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SUBJECT: **TRANSMITTAL OF BWROG REPORTS, NEDC-0000-0034-6043, "TECHNICAL JUSTIFICATION TO SUPPORT RISK-INFORMED COMPLETION TIME EXTENSIONS FOR THE STANDBY GAS TREATMENT (SGT) SYSTEM AND MAIN CONTROL ROOM ENVIRONMENTAL CONTROL (MCREC) SYSTEM FOR BWR PLANTS"**

We are transmitting the subject report in connection with the Risk Informed Technical Specification Task Force (RITSTF) Initiative 4a. The BWR Owners' Group (BWROG) has developed this report as a part of the RITSTF and has coordinated its submittal with the Nuclear Energy Institute.

This document provides the results of the application of a risk-informed analysis to identify improvements in completion time (CT) specified for Standby Gas Treatment (SGT) System and Main Control Room Environmental Control (MCREC) System in BWR Technical Specifications (TS). The analysis provides bounding risk assessments of the impact of adopting the proposed CT change.

The analysis concludes that plant safety and operational improvements can be achieved by extending the CT for a single subsystem in the SGT System and MCREC System from the current seven days to 30 days or 15 days, depending on the plant's core damage frequency, in order to perform on-line maintenance, repair, or testing. The proposed change is supported by the low risk associated with the extended CT versus the greater risk associated with shutting down the plant to perform maintenance or repair. The analysis is applicable for all US BWR products (BWR-2 through 6).

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If you have any questions regarding this report, please contact Fred Emerson (GE) at (910) 675-5615.

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Technical Justification to Support Risk-Informed Completion Time Extensions for the Standby Gas Treatment (SGT) System and Main Control Room Environmental Control (MCREC) System for BWR Plants

BWR Owners' Group
Risk-Informed Technical Specifications Committee

IMPORTANT NOTICE REGARDING CONTENTS OF THIS REPORT

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ABSTRACT

This document provides the results of the application of a risk-informed analysis to identify improvements in completion time (CT) specified for Standby Gas Treatment (SGT) System and Main Control Room Environmental Control (MCREC) System in BWR Technical Specifications (TS). The analysis provides bounding risk assessments of the impact of adopting the proposed CT change.

The analysis concludes that plant safety and operational improvements can be achieved by extending the CT for a single subsystem in the SGT System and MCREC System from the current seven days to 30 days or 15 days, depending on the plant's core damage frequency, in order to perform on-line maintenance, repair, or testing. The proposed change is supported by the low risk associated with the extended CT versus the greater risk associated with shutting down the plant to perform maintenance or repair.

The analysis is applicable for all the BWR products (BWR-2 through 6).

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ACRONYMS

BWR	Boiling Water Reactor
BWROG	Boiling Water Reactor Owners' Group
CCDP	Conditional Core Damage Probability
CDF	Core Damage Frequency
CE	Combustion Engineering
CEOG	Combustion Engineering Owners' Group
CRFA	Control Room Fresh Air
CT	Completion Time
GE	General Electric Company
ICCDP	Incremental Conditional Core Damage Probability
ICLERP	Incremental Conditional Large Early Release Probability
ICRRP	Incremental Conditional Radiation Release Probability
STS	Standard Technical Specifications
LCO	Limiting Condition of Operation
LER	Large Early Release
LERF	Large Early Release Frequency
LERP	Large Early Release Probability
LOCA	Loss-of-Coolant Accident
MCREC	Main Control Room Environmental Control
NRC	Nuclear Regulatory Commission
PSA	Probabilistic Safety Analysis
PRA	Probabilistic Risk Assessment
RG	Regulatory Guide
RRF	Radiation Release Frequency
SGT	Standby Gas Treatment
STS	Standard Technical Specifications
TS	Technical Specifications
WOG	Westinghouse Owners' Group

EXECUTIVE SUMMARY

This report provides the technical analysis to support extending the Technical Specifications (TS) completion time (CT) from seven days to 30 days or 15 days, depending on the plant's core damage frequency (CDF), for the inoperability of a single subsystem in the Standby Gas Treatment (SGT) System and the Main Control Room Environmental Control (MCREC) System. Selection of these TS improvements was based on a survey of BWR owners, which identified specific risk-informed TS change initiatives that have a high probability of enhancing plant safety and providing needed flexibility in the performance of corrective maintenance during power operations. This TS change will allow allocation of time for on-line maintenance, repair, and testing of the SGT and MCREC Systems.

The systems considered in this analysis have no direct contribution to core damage or large early release. Because of this, the guidance for making risk-informed TS changes provided in Regulatory Guide (RG) 1.174 and RG 1.177 (Reference 1 and 2) was extended in this analysis to encompass TS changes involving systems that mitigate the consequences from radiation release other than large early release. For this purpose, appropriate risk measures (similar to the changes in large early release frequency (ΔLERF) and incremental conditional large early release probability (ICLERP)) and associated acceptance criteria were introduced for systems whose function is to mitigate the consequences from radiation release other than large early release. The Westinghouse Owners' Group (WOG) used a similar approach in the risk-informed analysis (Reference 3) to modify TS actions relating to a complete loss of function (loss of both subsystems) in systems similar to the SGT and MCREC Systems. The NRC has approved this analysis for the Combustion Engineering (CE) plants (Reference 4). In addition, the BWR Owners' Group (BWROG) is preparing a similar analysis (Reference 5) for BWR plants involving loss of complete function for the SGT System, MCREC System, and two other systems for submittal to the NRC.

The change in CT for an inoperable SGT or MCREC subsystem is risk-informed and is in conformance with RG 1.174 and RG 1.177. Risk assessments performed to support these modifications are based on a bounding analysis and are applicable to the participating BWRs listed in Table A-1. Two options are provided in the analysis based on the individual plant's CDF. For plants having a CDF ≤ 2.5E-05/year, the proposed CT is changed from seven days to 30 days for an inoperable SGT or MCREC subsystem. For plants having a CDF ≤ 1.0E-04/year, the proposed CT is changed from seven days to 15 days. Furthermore, risks associated with the implementation of these TS changes will be managed in accordance with paragraph a(4) of 10 CFR 50.65 (Maintenance Rule).

The benefit derived from these changes provides needed flexibility in the performance of corrective and preventive maintenance of these systems during power operation. These

actions will avert the costs and risks associated with plant shutdowns and ensure that the public health and safety is preserved.

1.0 INTRODUCTION/BACKGROUND

During 1999, the BWR Owners' Group (BWROG) formed a committee to identify risk-informed Technical Specifications (TS) improvements. This activity was part of a NRC and Industry Joint Owners' Group program to define and implement risk-informed TS changes. Seven initiatives were identified as potential candidates for risk-informed TS improvements.

A survey of BWR owners was conducted in early 2004 to identify the specific risk-informed TS change initiatives that have a high probability of enhancing plant safety and providing needed flexibility in the performance of corrective and preventive maintenance during power operations. From this survey, two of the selected candidate improvements involve TS that specify a CT for loss of a single subsystem. The systems are the Standby Gas Treatment (SGT) System and the Main Control Room Environmental Control (MCREC) System. BWR Owners have also deemed these systems to have a higher than average likelihood of generating the need for Notices of Enforcement discretions. Both of these systems have no direct contribution to either core damage or large early release. This report provides the technical justification for extending the CT for a single inoperable subsystem in the SGT and MCREC Systems. Two options are provided in the analysis based on the individual plant's core damage frequency (CDF). For plants having a CDF ≤ 2.5E-05/year (Option 1), the proposed CT is changed from seven days to 30 days for an inoperable SGT or MCREC subsystem. For plants having a CDF ≤ 1.0E-04/year (Option 2), the proposed CT is changed from seven days to 15 days. The analysis for the remaining TS change candidates selected from the 2004 BWROG survey are included in a separate topical report (Reference 5).

The intent of the proposed modifications to the plant TS is to enhance overall plant safety by:

- Avoiding unnecessary unscheduled plant shutdowns.
- Minimizing plant transitions and associated transition and realignment risks.
- Providing for increased flexibility in scheduling and performing maintenance and surveillance activities.

Risk assessments performed within the scope of this analysis are consistent with the general guidance of Regulatory Guide (RG) 1.174 and RG 1.177. The risk-informed assessments of the proposed TS modifications are established based on bounding assumptions. Alternate risk measures (similar to incremental conditional large early release probability (ICLERP) and change in large early release frequency (ΔLERF)) were established for the two systems since they do not have a direct impact on either CDF or large early release frequency (LERF). These risk measures include (1) the incremental conditional radiation release (above system design limits) probability (ICRRP) and

(2) the change in the radiation release (above system design limits) frequency (ΔRRF). The acceptance criteria for ICLERP and ΔLERF were used for ICRRP and ΔRRF, respectively. This approach is also being used in the BWROG evaluation, currently in process, for the SGT System, MCREC System, and two other systems to support modification to TS conditions related to loss of function that lead to exigent plant shutdown (Reference 5). In addition, the Westinghouse Owners' Group (WOG) used a similar approach in the analysis for the Combustion Engineering plants of TS conditions leading to exigent plant shutdown conditions for similar systems considered in this report (Reference 3). The changes have been approved by the NRC for Combustion Engineering (CE) plants (Reference 4).

2.0 SCOPE OF PROPOSED CHANGES TO TECHNICAL SPECIFICATIONS

This report justifies the extension of the CT for a single inoperable SGT and MCREC subsystem. It is recommended that the current seven days CT be extended to 30 days for plants having a CDF ≤ 2.5E-05/year and 15 days for plants having a CDF ≤ 1.0E-04/year. The proposed changes are summarized in Table 2-1. The Standard Technical Specifications (STS) for BWR 4 and 6 plants (Reference 6 and 7) were used for convenience. However, the technical evaluation supports these changes for all BWRs with similar TS numbers and system functions. The BWR plants participating in this analysis are listed in Appendix A.

The benefit from these proposed CT extensions is to provide needed flexibility in the performance of corrective and preventive maintenance of these systems during power operation. These actions will avert the costs and risks associated with plant shutdowns while ensuring that the public health and safety is preserved.

The methodology for assessing the risk impact of the proposed modifications is described in Section 3. Section 4 provides the results of the risk-informed evaluation for the TS under consideration. Section 5 provides the system evaluations for each of the proposed risk-informed TS changes including qualitative considerations.

Table 2-1 Proposed Modifications to Technical Specifications

Option 1 – Plants Having CDF ≤ 2.5E-05/Year

System (1)	TS LCO(1)	Inoperable Condition	Current Action Completion Time to Restore One Subsystem	Proposed Time to Restore One Subsystem
Standby Gas Treatment (SGT) System	BWR 4: 3.6.4.3 BWR 6: 3.6.4.3	One SGT subsystem inoperable	7 days	30 days
Main Control Room Environmental Control (MCREC) System (2)	BWR 4: 3.7.4 BWR 6: 3.7.3	One MCREC subsystem inoperable	7 days	30 days

Option 2 - Plants Having CDF ≤ 1.0E-04/Year

System (1)	TS LCO(1)	Inoperable Condition	Current Action Completion Time to Restore One Subsystem	Proposed Time to Restore One Subsystem
Standby Gas Treatment (SGT) System	BWR 4: 3.6.4.3 BWR 6: 3.6.4.3	One SGT subsystem inoperable	7 days	15 days
Main Control Room Environmental Control (MCREC) System (2)	BWR 4: 3.7.4 BWR 6: 3.7.3	One MCREC subsystem inoperable	7 days	15 days

Table 2-1 Notes

(1) The Standard Technical Specifications (STS) system names are used for convenience. The analysis provided in this document supports changes for all BWRs plants that have similar names and design functions.

(2) For the BWR 6 STS, this system is called the Control Room Fresh Air (CRFA) System.

3.0 RISK ASSESSMENT APPROACH

This section presents the methodology for a risk-informed assessment of CT when a subsystem, which supports a design basis, is unavailable. The general methods used to support the risk-informed evaluations are based on RG 1.174 and RG 1.177.

The risk impact of the proposed TS changes was assessed following the three-tiered approach, recommended in RG 1.177, for evaluating proposed extensions in current CTs:

a) The first tier involves the assessment of the change in plant risk due to the proposed TS change. Such risk change is expressed (1) by the change in the average yearly core damage frequency (ΔCDF) and the ΔLERF and (2) by the incremental conditional core damage probability (ICCDP) and the ICLERP. The assessed ΔCDF and ΔLERF values are compared to acceptance guidelines, consistent with the Commission's Safety Goal Policy Statement as documented in RG 1.174, so that the plant's average baseline risk is maintained within a minimal range. The assessed ICCDP and ICLERP values are compared to acceptance guidelines provided in RG 1.177, which aim at ensuring that the plant risk does not increase unacceptably during the period the equipment is inoperable. Since the TS systems considered in this analysis do not directly impact CDF and LERF, appropriate risk measures (similar to ΔLERF and ICLERP) and acceptance criteria were introduced for systems whose function is to mitigate the consequences from radiation release other than large early release. A more detailed discussion of these risk matrices is provided in Section 3.1.

b) The second tier involves the identification of potentially high-risk configurations that could exist if equipment, in addition to that associated with the change, were to be declared inoperable simultaneously, or other risk-significant operational factors such as concurrent equipment testing were also involved. The objective is to ensure that appropriate restrictions are in place to avoid any potential high-risk configurations.

c) The third tier involves the establishment of an overall configuration risk management program (CRMP) to ensure that potentially risk-significant configurations resulting from maintenance and other operational activities are identified. The objective of the CRMP is to manage configuration-specific risk by appropriate scheduling of plant activities and/or appropriate compensatory measures.

The three tier approach and associated requirements discussed in Section 3 provide assurance that inoperable conditions have been analyzed and potential high risk configurations identified and controlled without the need for additional TS requirements. Compensating provisions, which are intended to support defense-in-depth considerations, will be incorporated into plant procedures, if deemed appropriate.

3.1 Risk Impact Measures and Acceptance Criteria

The guidance provided in RG 1.177 addresses only systems/components contributing to CDF and/or LERF. However, for the systems considered in this analysis, which have no direct impact on CDF and LERF, the philosophy of the three-tiered approach was extended to encompass TS changes involving systems that mitigate the consequences from radiation release other than large early release. For this purpose, appropriate risk measures (similar to ΔLERF and ICLERP) and acceptance criteria were introduced for systems whose function is to mitigate the consequences from radiation release other than large early release.

The risk impact measures adopted for the analysis of the SGT and MCREC Systems are: (1) the incremental conditional radiation release (above system design limits) probability, ICRRP, and (2) the change in the radiation release (above system design limits) frequency, ΔRRF. A similar expression as the ones used for ICCDP and ICLERP can be used for ICRRP by substituting the appropriate measure of risk, i.e., radiation release (above system design limits) frequency (RRF) instead of CDF:

$$ICRRP = \Delta R_{RRF} \times d = (R_{1,RRF} - R_{0,RRF}) \times d$$

where:

ΔR_{RRF} = the conditional risk increase, in terms of RRF, caused by the specified subsystem's unavailability,

d = the proposed extension of the time interval during which the plant is allowed to keep operating at power given the condition,

$R_{1,RRF}$ = the plant RRF with the subsystem permanently unavailable,

$R_{0,RRF}$ = the plant RRF without the proposed time extension.

The change in RRF (i.e., ΔRRF) for each subsystem is obtained by multiplying the respective ICRRP value by the yearly frequency, f, the frequency at which the subsystem is expected to be declared inoperable:

$$\Delta RRF = ICRRP \times f$$

The assessed ICRRP and ΔRRF values are compared to acceptance criteria similar to those included in RG 1.177 and RG 1.174 for core damage and large early release risks, respectively. The results of the risk assessments, in terms of the various risk measures, and their comparison to acceptance criteria are discussed in Section 4.

The acceptance criteria for radiation release risks other than large early release risks are defined for use in the evaluation of the SGT and MCREC Systems. It is conservatively assumed that a ΔRRF value smaller than 1.0 E-7 per year (i.e., the same as for a large release) is considered very small and, therefore, acceptable. In addition, in order to ensure that the acceptance criterion for ΔRRF will be met, the ICRRP value for each entry is required to be smaller than 5.0E-7 (i.e., the same value used in the criterion for ICCDP). It should be noted that the conservative acceptance criteria for radiation release risks, other than large early release risks, are introduced for the purposes of this evaluation and should not be generalized or interpreted for other risk-informed applications.

3.2 Identification of Potentially High Risk Configurations

The second tier of the three-tiered approach recommended in RG 1.177 involves the identification of potentially high-risk configurations that could exist if equipment, in addition to that associated with the TS change, were to be declared inoperable simultaneously. Insights from the risk assessments, in conjunction with important assumptions made in the analysis and defense-in-depth considerations, were used to identify such configurations. If potential high-risk configurations are identified, specific restrictions to the implementation of the proposed TS changes will be given. The TS conditions included in this analysis (loss of a single subsystem) do not involve loss of the design basis function since the remaining operable subsystem can perform this function.

These restrictions, labeled "Tier 2 Restrictions," are discussed in Section 4 of this report.

3.3 Configuration Risk Management

The third tier of the three-tiered approach recommended in RG 1.177 involves the establishment of an overall CRMP to ensure that potentially risk-significant configurations resulting from maintenance and other operational activities are identified. The objective of the CRMP is to manage configuration-specific risk by appropriate scheduling of plant activities and/or appropriate compensatory measures. This objective is met by licensee programs, which comply with the Maintenance Rule 10 CFR 50.65 (a)(4) requirement to assess and manage risk resulting from maintenance and other operational activities. These programs can support licensee decision-making regarding the appropriate actions to control risk whenever a risk-informed TS is entered.

4.0 RISK ASSESSMENT

The risk assessment approach, documented in Section 3, was implemented to the specific TS listed in Table 2-1. The following are the results of the risk assessments.

The assessed risk impacts for systems, which contribute to non-LER, are summarized in Table 4-1. The analysis uses conservative values in estimating the probability and frequency values given in Table 4-1 for an inoperable SGT subsystem and MCREC subsystem. The analysis values apply to both subsystems. There are no subsystem unique analysis values.

Two options are provided in Table 4-1 based on the individual plant's CDF. For plants having a CDF ≤ 2.5E-05/year, the proposed CT is changed from seven days to 30 days for an inoperable SGT or MCREC subsystem. For plants having a CDF ≤ 1.0E-04/year, the proposed CT is changed from seven days to 15 days.

The risk impact, summarized in Table 4-1, are given in terms of radiation release frequency change (ΔRRF) for each of the proposed TS changes related to systems and components that mitigate the consequences from radiation release (non-LER). Availability of such equipment is typically required to meet design basis dose limits.

The first column for each option lists the systems for which a TS change is proposed. The second column for each option lists the inoperable condition. The third column for each option lists the new proposed CT to restore the system's function. The fourth column for each option is the conditional probability of the second subsystem failing while the other subsystem is inoperable. The fifth column for each option is the conditional radiation release (non-LER) risk increase, ΔR_{RRF}, caused by the system's loss of function (conservatively assumed to be challenged with a 100% probability during a core damage event). The sixth column for each option lists the ICRRP values for continued plant operation at power for the entire proposed CT given loss of the system's function. The ICRRP values are obtained by multiplying the proposed CT value (column 3) by ΔR_{RRF} (column 5). The last two columns for each option list the assessed average expected RRF changes, ΔRRF, associated with the proposed CT extensions, for two different loss of function frequencies (i.e., a frequency of once every 18 months and once per year). This corresponds to one maintenance or repair event during an 18 months or one year refueling cycle. These values are consistent with the frequency values from a plant study of similar subsystems. The ΔRRF values are obtained by multiplying the corresponding ICRRP value by the average frequency of loss of subsystem (i.e., by 1/1.5 and 1, respectively).

The design basis function of the system is maintained during the CT as long as the other redundant subsystem remains operable. Given a failure of the second subsystem, the system function is lost. For purposes of this analysis, the plant's CDF was conservatively assumed as the challenge frequency for loss of the system function or conditional radiation release risk increase, ΔR_{RRF}. This is considered conservative for

BWR plants since not all core damage events lead to a significant release from the containment that challenge the systems considered in this analysis. The conditional radiation release increase (ΔR_{RRF}) is calculated as the product of the conditional probability of the second subsystem failure during the CT (column 4) times the CDF. A conservative value of 0.05 was assumed for Option 1 for the conditional probability of a second subsystem becoming inoperable. This failure probability value is considered conservative based on its relatively high subsystem failure rate of 7E-05/hr (approximately 1 failure in every 19 months). This failure rate is consistent with other subsystems of similar complexity. Applying the same failure rate for Option 2, the conditional probability of a second subsystem becoming inoperable during the proposed Option 2 CT is 0.025.

A conservative CDF value of 2.5E-05/year was also assumed for Option 1. The CDF of 2.5E-05/year is considered conservative since the CDF for a majority of BWR plants is significantly less that this value. In fact, the CDF for the majority of BWR plants is less than 5.0E-06/year. If an individual plant cannot justify a CDF of 2.5E-05/year, a second option is provided. Option 2 assumes a bounding CDF value of 1.0E-04/year, which is expected to bound all remaining BWR plants.

The assessed ICRRP values (sixth column) for both options are within the acceptance guidelines for radiation release risks (< 5.0E-07). The analyses for a loss of subsystem event (a frequency of once every 18 months and once per year) are also within acceptance guidelines for ΔRRF/year (1.0E-07/yr) for both options. Such acceptance guidelines are discussed in Section 3.1 where conservative acceptance criteria for radiation release risks, other than large early release risks, are defined in analogy to the criteria documented in RG 1.174 and RG 1.177 for CDF and LERF (i.e., 1.0E-7 per year for ΔRRF and 5.0E-7 for ICRRP). All the proposed changes meet the acceptance criteria. Additional sensitivity analyses were not necessary for systems that mitigate the consequences from radiation release (non-LER) due to the conservative assumptions used in the analysis in conjunction with the conservative interpretation of the risks associated with such systems and components. It should be noted that only internal events are considered in estimating a subsystem's challenge frequency. However, the risk assessment results would not be significantly different to impact any conclusions had external events been considered. The primary reason for this is the use of conservative values for the subsystem's challenge frequency. The total internal events CDF is used for an estimate of the challenge frequency. This is conservative since not all core damage events lead to releases. In addition, the challenge frequency estimate (CDF) of 2.5E-05/year used for Option 1 is a factor of 2 higher than the CDF calculated in most BWR Probabilistic Safety Analyses (PSAs). A survey of BWR PSAs indicates the calculated CDF is less than or equal to 1.0E-05/year for 75% of the 28 plants reporting. The CDF used for Option 2 (1.0E-04/year) is even more conservative than the Option 1 CDF and is a bounding CDF for all BWR plants. Based on these conservative assumptions and values used in the analysis, the results can be expected to apply to all initiating events, including external events.

Table 4-1

Radiation Release (Non-LER) Risk Impact Results

Option 1 – Plants Having CDF ≤ 2.5E-05/Year

System	Inoperable Condition	Proposed Completion Time (CT) (Days)	Conditional Prob of Second Subsystem Failure	Conditional Radiation Release Risk Increase (ΔR_{RRF}) (per year)	ICRRP (2)	ΔRRF/yr (3) (f = 1 per 18 months)	ΔRRF/yr (3) (f = 1 per year)
Standby Gas Treatment (SGT) System	One SGT subsystem inoperable	30	5.0E-02	1.3E-06	1.1E-07	7.3E-08	1.1E-07
Main Control Room Environmental Control (MCREC) System (1)	One MCREC subsystem inoperable	30	5.0E-02	1.3E-06	1.1E-07	7.3E-08	1.1E-07

Option 2 - Plants Having CDF ≤ 1.0E-04/Year

System	Inoperable Condition	Proposed Completion Time (CT) (Days)	Conditional Prob of Second Subsystem Failure	Conditional Radiation Release Risk Increase (ΔR_{RRF}) (per year)	ICRRP (2)	ΔRRF/yr (3) (f = 1 per 18 months)	ΔRRF/yr (3) (f = 1 per year)
Standby Gas Treatment (SGT) System	One SGT subsystem inoperable	15	2.5E-02	2.5E-06	1.0E-07	6.7E-08	1.0E-07
Main Control Room Environmental Control (MCREC) System (1)	One MCREC subsystem inoperable	15	2.5E-02	2.5E-06	1.0E-07	6.7E-08	1.0E-07

Table 4-1 Notes:

(1) For the BWR 6 STS, this system is called Control Room Fresh Air (CRFA) System. In addition, the same system that has a similar function at other BWR plants may be called a different name.

(2) ICRRP = Incremental Conditional Radiation Release Probability. Acceptance criterion: ICRRP < 5.0E-07.

(3) ΔRRF/year is obtained by multiplying ICRRP (Column 5) by the frequency in Column 6. Acceptance criterion: ΔRRF/yr < 1.0E-07/yr.

5.0 SYSTEM EVALUATION

This section provides a summary of the basis for change for each of the proposed risk-informed TS. The format of each of the subsequent subsections is a similar format used in the approved WOG report (Reference 3). The format is as follows:

a) Description
b) Plant Applicability (Only Modes 1, 2, and 3 are addressed in this evaluation)
c) Limiting Condition for Operation (LCO)
d) Licensing Basis for LCO
e) Condition Requiring Entry into Shutdown Action Statement
f) Proposed Modification to Shutdown Required Actions
g) Basis for Proposed Change
h) Defense-in-Depth Considerations
i) Compensating Provisions
j) Tier 2 Restrictions

The proposed changes presented in this report do not modify the existing design basis. Rather, the changes are related to risk-informed improvements to the CTs when a subsystem is inoperable. The modifications are consistent with the same basic principles established in TS for dealing with inoperable equipment. It is, therefore, concluded that the proposed changes to CTs are in compliance with current licensing regulations.

In performing the defense-in-depth assessment, it is assumed that the purpose of the TS Required Action to enter shutdown is to complete a short duration repair of the component under consideration. A more detailed discussion of defense-in-depth considerations is provided in Sections 5.1 and 5.2.

Safety margins are not reduced by implementation of the proposed changes. The proposed changes to CTs are expected to result in an overall risk reduction due to the avoidance of the transition to plant shutdown.

This section provides an integrated discussion of the risk and deterministic issues, focusing on specific TS. The design basis function of the systems considered in this analysis is maintained during the CT since a redundant subsystem is available to perform the design basis function. The CT extensions discussed in this section do not impact core damage or large early release probabilities even if the redundant subsystem fails during the CT causing loss of function. A quantitative assessment of the impact of the unavailability of these subsystems is presented in Section 3.

The recommended CT is intended to provide the operating staff additional time to resolve the subsystem inoperability while the plant remains at power. Expeditious resolution of the inoperability at power reduces the overall safety risk by avoiding the transition risks associated with plant shutdown

The basis for the current 7 day CT for BWR 4 and 6 STS was based on consideration of such factors as the availability of the operable redundant SGT subsystem (or MCREC subsystem) and the low probability of a DBA occurring during this period (Reference 6 and 7). The basis for the proposed CT used in this analysis is a risk-informed analysis, which expands on some of the same factors considered in the current TS CT basis.

5.1 Standby Gas Treatment (SGT) System (LCO 3.6.4.3 - BWR 4 and 6 STS)

Description: The SGT System consists of two fully redundant subsystems, each with its own set of ductwork, dampers, charcoal filter train, and controls. The function of the SGT System during Modes 1, 2, and 3 is to ensure that radioactive materials that leak from the primary containment into the secondary containment following a Design Basis Accident (DBA) are filtered and absorbed prior to exhausting to the environment. In addition, the SGT System maintains the reactor-building (secondary containment) atmosphere at a negative pressure. The SGT System is not designed for significant containment leakage or high steam environment.

Plant Applicability: All BWRs.

Limiting Condition for Operation (LCO): Two SGT subsystem shall be operable during Modes 1, 2, and 3.

Typical Licensing Basis for LCO: The SGT System is required by CFR 50, Appendix A, GDC 41, "Containment Atmosphere Cleanup". The design basis for the SGT System is to mitigate the consequences of a loss of coolant accident and fuel handling accidents. For all events analyzed, the SGT System is automatically initiated to reduce, via filtration and adsorption, the radioactive material released to the environment. The sizing of the SGT system equipment and components is based on the results of an infiltration analysis, as well as an exfiltration analysis of the auxiliary and enclosure building structures. The internal pressure of the SGT System boundary region is maintained at a negative pressure of 0.25 inches water gauge when the system is in operation.

Condition Requiring Entry into Shutdown Action Statement: Entry into shutdown (LCO Condition B) is required when the inoperability of one SGT subsystem exceeds the seven days CT (LCO Condition A).

Proposed Modification to Shutdown Required Actions: Option 1: For plants having a CDF ≤ 2.5E-05/year, revise the seven days CT (LCO Condition A) to restore one SGT subsystem to 30 days. Option 2: For plants having a CDF ≤ 1.0E-04/year, revise the seven days CT (LCO Condition A) to restore one SGT subsystem to 15 days.

Basis for Proposed Change: The risk-informed CT is based on the methodology described in Section 3.1. The risk-informed assessment results indicate that the proposed CT for both options for restoring the SGT subsystem will not lead to a significant increase in risk and may actually decrease risk by avoiding the risk associated with the transition to shutdown. The proposed CT for both options will not contribute to any risk increases in terms of core damage and large early release. The radiation release "Non-LER" risk impact associated with the proposed time increase was conservatively assessed in Section 4.0. Specifically, the proposed CT for both options would lead to the following "Non-LER" risk increases: (1) the probability of a "Non-LER" release during the proposed CT would increase by about 1.1E-07 for Option 1 and 1.0E-7 for Option 2; and (2) the "non-LER" frequency would increase by about 7.3E-8/year for Option 1 and 6.7E-08/year for Option 2. These increases in "Non-LER" risk, which are comparable in magnitude to what is considered acceptable for core damage and large early release risk increases, are very small. Furthermore, the proposed time extension is definitely risk beneficial when the averted core damage and large early release risks associated with avoiding plant shutdown are taken into consideration.

Defense-in-Depth Considerations: The SGT System design basis function is maintained with loss of a single SGT subsystem. The remaining redundant SGT subsystem can perform all design basis functions. The SGT System is required to ensure that the radioactive material leaking from the primary containment into the secondary containment following a DBA is filtered and absorbed prior to exhausting to the environment. Loss of the SGT System could cause site boundary doses, in the event of a DBA, to exceed the values given in the licensing basis. However, containment leakage at or near design basis levels, where the SGT would be effective, is not a significant risk contributor. For releases outside design basis levels, the SGT System would have very little effect and, therefore, would not change the overall risks calculated in Probabilistic Risk Assessments (PRAs). An extension of the CT for a single inoperable SGT subsystem is based on the low risk of system inoperability compared to the associated risks of plant shutdown.

Compensating Provisions: With one SGT subsystem inoperable, the remaining 100% capacity SGT subsystem is capable of performing the safety function. Additionally, protected system program measures will be taken, if deemed appropriate, to minimize the possibility of loss of the redundant subsystem.

Tier 2 Restrictions: None

5.2 Main Control Room Environmental Control (MCREC) System (LCO 3.7.4 - BWR 4 STS) or Control Room Fresh Air (CRFA) System (LCO 3.7.3 - BWR 6 STS)

The following evaluation applies to the MCREC System, as well as to the CRFA System.

Description: The function of MCREC System includes two independent and redundant high efficiency air filtration subsystems for emergency treatment of recirculated air or outside supply air. In addition to the safety-related standby emergency filtration function, parts of the MCREC System may operate to maintain the control room environment during normal operation. Upon receipt of the initiation signals (indicative of conditions that could result in radiation exposure to control room personnel), the MCREC System automatically switches to the isolation and pressurization mode of operation to prevent infiltration of contaminated air into the control room.

Plant Applicability: Almost all BWR have similar systems. These systems have a similar function to the MCREC System, but may be designated by a different name.

Limiting Condition for Operation (LCO): Two MCREC subsystems shall be operable during Modes 1, 2, and 3.

Typical Licensing Basis for LCO: The MCREC System is designed to maintain the control room environment for a 30 day continuous occupancy after a DBA without exceeding 5 rem whole body dose or its equivalent to any part of the body.

Condition Requiring Entry into Shutdown Action Statement: Entry into shutdown (LCO Condition C) is required when the inoperability of one MCREC subsystem exceeds the seven days CT (LCO Condition A).

Proposed Modification to Shutdown Required Actions: Option 1: For plants having a CDF ≤ 2.5E-05/year, revise the seven days CT (LCO Condition A) to restore one MCREC subsystem to 30 days. Option 2: For plants having a CDF ≤ 1.0E-04/year, revise the seven days CT (LCO Condition A) to restore one MCREC subsystem to 15 days.

Basis for Proposed Change: The risk-informed CT is based on the methodology described in Section 3.1. The risk-informed assessment results indicate that the proposed CT for both options for restoring one MCREC subsystem will not lead to a significant increase in risk and may actually decrease risk by avoiding the risk associated with the transition to shutdown. The proposed CT for both options will not contribute to any risk increases, in terms of core damage and large early release. The radiation release "Non-LER" risk impact associated with the proposed time increase was conservatively assessed in Section 4.0. Specifically, the proposed CT for both options would lead to the following "Non-LER" risk increases: (1) the probability of a "Non-LER" release during the proposed CT would increase by about 1.1E-07 for Option 1 and 1.0E-7 for Option 2; and (2) the "non-LER" frequency would increase by about 7.3E-8/year for Option1 and 6.7E-08/year for Option 2. These increases in "Non-LER" risk, which are comparable in magnitude to what is considered acceptable for core damage and large early release risk increases, are very small. Furthermore, the proposed time extension is definitely risk beneficial when the averted core damage and large early release risks associated with avoiding plant shutdown are taken into consideration.

Defense-in-Depth Considerations: The MCREC System design function is maintained with loss of a single MCREC subsystem. The remaining MCREC subsystem can perform all design basis functions. The MCREC System provides a protected environment from which operators can control the plant following an uncontrolled release of radioactivity, chemicals or toxic gas. The MCREC System is needed to protect the control room in a wide variety of circumstances. The current TS requires operability of two subsystems of MCREC System in Modes 1, 2, and 3 to support operator response to a DBA. An extension of the CT for a single inoperable MCREC subsystem is based on the low risk of system inoperability compared to the associated risks of plant shutdown.

Compensating Provisions: With one MCREC subsystem inoperable, the remaining 100% capacity MCREC subsystem is capable of performing the safety function. Additionally, protected system program measures will be taken to minimize the possibility of loss of the redundant subsystem, if deemed appropriate.

Tier 2 Restrictions: None

6.0 SUMMARY

This report justifies the extension of the CT for loss of a single SGT and MCREC subsystem. It is recommended that the current CT of seven days be changed to 30 days for plants having a CDF of ≤ 2.5E-05/year and to 15 days for plants having a CDF ≤ 1.0E-04/year based on the system's risk significance.

The proposed TS changes covered in this report are summarized in Table 2-1. These changes are risk-informed and are in conformance with RG 1.174 and RG 1.177, as appropriate. Risk assessments performed to support these modifications are based on a conservative analysis and are applicable to BWRs of participating utilities listed in Appendix A. Furthermore, risks associated with the implementation of these TS changes will be managed in accordance with paragraph a(4) of 10CFR50.65 Maintenance Rule (MR).

The benefit from these changes is that the proposed CT extensions provide needed flexibility in the performance of corrective and preventive maintenance of these components during power operation. These actions will avert the costs and risks associated with plant shutdowns and ensure that the public health and safety is preserved.

7.0 REFERENCES

1) Regulatory Guide 1.174, Rev 1, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," USNRC, November 2002.

2) Regulatory Guide 1.177, "An Approach for Plant-Specific, Risk-Informed Decisionmaking: Technical Specifications," USNRC, August 1998.

3) WCAP-16125-NP-A, Revision 0, "Justification for Risk-Informed Modifications to Selected Technical Specifications for Conditions Leading to Exigent Plant Shutdown", August 2004.

4) Letter from William D. Beckner, NRC, to Gordon Bischoff, Westinghouse Electric Company, "Safety Evaluation of WCAP-16125-NP, Rev. 0, 'Justification for Risk-Informed Modifications to Selected Technical Specifications for Conditions Leading to Exigent Plant Shutdown', TAC No. MB1257", July 9, 2004.

5) NEDC-0000-0032-9578, "Technical Justification to Support Risk-Informed Modifications to Selected Technical Specifications for Conditions Leading to Exigent Plant Shutdown for BWR Plants", March 2006.

6) NUREG-1433, Rev. 3.1, "Standard Technical Specifications, General Electric Plants, BWR /4",December 2005.

7) NUREG-1434, Rev. 3.1, "Standard Technical Specifications, General Electric Plants, BWR /6", December 2005.

Appendix A

PARTICIPATING UTILITIES

Table A-1

PARTICIPATING UTILITIES

Utility	Plant	BWR Type	Containment Type
Nuclear Management Company	Duane Arnold	4	I
AmerGen	Clinton	6	III
Progress Energy	Brunswick 1 & 2	4	I
Exelon	Dresden 2 & 3 Quad Cities 1 & 2 LaSalle 1 & 2	3 3 5	I I II
Detroit Edison	Fermi 2	4	I
Energy Northwest	Columbia Generating Station	5	II
Entergy	Pilgrim	3	I
Entergy	River Bend Grand Gulf	6 6	III III
FirstEnergy	Perry 1	6	III
AmerGen	Oyster Creek	2	I
Nebraska Public Power District	Cooper	4	I
Entergy Nuclear Northeast	FitzPatrick	4	I
Constellation energy	Nine Mile Point 1 Nine Mile Point 2	2 5	I II
Nuclear Management Company	Monticello	3	I
Exelon	Peach Bottom 2 & 3 Limerick 1 & 2	4 4	I II
PPL Corp.	Susquehanna 1 & 2	4	II
PSEG Nuclear	Hope Creek	4	I
Southern Company Nuclear	Hatch 1 & 2	4	I
Tennessee Valley Authority	Browns Ferry 2 & 3	4	I
Entergy	Vermont Yankee	4	I