August 5, 2004

Technical Specification Task Force
11921 Rockville Pike
Suite 100
Rockville, MD 200852

Dear Members of the TSTF:

The Nuclear Regulatory Commission (NRC) has completed the review of the Technical Specification Task Force Change Traveler, TSTF-430, R.2, "AOT Extension to 7 Days for LPI and Containment Spray." The staff has approved the proposed change. The Staff's Safety Evaluation Report for TSTF-430 is attached.

Please contact me at (301) 415-0184 or e-mail thb@nrc.gov if you have any questions or need further information on these proposed changes.

Sincerely,

/RA/

Thomas H. Boyce, Section Chief
Technical Specifications Section
Reactor Operations Branch
Division of Inspection Program Management

cc: Dennis Buschbaum, (WOG)
Bertram Morris, (BWROG)
Patricia Furio, (CEOG)
Paul Infanger, (BWOG)
Donald Hoffman, (EXCEL)
Brian Mann, (EXCEL)

August 5, 2044

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION TSTF-430, IMPLEMENTATION OF B&W TOPICAL BAW-2295, REVISION 1 "JUSTIFICATION FOR EXTENSION OF ALLOWED OUTAGE TIME FOR LOW PRESSURE INJECTION AND REACTOR BUILDING SPRAY SYSTEMS" (TAC NO. MA3939)

1.0 INTRODUCTION

By letter dated October 9, 1998, the B&W Owners Group, (B&WOG) submitted Topical Report BAW-2295, Revision 1, "Justification for Extension of Allowed Outage Time for Low Pressure Injection and Reactor Building Spray Systems" for staff approval. Specifically, the topical provides the deterministic and risk assessments to support the increase in allowable outage time (AOT) for one train of inoperable Low Pressure Injection (LPI) and Reactor Building Spray (RBS) to 7 days. The report gives justification for increasing the "ECCS Operating" Technical Specification AOT for one inoperable train of the LPI and one inoperable train of the RBS system. The technical analysis covers seven B&W units: Arkansas Nuclear One Unit 1 (ANO-1), Crystal River Unit 3 (CR-3), Davis Besse Unit 1 (DB-1), Oconee Nuclear Power Station (Oconee 1, 2, and 3), and Three Mile Island Unit 1 (TMI-1). As an additional item, CR-3 requested a 7 day AOT for the decay heat closed cycle cooling and decay heat seawater systems.

The topical used plant-specific probabilistic risk assessments (PRAs) to assess the risk impact of increased decay heat removal/low pressure injection and reactor building spray maintenance unavailability at power. Each B&WOG utility performed the plant-specific analyses using their PRA. The topical includes the generic methodology and the results of the analysis for each utility's analysis.

The LPI serves a dual function, as a component of the decay heat removal (DHR) system, and as a component of the emergency core cooling system (ECCS) in the emergency operating mode. In the B&W plant design, the DHR system and LPI are combined and share most components, including pumps, valves and piping. The function of LPI portion of the ECCS is to flood the core with borated water immediately following a large or intermediate loss-of-coolant accident (LOCA) to prevent a significant amount of cladding failure with subsequent release of fission products into the containment. The DHR system is a high-capacity, low-head system with separation and sufficient number of components to provide two-train redundancy for the safeguards mode of operation. It also removes heat from the core for extended periods of time following a LOCA and in non-emergency conditions such as shutdown and refueling operations.

The RBS removes heat and fission products from the post-accident containment atmosphere by directing borated water spray into the containment following a LOCA. The system consists of two pumps, two spray headers, and necessary piping, valves, instrumentation, and controls. The LPI and RBS are related systems in that they both take suction from the borated water storage tank (BWST) and can also draw suction from the reactor building sump for coolant recirculation. When the water in the BWST reaches a low level during the injection mode, the

re-circulation mode is initiated by realigning the LPI/RBS pump suction from the BWST to the reactor building emergency sump. Each LPI train shares common suction piping with its corresponding RBS train.

The TS that is impacted by the licensee's request is the portion of the ECCS operating TS that pertains to the AOT for one inoperable train of LPI. Currently, the TS requires that two trains of LPI be operable with one train allowed inoperable for a specified AOT; from 24 hours for ANO to 72 hours for Crystal River-3, Davis-Besse, Oconee-1,2,3 and TMI-1. The B&W plant improved standard technical specifications (STS) have a 72-hour AOT. It is proposed that the AOT for one inoperable train of LPI be extended to seven days (168 hours). The high pressure injection (HPI) AOT is not being extended at this time. For those plants that specify an AOT for an inoperable ECCS train (LPI and HPI combined), the LPI AOT will be split out from the ECCS AOT, using the proposed seven-day AOT for LPI and retaining the current AOT for HPI. The seven-day AOT will apply when the LPI (DHR) train is the only reason for the inoperability of the HPI train.

At times, one train of RBS is impacted by LPI train maintenance because of the common suction piping. Therefore, the TS change request also includes a proposal to extend the AOT for one inoperable train of RBS to seven days (168 hours).

2.0 REGULATORY EVALUATION

Risk-informed improvements to technical specifications (TS) are intended to maintain or improve safety while reducing unnecessary burden, and to bring TS into congruence with the Commission's other risk-informed regulatory requirements, in particular the risk assessment and management requirements of 10 CFR 50.65(a)(4).

Technical specifications have taken advantage of risk technology as experience and capability have increased. Since the mid-1980's, the NRC has been reviewing and granting improvements to TS that are based, at least in part, on probabilistic risk assessment (PRA) insights. In its final policy statement on TS improvements of July 22, 1993, the Commission stated that it expects that licensees will utilize any plant specific PRA or risk survey in preparing their TS related submittals. The Commission reiterated this point when it issued the revision to 10 CFR 50.36, "Technical Specifications," in July 1995. In August 1995, the NRC adopted a final policy statement on the use of PRA methods in nuclear regulatory activities that encourage greater use of PRA to improve safety decision making and regulatory efficiency. Since that time, the industry and the NRC have been pursuing increased use of PRA in developing improvements to TS.

2.1 ADJUSTING COMPLETION TIMES and SURVEILLANCE INTERVALS

Guidance documents have been prepared to assist in requesting risk-informed allowed outage time (also called completion time) and surveillance test interval extensions (Regulatory Guide 1.177 and Standard Review Plan Chapter 16.1). These efforts (categorized as "Option 1" in the framework of the Risk Informed Regulatory Improvement Program) have resulted in risk informed amendments at numerous plants, and owners groups continued to submit topical reports to support additional applications.

2.2 RISK MANAGEMENT TECHNICAL SPECIFICATIONS

Issuance of the maintenance rule, 10 CFR 50.65, in July 1991 marked the advent of a regulation with significant implications for the evolution for TS. Prior to 50.65, TS were the primary rules governing operations, including what equipment must normally be in service, how long equipment can be out of service, compensatory actions, and surveillance testing to demonstrate equipment readiness. The goal of these TS is to provide adequate assurance of the availability and reliability of equipment needed to prevent, and if necessary mitigate, accidents and transients. The maintenance rule shares this same goal but operates at a more fundamental level with a dynamic and more comprehensive process.

3.0 TECHNICAL EVALUATION

The B&WOG conducted a study on the TS requirements of the LPI and RBS systems, and submitted a request for extending the AOT for these two systems (BAW-2295, Revision 1, October 1997) to seven days. The B&WOG submittal is referred in this report as the "B&W submittal" or "the submittal".

3.1 DETERMINISTIC EVALUATION

The deterministic evaluation consisted of each utility's review of the systems and safety functions that are impacted by the entry into the LPI/RBS train AOT. The licensee assures that all the affected DHR, LPI and RBS safety functions are identified, and quantitatively and qualitatively assessed.

The licensees determined that there are no systems, structures, or components that will change status due to the proposed changes (i.e., no additional systems, structures, or components will become significant to public health and safety due to the proposed change). No new accidents or transients will be introduced by the proposed change.

Currently, the licensees have protective measures to ensure that unanticipated compromises to the system redundancy, independence, and diversity will not occur during maintenance activities. The B&WOG indicated that these protective measures will continue after the proposed AOT has been implemented.

The impact of the proposed changes on the safety margins was also considered. Extending the AOT to 7 days for one inoperable train does not impact any assumptions or inputs in the final safety analysis report (FSAR).

In summary, the B&WOG has requested to extend the AOT for one inoperable LPI train and one inoperable RBS train to 7 days (168 hours). The review by the B&WOG included both deterministic and probabilistic assessments. Since there are no changes in the inputs or assumptions in the FSAR, and the protections to maintain redundancy and diversity will remain intact, the staff agrees with the assessments.

3.2 PROBABILISTIC EVALUATION

The staff used a three-tiered approach to evaluate the risk associated with the proposed changes. The first tier evaluates the PRA model and the impact of the change on plant operational risk. The second tier addresses the need to preclude potentially high risk configurations, should additional equipment outages occur during the AOT period. The third tier considers the licensee's configuration risk management program (CRMP); to ensure that equipment removed from service immediately prior to or during the proposed AOT will be appropriately assessed from a risk perspective.

3.2.1 PROBABILISTIC RISK ASSESSMENT

The risk measures used to assess the impact of the changes are consistent with the measures defined in Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Current Licensing Basis," 1998, and RG 1.177, "An Approach for Plant-Specific, Risk-Informed Decision Making: Technical Specifications", 1998, with only minor changes. The measures presented in the B&WOG request can be used to obtain the different measures defined in the RGs.

The risk impacts calculated are compared against the acceptability guidelines in the NRC's RGs for risk-informed and performance-based regulation. With the proposed change, the plant's CDF and LERF from internal events will remain below 1.0E-4 and 1.0E-5, respectively. The increases in CDF and LERF will, respectively, remain below 1.0E-5 and 1.0E-6 for ANO-1, CR-3, DB-1, and Oconee; the measures specific to the Single AOT risks range from 3.4E-7 to 1.5E-6 at the upper end, being slightly above the RG 1.177 incremental conditional core damage probability (ICCDP) guideline value of 5E-7. These ICCDP values are acceptable due to the compensatory measures described below (essentially when ICCDP is substantially greater than 5.0E-7, specific compensatory measures are implemented in an effort to reduce these risk impacts).

The compensatory measures defined as part of the proposed LPI and RBS AOT changes are applicable, and will reduce the risk impact during the AOT to more acceptable levels. The compensatory measures that lower the risk impacts are:

- avoiding simultaneous outages of additional risk-significant components during the AOT of the LPI and RBS system trains. The components whose simultaneous outages are to be avoided, in addition to the current TS requirements, are both trains of the emergency feedwater (EFW), high pressure injection (HPI), reactor building cooling unit (RBCU), and their power supplies.

- defining specific criteria for scheduling only those preventive maintenance procedures which can be completed within the AOT, such that the chance for a forced outage due to failure to complete the maintenance is negligible.

- assuring that the frequency of entry into the AOT, and consequently the average maintenance duration per year, remains within that assumed in the submittal. In some cases, a reduction of the number of entries in to the AOT was assumed.

– taking measures to ensure that while maintaining the LPI or RBS systems, both trains are not made unavailable unless it is necessary. In many situations, maintenance in one of the trains can be conducted without affecting the other train.

At this time, no compensatory measures were proposed by CR-3 for the Decay Heat Closed Cycle Cooling System and the Decay Heat Seawater System.

As part of the implementation plan for the AOT changes, defining specific procedures to assure that the compensatory measures noted above are implemented is applicable.

The proposed change is expected to have a beneficial impact on the risk during the shutdown period, no impact during the transition period, and a small impact on the risk during power operation when the compensatory measures are implemented. Without the compensatory measures, for some plants, the proposed AOT measures were not demonstrated to be within guideline values (AOT relaxations for two systems (four for CR-3) are involved). It is noted that there are some conservative assumptions in the modeling and analysis, and that these measures may be demonstrated to be smaller when the conservative assumptions are removed.

3.2.2 PRA QUALITY

All of the plant-specific PRAs used by the B&WOG utilities to quantify the incremental risk associated with the proposed AOT extension have received extensive internal peer review. In addition, several of the B&WOG PRAs have a long-standing and evolving history of development and application in plant operations and licensing.

The B&WOG Risk-Based Applications Working Group (RBAWG) maintains communications between utility PRA experts to facilitate comparison and continuous improvement of the utilities' PRA methods.

To ensure that specific PRAs are adequate to support the requested TS changes, the staff will require each licensee to furnish, in its submittal, information on PRA quality, including:

- Verification that the PRA reflects the as-built, as-operated plant.
- Updates of the PRA since the last review cycle, including corrections of weaknesses identified by past reviews.
- Details of their peer review process, a summary of the peer review findings, and a discussion of this independence of internal reviews/reviewers.
- Description of PRA quality assurance methods.
- Results of reviews of pertinent accident sequences and cut sets for irregularities (with respect to this application).

3.2.3 CONCLUSIONS REGARDING B&WOG LICENSEES PROBABILISTIC RISK ASSESSMENTS USED TO SUPPORT THE PROPOSED AMENDMENTS

Based on the three-tiered approach, the staff finds or requires the following:

a. The proposed LPI and RBS AOT relaxations to seven days result in Single AOT Risks slightly in excess of the staff's guideline values for incremental conditional core damage probability (ICCDP) except for TMI-1, where the staff judges that the excess is substantial.

b. The licensees' submittals shall discuss implementation of procedures that prohibit entry into extended LPI and/or RBS AOTs for scheduled maintenance purposes if external event conditions or warnings are in effect. The licensees' procedures will also include compensatory measures and normal plant practices that help avoid potentially high risk configurations during the proposed extended LPI and RBS AOTs.

c. The licensees' submittals shall contain Tier 2 information describing the avoidance of simultaneous outages of additional risk-significant components during the AOTs of the LPI and RBS system trains. The submittals shall also describe the risk-informed configuration risk management program (CRMP) to assess the risk associated with the removal of equipment from service (Tier 3) during the extended LPI and RBS AOTs. This program provides the necessary assurances that appropriate assessments of plant risk configurations are sufficient to support the proposed AOT extension requests for LPI and RBS.

d. The licensees' submittals shall include marked up LPI and RBS technical specifications.

e. The licensees' submittals shall include PRA quality information [(Section 3 above)]. The NRC staff concludes that the LPI and RBS AOT extensions will result in acceptable increases in plant risk, except for TMI-1, (where the ICCDP is 7 times the RG1.177 ICCDP acceptance guideline value) and the annual risk for CR-3 (artificially high due to the assumption and request for seven day AOTs for Decay Heat Closed Cycle Cooling and Decay Heat Seawater Systems). The licensees have/shall have processes for scheduling and controlling maintenance activities into which plant risk is incorporated; this compensates for the small risk increases and uncertainties associated with the proposed LPI and RBS AOT changes. The staff finds, therefore, that if b., c., d., and e., above are provided by a licensee, the PRA insights provided support the proposed LPI and RBS AOT extensions for all the plants with the exception, at this time, of TMI-1. Additionally, AOT extensions for the Decay Heat Closed Cycle Cooling and Decay Heat Seawater Systems are acceptable at this time.

3.3 CONFIGURATION RISK MANAGEMENT PROGRAM

The licensees shall propose, in a new TS, or other administratively controlled documents that the staff finds acceptable, a "Configuration Risk Management Program." The Configuration Risk Management Program (CRMP) provides a proceduralized risk-informed assessment to

manage the risk associated with equipment inoperability. The programs apply to technical specification structures, systems, and components for which a risk-informed allowed outage time has been granted. The term "completion time" is synonymous with "allowed outage time". The proposed programs include the following elements:

a. Provisions for the control and implementation of a Level 1, at power, internal events, PRA-informed methodology. The assessment shall be capable of evaluating the applicable plant configuration.

b. Provisions for performing an assessment prior to entering the LCO Condition for preplanned activities.

c. Provisions for performing an assessment after entering the LCO Condition for unplanned entry into the LCO Condition.

d. Provisions for assessing the need for additional actions after the discovery of additional equipment out-of-service conditions while in the LCO Condition.

e. Provisions for considering, qualitatively or quantitatively, other applicable risk significant contributors such as Level 2 issues and external events.

As stated above, the CRMPs are acceptable in that the programs provide the necessary assurances that appropriate assessments of plant risk configurations using software, matrices, or PRA analyses augmented by appropriate engineering judgment, are sufficient to support the proposed AOT extension requests for LPIs and RBSs.

In addition, the CRMPs are used to assess changes in core damage frequency resulting from changes in applicable plant configurations. The CRMPs use software, matrices, or if necessary, the full PRA to aid in the risk assessment of online maintenance and to evaluate the change in risk from a component failure.

The CRMP is used when a LPI and/or RBS train is intentionally taken out of service for a planned activity excluding short duration activities. In addition, the CRMP is used for unplanned maintenance or repairs of the LPI and/or RBS.

The licensee has committed/will have committed to implementation of the CRMP in accordance with Regulatory Guide 1.177 and as described below.

The Configuration Risk Management Program (CRMP) includes the following key elements:

Key Element 1: Implementation of CRMP

The intent of the CRMP is to implement (a)(4) of the Maintenance Rule (10 CFR 50.65) with respect to on-line maintenance for risk-informed technical specifications, with the following additions and clarifications:

a. The scope of the structures, systems and components (SSCs) to be included in the CRMP will be those SSCs modeled in the licensee's plant PRA in addition to those

SSCs considered risk significant in accordance with the plant Maintenance Rule Program that are not modeled in the PRA.

b. The CRMP is PRA-informed, and may be in the form of either a matrix, an on-line assessment, or a direct PRA assessment.

c. CRMP will be invoked as follows for:

Risk-Informed Inoperability: A risk assessment shall be performed prior to entering the LCO Condition for preplanned activities. For unplanned entry into the LCO Condition, a risk assessment will be performed in accordance with plant procedures, utilizing the CRMP and associated maintenance configuration matrix, augmented by appropriate engineering judgement.

Additional SSC Inoperability and/or Loss of Functionality: When in the risk-informed Completion Time, if an additional SSC within the scope of the CRMP becomes inoperable/non-functional, a risk assessment shall be performed in accordance with the CRMP and plant procedures.

Tier 2 commitments apply for planned maintenance only, but will be evaluated as part of the Tier 3 assessment for unplanned occurrences.

Key Element 2: Control and Use of the CRMP

a. Plant modifications and procedure changes will be monitored, assessed, and dispositioned as part of the normal PRA update process:

- Evaluation of changes in plant configuration or PRA model features can be dispositioned by implementing PRA model changes or by the qualitative assessment of the impact of the changes on the CRMP. This qualitative assessment recognizes that changes to the PRA take time to implement and that changes can be effectively compensated for without compromising the ability to make sound engineering judgments.

- Limitations of the CRMP are identified and understood for each specific Completion Time extension.

b. Procedures exist for the control and application of CRMP, including description of the process when outside the scope of CRMP.

Key Element 3: Level 1 Risk-Informed Assessment

The CRMP is based on a Level 1, at power, internal events PRA model. The CRMP assessment may use any combination of quantitative and qualitative input. Quantitative assessments can include reference to software, pre-existing calculations, or new PRA analyses.

a. Quantitative assessments are not always necessary for sound decision making.

b. When quantitative assessments are not necessary for sound decision making, or are beyond the scope of the PRA model, qualitative assessments will be performed.

c. Qualitative assessments will consider applicable, existing insights from quantitative assessments previously performed.

Key Element 4: Level 2 Issues/External Events

External events and Level 2 issues are treated qualitatively and/or quantitatively.

The staff expects the licensee to implement these TS changes or other administratively controlled documentation in accordance with the three-tiered approach described above. The AOT extension will allow efficient scheduling of online maintenance within the boundaries established by implementing the maintenance rule. The licensee will monitor LPI and RBS performance in relation to the maintenance rule performance criteria. Therefore, application of implementation and monitoring strategies will help to ensure that extension of the TS AOTs does not degrade operational safety over time, and that the risk incurred when an LPI and/or RBS train is taken out of service is acceptable.

4.0 CONCLUSION

The B&WOG submitted Topical Report BAW-2295, Rev. 1 in which the owners group requested an extension of the AOT for LPI and RBS to seven days for ANO, Crystal River 3, Davis-Besse, Oconee 1,2,3 and TMI-1. Additionally, a request was made to extend the AOT for Crystal River-3 Decay Heat Closed Cycle Cooling and Decay Heat Seawater Systems to seven days. The submittal supported the request both deterministically and probabilistically.

Based on the deterministic review the staff concluded that the AOT extension does not introduce any changes to the systems, structures, or components. Additionally, there are no new transients as a result of the proposed AOT extensions. Therefore, deterministically the AOT extension is acceptable.

The staff used a three-tiered approach to evaluate the risk associated with the proposed license amendment. Based on the three-tiered approach, we find that: (1) for all but one plant, the proposed TS AOT modifications (relaxation to 7 days for LPI and RBS) have a small quantitative impact on plant risk; (2) the licensees have/will have in place controls on equipment to reduce the likelihood of risk significant plant configurations during the proposed AOT; and (3) the licensees have/will have implemented a risk-informed plant CRMP to assess the risk associated with the removal of equipment from service during the AOT. In addition, the staff will require the licensees to incorporate the CRMP description into their technical specifications or other administratively controlled documents that the staff finds acceptable.

Therefore, we conclude that the plant PRA analyses support the proposed AOT extensions from 1 and 3 to 7 days for all the B&WOG plants (Arkansas Nuclear One Unit 1 (ANO-1), Crystal River Unit 3 (CR-3), Davis Besse Unit 1 (DB-1), Oconee Nuclear Power Station (Oconee 1, 2, and 3), except, at this time, Three Mile Island, Unit 1. Additionally, the requested AOT extensions to 7 days for the Decay Heat Closed Cycle Cooling and Decay Heat Seawater Systems for Crystal River, Unit 3 are supportable at this time. Final approval is contingent upon submittal of an acceptable CRMP, plant-specific Tier 2 information, plant-specific

documentation on PRA quality, marked up TS, and information on how external events would impact the analysis.