June 12, 2001

Mr. James M. Kenny, Chairman
BWR Owners' Group
c/o PPL
Two North Ninth Street
Mail Code GENA6-1
Allentown, PA 18101-1179

SUBJECT: SAFETY EVALUATION RELATED TO TOPICAL REPORT NEDO-32991, "REGULATORY RELAXATION FOR BWR POST ACCIDENT SAMPLING STATIONS (PASS)" DATED OCTOBER 2000 (TAC NO. MB0666)

Dear Mr. Kenny:

By letter dated November 30, 2000 (BWROG-00089), the BWR Owners Group (BWROG) submitted Topical Report NEDO-32991, "Regulatory Relaxation for BWR Post Accident Sampling Stations (PASS)," for the NRC staff's review. The BWROG's report proposed to eliminate all regulatory requirements related to PASS for boiling water reactors (BWRs).

The enclosed safety evaluation addresses the staff's review of NEDO-32991 for BWRs. 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 3.0 of the safety evaluation. In doing this, the staff also identified three actions in Section 4.0 of the safety evaluation that should be fulfilled by a licensee referencing the topical report in a plant-specific application to eliminate PASS from their technical specifications.

Licensees that have incorporated the use of PASS into their emergency plans (EP) will need to perform an assessment in accordance with 10 CFR 50.54(q) to determine whether eliminating PASS decreases the effectiveness of the EP. Based on the enclosed safety evaluation, the staff concludes that eliminating the PASS for sampling the 15 parameters listed in the safety evaluation is unlikely to 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 plant. If a licensee should determine that the effectiveness of the EP is not decreased, then, in accordance with 10 CFR 50.54(q), the removal of the PASS would not require staff approval.

As stated in the safety evaluation, the staff concludes, based upon the justification provided in NEDO-32991, that there is reasonable assurance that the health and safety of the public will not be endangered by operation of BWRs without PASS. Therefore, it is acceptable to eliminate PASS from the licensing basis for BWRs.

The NRC requests that the BWROG publish an accepted version of the revised NEDO-32991 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 an "-A" (designating accepted) following the report identification number (i.e., NEDO-32991-A).
If the NRC's criteria or regulations change so that its conclusion in this letter, that the topical

report is acceptable, is invalidated, the BWROG 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/

Stuart A. Richards, Director
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Project No. 691

Enclosure: Safety Evaluation

cc w/encl: See next page

If the NRC's criteria or regulations change so that its conclusion in this letter, that the topical report is acceptable, is invalidated, the BWROG 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/

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cc w/encl: See next page

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO TOPICAL REPORT NEDO-32991, "REGULATORY RELAXATION FOR

BWR POST ACCIDENT SAMPLING STATIONS (PASS)"

BWR OWNERS GROUP

PROJECT NO. 691

1.0 INTRODUCTION

In its letter dated November 30, 2000, the BWR Owners Group (BWROG) submitted Topical Report NEDO-32991, "Regulatory Relaxation for BWR Post Accident Sampling Stations (PASS)," to be reviewed by the staff for eliminating PASS requirements from boiling water reactors (BWRs).

The BWROG request followed the staff's approval of similar requests for elimination of PASS requirements from the Combustion Engineering Owners Group (CEOG) and the Westinghouse Owners Group (WOG). The staff's safety evaluation for the CEOG Topical Report CE NPSD-1157, Revision 1, "Technical Justification for the Elimination of the Post Accident Sampling System From the Plant Design and Licensing Basis for CEO Utilities," is dated May 16, 2000 (ADAMS Accession Number ML003715250). The staff's safety evaluation for the WOG Topical Report WCAP-14986, "Post Accident Sampling System Requirements: A Technical Basis," is dated June 14, 2000 (ADAMS Accession Number ML003723268). The safety evaluations for the CEOG and WOG topical reports included the NRC staff's assessment of public comments received following a *Federal Register* notice (64 FR 66213) published on November 24, 1999, that requested public comment on the NRC's pending action to approve the topical reports. The staff also described in a *Federal Register* notice (65 FR 65018) published on October 31, 2000, how plant-specific applications to eliminate PASS-related requirements for CE and Westinghouse plants could be submitted using the Consolidated Line Item Improvement Process (CLIIP).

NEDO-32991 evaluated the various requirements for PASS to determine their contribution to plant safety and accident recovery. The BWROG concluded that 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). The BWROG acknowledged that for plant-specific contingencies some licensees might maintain certain sampling capabilities currently provided by PASS. With 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 provided that the plant's configuration and operating practices are controlled in accordance with applicable regulatory

requirements. As discussed in the topical report, NUREG-0737 and other references to containment sump are applicable to the suppression pool in BWRs.

Specifically, the BWROG recommended in NEDO-32991 the following:

1. Eliminate PASS sampling of reactor coolant dissolved gases.
2. Eliminate PASS sampling of reactor coolant hydrogen.
3. Eliminate PASS sampling of reactor coolant oxygen.
4. Eliminate PASS sampling of reactor coolant chlorides.
5. Eliminate PASS sampling of reactor coolant pH.
6. Eliminate PASS sampling of reactor coolant boron concentrations.
7. Eliminate PASS sampling of reactor coolant conductivity.
8. Eliminate PASS sampling of radioisotopes in the reactor coolant.
9. Eliminate PASS sampling of containment hydrogen.
10. Eliminate PASS sampling of containment oxygen.
11. Eliminate PASS sampling of radioisotopes in the containment atmosphere.
12. Eliminate PASS sampling of suppression pool pH.
13. Eliminate PASS sampling of chlorides in the suppression pool.
14. Eliminate PASS sampling of boron in the suppression pool.
15. Eliminate PASS sampling of radioisotopes in the suppression pool.

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 radioisotopes 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, "Technical Specifications," which provided guidance on how to address post-accident sampling in the technical specifications for BWRs and pressurized water reactors (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 many operating plants through license conditions or by orders.

Regulatory Guide 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 Commission'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. Regulatory Guide 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 reactor coolant
- Boron, pH, chlorides, and radioisotopes in the containment sump

Since these criteria for PASS have been issued, the NRC has performed several generic evaluations pertinent to the staff's evaluation of NEDO-32991, which are discussed below.

In the mid 1980s, the staff had a contractor review regulatory requirements that may have 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 (ALWR) 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) elimination of dissolved gas (including dissolved hydrogen) analysis is appropriate for BWRs; (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 radioisotopes (used to determine the degree of core damage) to 24 hours is appropriate.

In addition, in 1993, the staff evaluated the CEOG Topical Report CEN-415, "Modifications of Post Accident Sampling System Requirements," (Revision 1, December 1991). In a letter dated April 12, 1993, 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, before its review of NEDO-32991, the staff reviewed and approved the CEOG Topical Report CE NPSD-1157, Revision 1, and the WOG Topical Report WCAP-14986. The staff also approved several plant-specific proposals to eliminate PASS-related requirements. The staff considered the conclusions (and the basis for the conclusions) from these generic evaluations as part of its review of NEDO-32991.

3.0 EVALUATION

The NRC staff's review of the technical basis for each of the changes to PASS proposed in NEDO-32991 is discussed below.

3.1 Eliminate PASS Sampling of Reactor Coolant Dissolved Gases

Dissolved gas sampling is specified in NUREG-0737 and Regulatory Guide 1.97. The staff documented in SECY-93-087 that there would be no need to have the capability to analyze dissolved gases in evolutionary and passive BWRs. The bases for the staff's finding in SECY-93-087 is applicable to operating BWRs.

After discussions with Mr. T. A. Green, General Electric Project Manager, it was determined that the first sentence on page 4-2 of Topical Report NEDC-32991, under Section (1), "Reactor Coolant Dissolved Gases and Reactor Coolant Hydrogen," subsection titled, "Justification," will be deleted. The words, "In addition," in the second sentence will also be deleted. The paragraph for this subsection will start, "The BWR vessel depressurization....."

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of reactor coolant dissolved gases is acceptable.

3.2 Eliminate PASS Sampling of Reactor Coolant Hydrogen

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

The staff documented in SECY-93-087 that there would be no need to have the capability to analyze dissolved gases in evolutionary and passive BWRs. The bases for the staff's finding in SECY-93-087 is applicable to operating BWRs. Monitors in the containment can provide measurement of hydrogen generated from core damage mechanisms such as the metal-water reaction.

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of reactor coolant hydrogen is acceptable.

3.3 Eliminate PASS Sampling of Reactor Coolant Oxygen

PASS sampling of the reactor coolant for measurement of oxygen is only recommended in NUREG-0737, but is specified in Regulatory Guide 1.97, whenever the reactor coolant concentration of chlorides exceeds 1.5 parts per million (ppm).

High concentrations of oxygen in the reactor coolant can enhance stress corrosion cracking of stainless steel components caused by the presence of chlorides. Measurement of oxygen concentrations to address corrosion concerns would not be a high priority action during the short-term mitigation of severe accidents. Analyses referenced by the BWROG have shown that oxygen concentrations will remain relatively low when the reactor coolant remains at high pressures. When the reactor coolant system (RCS) is depressurized, measurements of oxygen concentrations can be obtained from monitors in containment. Longer-term assessments will, if necessary, be accommodated through the use of plant-specific contingency plans (see Section 4.0).

As a result of previous interactions with the NRC staff, some licensees may have previously revised PASS capabilities to eliminate the measurement of oxygen in the RCS. Consistent with the previous interactions as well as the review of NEDO-32991, the staff concludes that the proposal to eliminate PASS sampling of reactor coolant oxygen is acceptable for those licensees that may currently have that capability.

3.4 Eliminate PASS Sampling of Reactor Coolant Chlorides

PASS sampling of chlorides in the reactor coolant is specified in NUREG-0737 and Regulatory Guide 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 reactor coolant 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. NUREG-0737 did not require samples to be taken for determination of chlorides for between one and four days. Such assessments can, if necessary, be accommodated through the use of plant-specific contingency plans (see Section 4.0).

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of reactor coolant chlorides is acceptable.

3.5 Eliminate PASS Sampling of Reactor Coolant pH

PASS measurement of the reactor coolant pH is specified in Regulatory Guide 1.97 and the NUREG-0737 post-implementation guidelines.

Reactor coolant pH control is important for controlling stress corrosion cracking of stainless steel components and for iodine retention. The BWROG provided sufficient argument in the topical report that the pH of the reactor coolant would remain above 7.0 following loss-of-coolant accidents. Also, reactor coolant pH can be satisfactorily estimated by calculations and in some cases, injection of sodium pentaborate solution from the standby liquid control system (SLCS) would raise the pH of the reactor coolant. If additional interest in the pH of the reactor coolant is warranted by a particular accident condition, assessments could be accommodated through the use of plant-specific contingency plans (see Section 4.0).

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of reactor coolant pH is acceptable.

3.6 Eliminate PASS Sampling of Reactor Coolant Boron

PASS sampling of the reactor coolant for measurement of boron is specified in NUREG-0737 and Regulatory Guide 1.97. In addition, the staff recommended in SECY 93-087 that the capability to obtain PASS samples of reactor coolant boron within 8 hours of accident initiation (after the plant reaches a stable state) be maintained for advanced light water reactors.

For BWRs, boration of the reactor coolant is not a routine way to control core reactivity. Although boron solution may be added from SLCS to address an event such as an anticipated transient without scram (ATWS), alternatives to the use of PASS are available to estimate boron concentrations and to assess the criticality of the reactor core.

Based on the above, the staff concludes that the proposal to eliminate PASS sampling for reactor coolant boron is acceptable.

3.7 Eliminate PASS Sampling of Reactor Coolant Conductivity

The PASS sampling of the reactor coolant for measuring conductivity of the coolant is not specified in NUREG-0737 or Regulatory Guide 1.97. The measurement of reactor coolant conductivity is used to confirm other analyses such as concentrations of chlorides or boron. Since the NRC did not require the measurement of reactor coolant conductivity, the staff does not object to the elimination of this PASS sample.

3.8 Eliminate PASS Sampling of Reactor Coolant Radioisotopes

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

The topical report states that post accident measurement of reactor coolant radioisotopes is currently used to perform core damage assessment. In regards to core damage assessment, the topical report states that measurement of radioisotopes with PASS is not needed because

alternate methods using in-plant instrumentation will provide more timely information. The revised BWROG core damage assessment guidelines will use in-plant instrumentation such as water level, hydrogen concentrations in containment, and containment radiation levels.

The staff considers radioisotope sampling information to be potentially useful in estimating the degree of core damage, but recognizes that there are limitations associated with its use, in particular regarding the time needed to obtain the sample. Therefore, the staff considers it more appropriate for emergency response purposes to estimate the degree of core damage based upon real-time indications.

In addition, the staff considers radioisotope sampling information to be useful in classifying certain types of events (such as reactivity excursion or mechanical damage) which could cause fuel damage without having an indication of a loss of reactor coolant inventory. However, the staff agrees with the topical report contention that other indicators of failed fuel, such as offgas radiation monitors, main steamline radiation monitors, and, possibly direct sampling of the reactor coolant can provide the necessary information. Licensees that submit a license amendment request to eliminate PASS will be expected to verify that they have or will commit to develop an ability to estimate fuel damage resulting in reactor coolant activity of approximately 300 micro curies per milliliter (ml) dose-equivalent iodine in order to support an emergency action level (EAL) for the Alert emergency classification (see Section 4.0).

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of reactor coolant radioisotopes is acceptable.

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 Regulatory Guide 1.97.

Containment hydrogen measurement is used to estimate the amount of core damage and verify that combustible levels of hydrogen and oxygen which could threaten containment are not reached. NEDO-32991 states, and the staff agrees, that containment hydrogen is best determined through the use of the redundant, safety-grade, containment hydrogen concentration monitors required by 10 CFR 50.44(b)(1) and NUREG-0737 Item II.F.1, and relied upon to meet the data reporting requirements of 10 CFR Part 50, Appendix E, Section VI.2.a.(ii)(3).

The staff concludes that during the early phases of an accident, the safety-grade hydrogen monitors provide an adequate capability for monitoring containment hydrogen concentration and are an acceptable alternative to maintaining the capability to obtain and analyze containment atmosphere samples for hydrogen within 3 hours. Approval of the change regarding PASS sample analysis does not change the requirements contained in 10 CFR 50.44(b)(1), the criteria in NUREG-0737 Item II.F.1, and Regulatory Guide 1.97 regarding the need to establish containment hydrogen concentration monitoring within 30 minutes of the initiation of safety injection. The staff notes that the NRC recently issued confirmatory orders for several plants that replaced the requirement to establish hydrogen monitoring within

30 minutes of the initiation of safety injection with a functional requirement that allows the licensee the flexibility to determine the appropriate time limit for providing indication of hydrogen concentration in containment. This same mechanism is available to other licensees who were issued orders in the 1983 time-frame confirming their requirements made in response to NUREG-0737 Item II.F.1. Consideration of plant-specific emergency action levels, emergency operating procedures (EOPs), and severe accident management guidelines (SAMGs), can be used by those licensees in establishing the plant-specific time limit. For licensees that were not issued orders confirming their requirements regarding NUREG-0737 Item II.F.1, the licensees should determine the proper way to revise the licensing bases and to determine if prior NRC approval of the changes in timing is necessary.

In view of the value of sampling the containment atmosphere for hydrogen to complement the information from the safety-grade hydrogen monitors (i.e., by confirming the indications from the monitors), licensees referencing NEDO-32991 should retain a capability for sampling the containment atmosphere during the later stages of accident response (see Section 4.0, item 2) and maintain the capability to analyze such samples for hydrogen.

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of containment atmosphere hydrogen concentration is acceptable.

3.10 Eliminate PASS Sampling of Containment Oxygen

PASS sampling of the containment atmosphere for oxygen measurement is specified in Regulatory Guide 1.97.

Containment oxygen measurement serves to verify that the oxygen level does not reach the level that could support combustion which could result in containment failure. NEDO-32991 states, and the staff agrees, that containment oxygen is best determined through the use of the in-line oxygen monitors that are addressed in technical specifications for post-accident monitoring instrumentation for BWRs.

In view of the value of sampling the containment atmosphere for oxygen to complement the information from the oxygen monitors (i.e., by confirming the indications from the monitors), licensees referencing NEDO-32991 should retain a capability for sampling the containment atmosphere during the later stages of accident response (see Section 4.0, item 2) and maintain the capability to analyze such samples for oxygen.

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

3.11 Eliminate PASS Sampling of Radioisotopes in the Containment Atmosphere.

PASS sampling of the containment atmosphere for radioisotope measurements is specified in NUREG-0737 and Regulatory Guide 1.97. NUREG-0737 specifies that the PASS have the capability to promptly quantify certain radioisotopes that are indicators of the degree of core

damage. Furthermore, Regulatory Guide 1.97 specifies that the isotopic analysis serves the purpose of accident release assessment.

PASS measurements of the containment atmosphere radioisotope concentrations 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. The topical report states that PASS sampling of containment atmosphere radioisotopes can be eliminated because these samples are not representative of the concentration of radioisotopes which may be released to the environment. The basis for this conclusion is that the concentration of the radioisotopes at the sample point may not be representative of the concentration in containment, the potential for revolitization of fission products upon containment depressurization, plate out of aerosols (e.g., cesium iodide (CsI)) in the sample lines, and time delays associated with obtaining, processing and interpreting the sample during non-stable phases of the accident. In addition, the topical report stated that samples of the containment atmosphere could be obtained and analyzed without reliance on the PASS.

The staff recognizes that, as described in Supplement 3 to NUREG-0654, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," initial protection action recommendations (PARs) should be based upon plant indications of actual or projected core damage. Following this initial PAR, the licensee should continue assessment of the accident to determine whether the PAR should be modified (relaxation of the PAR should not occur until the source of the threat is clearly under control). In NUREG-0654, the NRC indicated that licensees' capability to perform this assessment should include the post-accident sampling capability. Therefore, the staff's evaluation of the topical report's recommendation for elimination of sampling the containment atmosphere for radioisotopes focused on the need for this information to support whether initial PARs should be modified.

The staff generally agrees with the topical report's assessment regarding the limitations associated with obtaining representative samples of the containment atmosphere. The staff considers that these limitations should be taken into account when determining how to utilize the containment atmosphere sample information during an event. However, the staff position is that, due to these limitations, information obtained from PASS samples would not be a primary factor in licensee and offsite emergency response decision-making regarding PARs during the early phases of an accident. However, the staff considers that containment atmosphere sample information would provide the public additional confidence that the licensee understood the magnitude of any remaining threat that the accident may pose after plant conditions in the accident have stabilized and would also support long-term recovery operations. Therefore, the staff also concludes that a plan should be developed for sampling the containment atmosphere; however, the staff does not consider it necessary to have dedicated equipment to obtain this sample in a prompt manner. These plans should detail the plant's existing sampling capabilities and what actions (e.g., assembling temporary shielding) may be necessary to obtain and analyze highly radioactive samples (See Section 4.0).

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of containment atmosphere radioisotopes is acceptable.

3.12 Eliminate PASS Sampling of Suppression Pool Radioisotopes

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

The topical report states that measurement of radioisotopes with PASS is not needed for core damage assessment because alternate methods using in-plant instrumentation will provide more timely information. The revised BWROG core damage assessment guidelines will use in-plant instrumentation such as water level, hydrogen concentrations in containment, and containment radiation levels.

The staff considers radioisotope sampling information to be potentially useful in estimating the degree of core damage, but recognizes that there are limitations associated with its use, in particular regarding the time needed to obtain the sample. Therefore, the staff considers it more appropriate for emergency response purposes to estimate the degree of core damage based upon real-time indications.

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of suppression pool radioisotopes is acceptable.

3.13 Eliminate PASS Sampling of Suppression Pool pH

PASS measurement of the suppression pool pH is specified in Regulatory Guide 1.97 and the NUREG-0737 post-implementation guidelines.

Suppression pool pH control is important for controlling stress corrosion cracking of stainless steel components and for iodine retention. The BWROG provided sufficient argument in the topical report that the pH of the reactor coolant and suppression pool would remain above 7.0 following loss-of-coolant accidents. Also, reactor coolant and suppression pool pH can be satisfactorily estimated by calculations and in some cases, injection of sodium pentaborate solution from the SLCS would raise the pH of the water in the reactor coolant system and suppression pool. If additional interest in the pH of the water inventory in the suppression pool is warranted by a particular accident condition, assessments could be accommodated through the use of plant-specific contingency plans (see Section 4.0).

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of suppression pool pH is acceptable.

3.14 Eliminate PASS Sampling of Suppression Pool Chlorides

PASS sampling and measurement of the suppression pool for chlorides are specified in Regulatory Guide 1.97.

High concentration of chlorides in the suppression pool can cause stress corrosion cracking of stainless steel components. Chlorides are introduced into the reactor coolant and suppression pool by incoming water from external sources containing chlorides. For plants that 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. NUREG-0737 did not require samples to be taken for determination of chlorides for between one and four days. Such assessments can, if necessary, be accommodated through the use of plant-specific contingency plans (see Section 4.0).

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of suppression pool chlorides is acceptable.

3.15 Eliminate PASS Sampling of Suppression Pool Boron

Suppression pool and RCS boron concentration sampling and measurement are specified in Regulatory Guide 1.97.

For BWRs, boration of the reactor coolant is not a routine way to control core reactivity. Although boron solution may be added from the SLCS to address an event such as an ATWS, alternatives to the use of PASS are available to estimate boron concentrations of the reactor coolant, including the suppression pool, and to assess the criticality of the reactor core.

Based on the above, the staff concludes that the proposal to eliminate PASS sampling of suppression pool boron is acceptable.

4.0 SUMMARY

The staff concludes that NEDO-32991 provides a sufficient technical basis to eliminate the following PASS criteria specified in NUREG-0737 and Regulatory Guide 1.97:

1. Reactor coolant dissolved gases
2. Reactor coolant hydrogen
3. Reactor coolant oxygen
4. Reactor coolant chlorides
5. Reactor coolant pH
6. Reactor coolant boron
7. Reactor coolant conductivity
8. Reactor coolant radioisotopes
9. Containment atmosphere hydrogen
10. Containment atmosphere oxygen
11. Containment atmosphere radioisotopes

12. Suppression pool radioisotopes
13. Suppression pool pH
14. Suppression pool chlorides
15. Suppression pool boron

Referencing NEDO-32991 in License Amendment Applications

It is the staff's understanding that the BWROG will submit a proposed change to the Standard Technical Specifications (NUREGS-1433 and -1434) to eliminate PASS-related requirements. Given the approval of this topical report and the previous actions taken for the CEOG and the WOG, the staff expects to offer licensees the opportunity to make plant-specific applications using the CLIIP (see RIS-2000-06, "Consolidated Line Item Improvement Process for Adopting Standard Technical Specifications Changes for Power Reactors," dated March 20, 2000).

The staff has identified the following actions (as discussed in the above sections) that licensees should commit to fulfill when proposing to eliminate PASS in accordance with NEDO-32991 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 radiation readings to coolant concentrations.

2. Develop contingency plans for obtaining and analyzing highly radioactive samples of reactor coolant, suppression pool, and containment atmosphere. These plans should detail the plant's existing sampling capabilities and what actions (e.g., assembling temporary shielding) may be necessary to obtain and analyze highly radioactive samples. Because these are contingency plans, the staff concludes that, in accordance with 10 CFR 50.47 and Appendix E to 10 CFR Part 50 for emergency plans, these contingency plans must be available to be used by the licensees during an accident; however, these contingency plans do not have to be carried out in emergency plan drills or exercises.

3. Licensees will maintain an I-131 site survey detection capability, including an ability to assess radioactive iodines released to offsite environs, by using effluent monitoring systems or portable sampling equipment

The staff's expectation that licensees will make these regulatory commitments will be incorporated into the safety evaluations proposed under the CLIIP for this change. Licensees may propose amendments without the above regulatory commitments but would need to provide additional plant-specific justifications for not including them in the planned elimination of PASS requirements.

5.0 CORE DAMAGE ASSESSMENT METHODOLOGY

NEDO-32991 mentions that the BWROG is developing a revised core damage assessment guideline. Licensees need to maintain the capability to estimate the amount of core damage to support emergency planning and accident management procedures. As mentioned above, the

staff generally agrees that guidelines based on real-time measurements of plant parameters offer advantages over purely PASS-based assessments. Because the NRC has defined roles and responsibilities in responding to accidents at nuclear power plants, the staff requests that the BWROG provide a copy of the core damage assessment methodology to the NRC after it is issued for use by participating licensees.

6.0 CONCLUSION

The staff concludes, based upon the justification provided in NEDO-32991, that there is reasonable assurance that the health and safety of the public will not be endangered by operation of BWRs without PASS. Therefore, the staff concludes that it is acceptable for BWR licensees to eliminate PASS from the licensing basis for their facilities. Licensees proposing to do so will be expected to include in their applications the three commitments specified above or to provide additional plant-specific justifications for the commitment(s) that are not included.

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Date: June 12, 2001