practical by the appropriate decision-makers, be used to supplement the continuous hydrogen monitors.

In consideration of the evaluation above for the need for PASS sampling of containment hydrogen, the containment atmosphere sampling function of PASS is considered unnecessary and can be eliminated from all operating B&W PWRs. In the event that emergency management practices require knowing the containment hydrogen concentration in ranges above that of the continuous hydrogen monitors, contingency plans will be provided for obtaining and analyzing containment atmospheric hydrogen after plant conditions have stabilized for long-term post-accident conditions.

3.10 Eliminate PASS Sampling of Containment Oxygen

PASS sampling of the containment atmosphere for oxygen measurement is specified in RG 1.97. This measurement is recommended by NUREG-0737, but not required.

Containment oxygen measurement serves to ensure that the oxygen level does not reach the limit of deflagration or detonation with the generated hydrogen. Since, in the post-accident environment the only source of oxygen is radiolysis of sump water, it is not expected that this source will cause a significant increase of oxygen above the concentration that would already exist in the containment atmosphere.

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of containment oxygen is acceptable. The PASS measurement of containment atmospheric oxygen can be eliminated from B&W PWRs.

3.11 Eliminate PASS Sampling of Radionuclides in the Containment Atmosphere

PASS sampling of the containment atmosphere for radionuclide measurement is specified in NUREG-0737 and RG 1.97. NUREG-0737 specifies that the PASS has the capability to quickly determine the level of certain radionuclides that are indicators of the degree of core damage. In addition, RG 1.97 specifies that the isotopic analysis serves the purpose of accident release assessment.

The measurements of containment atmosphere radionuclide concentration obtained from PASS are used to estimate the degree of core damage and to refine the source term used in dose assessments. In turn, core damage estimates and dose assessments are used in evaluating the type and extent of public protective actions which may be warranted. PASS sampling of containment atmosphere radionuclides can be eliminated because these samples are not representative of the concentration of radionuclides which may be released to the environment. The basis for this conclusion is that further containment depressurization can lead to additional fission products being released to the containment, significant amounts of fission products may be deposited on RCS internal surfaces without being released to the containment, plateout of aerosols (e.g., cesium iodide or Csl) in the sample lines, and time delays associated with obtaining, processing and interpreting the sample during non-stable phases of the accident. In addition, samples of the containment atmosphere could be obtained and analyzed without depending on the PASS.

Several other plant indicators can be used to provide information for assessing core damage that can be obtained more expeditiously than PASS and with a sufficient degree of accuracy. These indicators consist of containment radiation and hydrogen monitors and core exit thermocouples.

Site surveys can be performed at various plant and offsite locations in performing offsite dose assessments. Surveys of this type are applicable to all accidents and monitoring is possible at specific release points.

During the accident recovery, it may become necessary to sample the containment in order to evaluate the containment environment. It is not necessary to provide dedicated equipment for containment samples during the accident recovery phase. Contingency methods for obtaining containment samples in the recovery phase will be formulated.

From the analysis above, PASS features to obtain containment atmospheric radionuclide samples are not necessary and may be eliminated from B&W PWRs. There are other indicators of plant conditions that can be used for core damage assessment and offsite dose determination. In the accident recovery phase, already existing plans can be implemented to obtain and analyze radioactive containment samples at the times during which plant conditions have stabilized. Based on the discussion above, the elimination of the containment radionuclide sampling capability of PASS from B&W PWRs is acceptable.

3.12 Eliminate PASS Sampling of Containment Sump Radionuclides

RG 1.97 requires the ability to perform radionuclide analyses of containment sump water. This same requirement is not specified by NUREG-0737. Determining the level of radionuclides in the containment sump provides an indicator of core damage and enables the prediction of offsite dose due to leakage from emergency core cooling system recirculation flow paths. From an accident management and mitigation standpoint, real time indicators should be utilized to estimate core damage. Use of the containment sump sampling feature of PASS is too time consuming to fulfill this need. The need to assess core damage or projected damage can more appropriately be provided for by containment radiation and hydrogen monitors and core exit thermocouples. These instruments also have the required accuracy.

With regard to offsite dose determination and prediction, PASS sampling of the containment requires too much time to be effective. This need is better met by onsite and offsite surveying which apply to all accidents. In addition, specified locations may be used in surveying for varying conditions. Site surveys provide better data for offsite dose assessment.

In consideration of the above discussion, the need for PASS sampling of containment sump water radionuclides is unnecessary and can be eliminated from B&W PWRs. There are other methods available for core damage assessment and offsite dose determination.

3.13 Eliminate Pass Sampling of Containment Sump pH

RG 1.97 specifies the need to obtain and analyze containment sump samples for pH. NUREG-0737 has no requirement for this. The sump pH is monitored to enable its control within an acceptable range. This is necessary to prevent or limit stress corrosion cracking of stainless steel components in the RCS and to maintain the ability of sump water to retain iodine.

Following an accident, containment sump water pH is maintained in an alkaline condition by passive control or by containment spray additives. In the event that containment spray is not activated, the estimation of sump pH can be performed by knowing the sources, amounts and chemistries of water entering the sump.

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of containment sump pH in B&W PWRs is acceptable.

3.14 Eliminate PASS Sampling of Containment Sump Chlorides

PASS sampling and measurement of the containment sump for chlorides is specified in RG 1.97. Chloride sampling of the containment sump is not specified by NUREG-0737.

A high concentration of chlorides in the containment sump can lead to stress corrosion cracking of stainless steel components and limit retention of iodine in containment sump water. For plants with fresh water cooling systems, the problem is minimal; but for the plants with brackish water (with a single barrier between the cooling water and the containment and without pH control), it is a greater concern. However, the volumes and chemistries of water passing to the containment sump would be known by the operator thereby allowing an estimate of sump chloride concentration to be made. It is not necessary to know containment sump chloride concentration for accident management, mitigation or recovery. However, over the long term, the concentration of chlorides must be controlled to limit stress corrosion cracking of stainless steel components and to aid in the retention of iodine in sump water.

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of containment sump chlorides in B&W PWRs is acceptable.

3.15 Eliminate Pass Sampling of Containment Sump Boron

The capability to obtain grab samples from the containment sump is specified by RG 1.97 but not in NUREG-0737. In the event that sump water is recirculated in order to maintain reactor cooling, it is necessary to also verify subcriticality by analyzing sump samples for boron content.

In considering the potential sources of water that would be used for this purpose, the borated water storage tank and the core flood tanks will assure continued subcriticality when mixed with the RCS water as described above. This evaluation is true at any time during the fuel cycle. In the event that unborated water enters the containment sump, the sump boron concentration will be reduced. If this happens, the sump boron concentration may be estimated by knowing the respective concentrations of the various water sources and the corresponding amounts of water.

The assessment above indicates that the need for a post-accident sampling capability of containment sump boron is not necessary and can be eliminated from B&W PWRs.

4.0 SUMMARY

The staff concludes that BAW-2387 provides a sufficient technical basis to eliminate the following PASS criteria specified in NUREG-0737 and RG 1.97:

1. RCS dissolved gases,
2. RCS hydrogen,
3. RCS oxygen,
4. RCS chlorides,
5. RCS pH,
6. RCS boron,
7. RCS conductivity,
8. RCS radionuclides,
9. Containment atmosphere hydrogen,
10. Containment atmosphere oxygen,
11. Containment atmosphere radionuclides,
12. Containment sump radionuclides,
13. Containment sump pH,
14. Containment sump chlorides, and
15. Containment sump boron.

4.1 Licensee Required Actions

The staff has identified the following licensee required actions that must be fulfilled by a licensee that eliminates the PASS for sampling the above 15 parameters in accordance with BAW-2387 and this safety evaluation:

1. Establish a capability for classifying fuel damage events at the Alert level threshold (typically this is 300 microcuries per ml dose equivalent iodine). This capability may utilize the normal sampling system or correlations of sampling or letdown line dose rates to coolant concentrations.

2. Develop contingency plans for obtaining and analyzing highly radioactive samples of reactor coolant, containment sump, and containment atmosphere.

3. The staff does not consider that the changes as discussed in this topical report will result in a decrease in the effectiveness of the emergency plan, however the licensee must determine for its own plant(s) that no decrease in the effectiveness of the emergency plans will result from the removal/downgrade of the PASS.

4. Licensees will maintain offsite capability to monitor radioactive iodines.

5. Containment hydrogen monitors required by 10 CFR 50.44(b)(1) may not be eliminated. The staff recommends that licensees maintain the capability to sample and analyze hydrogen in the containment atmosphere in order to support severe accident management guidelines.

4.2 Public Comment

In a notice published in the Federal Register on November 24, 1999 (64 FR 66213), the NRC requested comments on its pending action to approve two industry developed topical reports concerning the elimination of the PASS. The NRC received 19 comment letters. Input from the public stakeholders is an important part of the NRC's decisionmaking process. The NRC concluded that the PASS provides a small benefit in emergency response. The primary benefit is in confirming other indications used to make emergency response decisions. The benefit of PASS is limited by the time needed to obtain the samples and problems associated with obtaining accurate samples.

5.0 CONCLUSION

The staff concludes, based upon the justification provided in BAW-2387, that there is reasonable assurance that the health and safety of the public will not be endangered by operation of B&W PWRs without PASS. Therefore, the staff concludes that it is acceptable for licensees to eliminate PASS from the licensing basis for the B&W PWRs.

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