ENCLOSURE 1

(TO SAFETY EVALUATION)

SAIC-90/1031

TECHNICAL EVALUATION REPORT

TECHNICAL SPECIFICATION IMPROVEMENT ANALYSIS FOR BWR ISOLATION ACTUATION INSTRUMENTATION NOT COMMON TO RPS AND ECCS

SAIC

Science Applications International Corporation

An Employee-Owned Company

Final Report, Revision 1
April 2, 1990

22 pp

Prepared for:

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Contract NRC-03-87-029
Task Order No. 60

9004100199 1A

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1.0 Introduction

In June 1989, General Electric (GE) submitted to the Nuclear Regulatory Commission (NRC) a report entitled "Technical Specification Improvement Analysis For BWR Isolation Actuation Instrumentation" (1). This GE topical report is a continuation of a series of reports previously submitted to the NRC that analyzed the effects of Technical Specification changes on the Reactor Protection System (RPS), Emergency Core Cooling System (ECCS) actuation instrumentation, and isolation actuation instrumentation common to RPS and ECCS (2,3,4,5,6,7). This GE topical report presents an analysis of the impact of increases in surveillance test intervals (STIs) and allowed out-of-service times (AOTs) on the remaining isolation instrumentation not evaluated in the previous submittals. GE's stated primary objective for revising the Technical Specifications was to minimize unnecessary testing and excessively restrictive AOTs that could potentially degrade overall plant safety.

Science Applications International Corporation (SAIC), under contract to the NRC, has reviewed the GE topical report, and the results are presented in this report. The SAIC review, using NRC guidance, has concentrated on only one selected isolation function, which was deemed to represent all others in complexity and functional dependence. The objective of this review was to determine the adequacy of the isolation model and the assumptions used to arrive at the results and conclusions. It should be noted that the SAIC review covers information presented in the GE topical report only, without attempting to reevaluate the information provided in previously submitted reports, including the methodology and related reliability data.

The GE topical report has been designated "Proprietary" in its entirety. Much of the information normally presented in a technical review document would also be considered proprietary. Therefore, this review report is divided into two parts. The main body of the report summarizes the results of the review and is non-proprietary. Relevant proprietary information is contained in a separate addendum.

2.0 Methodology

2.1 Overview of the Methodology

The methodology, for evaluating the impact of Technical Specification changes on plant safety, has been presented in previous GE reports which were reviewed by the NRC (8, 9, 10). This section presents an overview of the methodology along with applicable general comments.

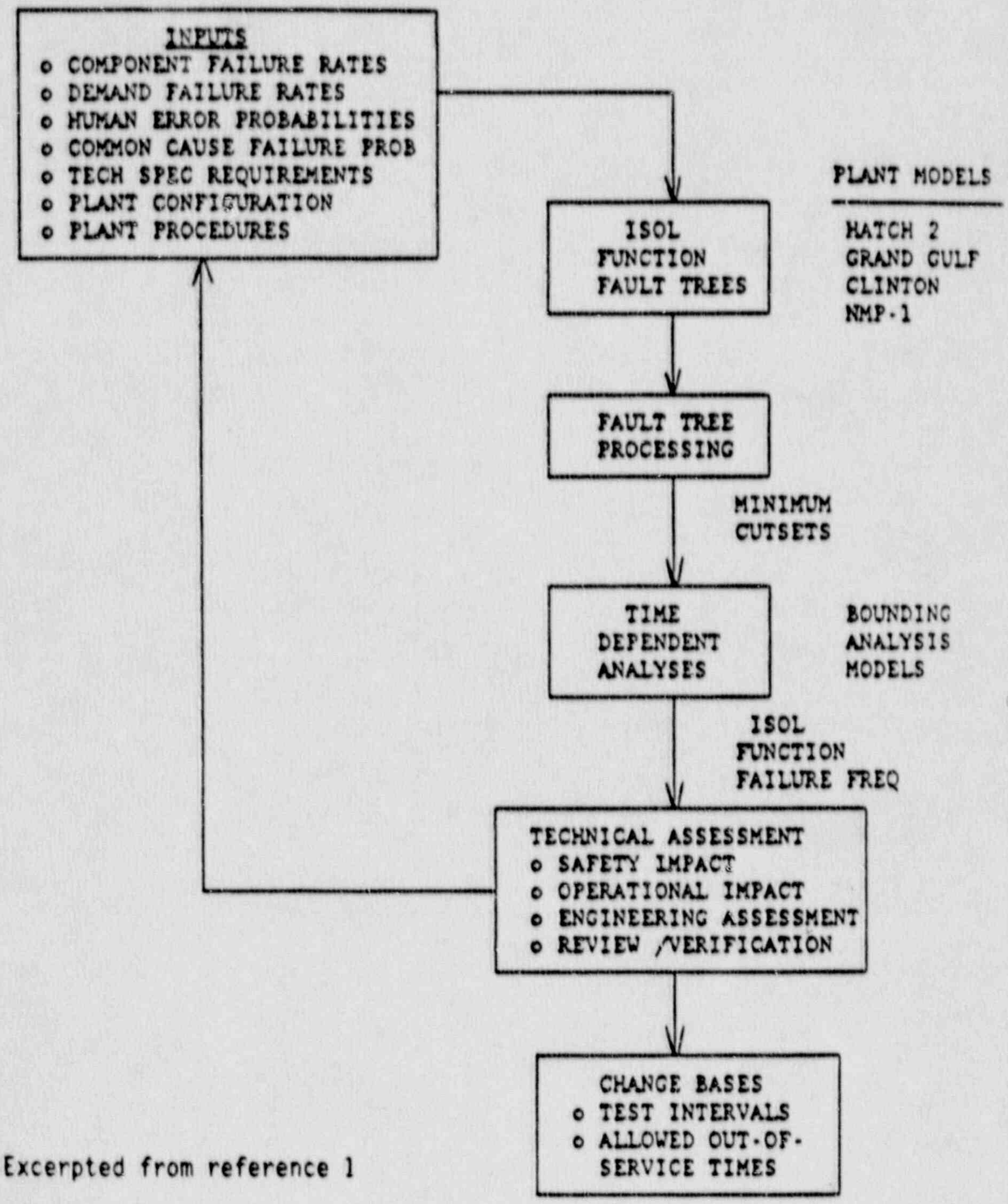
Figure 2.1 illustrates the GE general approach for assessing the impact of changes in plant Technical Specifications (1). The objective is to evaluate the impact of STI and AOT changes on plant risk in terms of a change in core melt frequency (CMF). The analysis follows the state-of-the-art techniques in probabilistic risk assessment. This requires that relevant information, such as initiating event frequency, component reliability data (including both the time-dependent and time-independent failure rates), system descriptions, success criteria, etc., be collected and defined. Based on this information, functional/system fault trees for each relevant system are generated and analyzed to evaluate the impact of the proposed Technical Specification changes.

The objective of this General Electric (GE) topical report is to evaluate the impact of Technical Specification changes on the isolation functions due to change in STIs and AOTs. The analysis encompassed all four BWR product lines, including BWR-2, BWR-3/4, BWR-5/6 (Relay), and BWR-6 (Solid State). The report focuses only on the isolation functions that are not common to the RPS or ECCS. The impact of Technical Specification changes, associated with the trip functions that are common to the RPS and ECCS instrumentation, was previously presented and reviewed by NRC (6,10). Table 2.1 provides a listing of typical isolation trip functions included in the GE report.

For each isolation trip function, fault trees were developed to the appropriate sensor level. The fault trees were then quantified to determine the impact of the Technical Specification changes. For this evaluation GE used the SOCRATES computer program; a PC-based time-dependent reliability analysis code developed by EPRI (11). The isolation function trip failure frequencies (TFFs) were then evaluated using the appropriate initiating

Figure 2.1

Technical Specification Improvement Analysis Procedure+



+ Excerpted from reference 1

Table 2.1

Isolation Functions* Analyzed for BWR-6 Relay Plant+

TRIP FUNCTIONS	ANALYZED IN RPS OR ECCS
PRIMARY CONTAINMENT	
a. RPV Low Water Level 2	YES
b. RPV Low Level 1	YES
c. Drywell Pressure - High	YES
d. Containment and Drywell Vent Exhaust - High Rad	NO
e. Manual Initiation	NO
MAIN STEAM LINE ISOLATION	
a. RPV Water Level 1	YES
b. Main Steam Line - High Rad	YES
c. Main Steam Line Pressure - Low	NO
d. Main Steam Line Flow - High	NO
e. Condenser Vacuum - Low	NO
f. Main Steam Line Tunnel Temp - High	NO
g. Main Steam Tunnel Delta Temp - High	NO
h. Manual Initiation	NO
RCIC SYSTEM ISOLATION	
a. RCIC Steam Line Flow - High	NO
b. RCIC Steam Supply Pressure - Low	NO
c. RCIC Turbine Exhaust Diaphram Pres - High	NO
d. RCIC Equip Room Amb Temp - High	NO
e. RCIC Equip Room Delta Temp - High	NO
f. MSL Tunnel Amb Temp - High	NO
g. MSL Tunnel Delta Temp - High	NO
h. MSL Tunnel Temp Timer	NO
i. RHR Equip Room Amb Temp - High	NO
j. RHR Equip Room Delta Temp - High	NO
k. RHR/RCIC Steam Line Flow - High	NO
l. Manual Initiation	NO
m. Drywell Pressure - High	YES
SECONDARY CONTAINMENT	
a. RPV Low Water Level 2	YES
b. Drywell Pressure - High	YES
c. Fuel Handling Area/Vent Exhaust Rad - High	NO
d. Fuel Handling Area Pool Sweep Exhaust Rad - High	NO
e. Manual Initiation	NO
RWCU SYSTEM ISOLATION	
a. RWCU Delta Flow - High	NO
b. RWCU Delta Flow Timer	NO
c. RWCU Equip Area Temp - High	NO
d. RWCU Equip Area Delta Temp - High	NO
e. RPV Water Level 2	YES
f. MSL Tunnel Temp - High	NO
g. MSL Tunnel Delta Temp - High	NO
h. SLCS Initiation	NO
i. Manual Initiation	NO
RHR SYSTEM ISOLATION	
a. RHR Equip Room Temp - High	NO
b. RHR Equip Room Delta Temp - High	NO
c. RPV Low Water Level 3	YES
d. RPV Pressure - High	YES
e. Drywell Pressure - High	YES
f. Manual Initiation	NO

* Trip Functions not Analyzed as part of RPS or ECCS are considered in this analysis

+ Excerpted from reference 1

event frequency for each isolation function. (For example, for the Main Steam Isolation function the accident initiator was chosen to be the Main Steam Line Break event). The results were then evaluated based on changes in isolation function TFFs. If the impact of the proposed STI and AOT changes resulted in a change in a TFF of less than 1.0E-7/year on an absolute basis, or in less than a 10% change on a relative basis, then GE considered the proposed STI and AOT Technical Specifications relaxation to be acceptable.

2.2 Review of Modifications to the Previously Accepted Methodology

The use of the acceptability criteria of a net change in failure frequency of 1.0E-7/year on an absolute basis, or a 10% change on a relative basis is consistent with the one used in the previous Technical Specification Improvement Progam topical reports (3, 7).

As described in reference 4, the guideline for evaluating the impact of changes in ECCS actuation instrumentation Technical Specifications was set at a 1% (or less) increase in the water injection function unavailability. This criterion was considered acceptable by the NRC (9). In a subsequent topical report (7), GE made modifications to the acceptability criterion by changing the 1% increase guideline to a 4% increase in the ECCS unavailability. Additionally, in cases where the 4% increase could not be met, the guideline was augmented by limiting the impact of the Technical Specification changes to an absolute increase of 1.0E-6/yr in the water injection function failure frequency.

A review of the modification to the acceptance criterion (from 1.0E-6/yr to 1.0E-7/yr and from a 4% increase to a 10% increase) indicates that the changes do not greatly impact the plant safety margin. Considering the case of a failure of isolation actuation function and an initiating event that will result in a core melt accident, a 10% increase in the function unavailability will lead to substantially less than a 10% increase in the total core melt frequency. This increase in core melt frequency is rather insignificant since it is considerably smaller than the uncertainties associated with the CMF estimate. As stated in reference 12, we concur with GE on the use of an alternate guideline (i.e. 1.0E-7/yr increase in functional trip failure frequency) for extremely reliable systems, that are unable to satisfy the 10% increase limit criterion. This alternate criterion [10^{-7} per year] is comparable to guidelines used in other programs, such as the NRC sponsored Systematic Evaluation Program (SEP) (13) for determining the relative risk significance of proposed plant modifications.

However, as was previously commented (12), the impact of Technical Specification modifications on plant safety cannot be judged on an individual change, but should be evaluated based on the cumulative effects. If an individual Technical Specification change results in an increase in the core melt frequency of 1% to 10%, its impact of plant risk is very small. However, if all of the Technical Specification changes are considered together, the cumulative impact could be larger than the sum of individual changes due to the potential for synergetic effect of changes in different systems on one another. Thus, during the course of evaluating the Technical Specification improvement for each plant, it is recommended that not only the current proposed change in Technical Specifications be considered, but also those that were previously proposed so that a complete evaluation of the potential impact of Technical Specification changes on the plant safety profile can be made.

3.0 Evaluation

This section presents a discussion of our review of the results provided in the GE topical report for four BWR product lines and the applicability of these analyses to the other plants in the same product lines. The GE results are intended to provide a technical basis for extending the test intervals of the isolation actuation instrumentation (IAI) in each product line. GE has proposed the following changes to the STIs, and test and repair AOTs:

1. The STIs be changed from monthly to quarterly consistent with the current limiting 3-month calibration intervals for most trip sensors.

2. The AOTs for surveillance test be extended from 2 hours to 6 hours, and for repair from 1 hour to 24 hours.

For each product line, the unavailabilities of the isolation function trip frequencies were evaluated for two scenarios: a "minimum" and a "maximum." The "minimum" isolation function unavailabilities were based on average failure rates for individual valve relays and sensor channels, and the current test AOT of 2 hours and repair AOT of 1 hour. Then, the "minimum" scenario was evaluated for two cases: Case 1, STI = 730 hours, and Case 2, STI = 2190 hours. These two cases were analyzed without changing AOTs.

The "maximum" isolation function unavailabilities were based on individual valve relay and sensor channel failure rates being increased by a factor of 3, and the test and repair AOTs extended to 6 and 24 hours, respectively. Again, two cases were analyzed for this scenario: Case 1, STI= 730 hours, and Case 2, STI = 2190 hours. GE stated that the factor of 3 increase in the failure rate was used in order to bound any variation in failure rates and number of components within a logic channel that could exist among individual plants within the product line.

Then, for each scenario, GE estimated the difference between the two cases which represented the change in function unavailabilities due to an increase in STIs alone.

For the purposes of this review, using NRC guidance, we selected only one isolation function, namely the BWR-3/4 main steam isolation valve (MSIV) isolation function. This isolation function model was selected since it represents the most complex system among the isolation functions presented in the topical report. Our evaluation of the GE topical report covers a detailed review of this representative isolation function to determine the adequacy of the modeling, data, and results, and the applicability of the representative plant results to the other plants within the product line.

3.1 Analysis

3.1.1 Isolation Function Modeling

GE constructed specific fault trees for each isolation function of interest for the four product lines. As discussed previously, the BWR-3/4 MSIV isolation function was selected as a representative sample for the review.

Upon request, GE provided the fault tree in conjunction with the detailed elementary diagrams of the Main Steam IAI and SOCRATES input and output data (14). This information was reviewed in detail, in conjunction with the original submittal, and the findings are presented below.

The MSIV closure is initiated by seven different sensor variables. Four of the seven sensor variables were explicitly modeled and evaluated in the GE analysis. The sensors considered were; main steam line high flow, high tunnel temperature, low main steam line pressure, and low reactor water level (Level 1). The low water reactor level (Level 1) was already analyzed as part of the instrumentation common to the RPS and ECCS. However, the inclusion of this signal in this analysis is necessary to properly represent the current Technical Specifications of the MSIV isolation instrumentation. Two of the sensors (low condenser vacuum and high main steam line radiation) which were not evaluated are considered as part of the isolation instrumentation common to the RPS and ECCS. The remaining sensor (high area temperature in the turbine building) was not considered with the explanation that it is part of a similar isolation initiating event and is therefore bounded by the representative initiating event analysis. The logic for each of these sensor variables is one-out-of-two twice.

The MSIV isolation failure fault tree was constructed to a level of detail, e.g. relays, valves, trip units, transmitters, and switches, at which failure rate data are easily available. Several simplifications consistent with the previous Technical Specification analyses were also adopted in constructing this fault tree. The fault tree also modeled the potential for common miscalibration of like sensors during each test.

We concur with the GE approach in constructing the fault tree and find the fault tree to properly represent the failure combinations which result in MSIV isolation function failure.

3.1.2 Data

A review of the component failure data used in the quantification process indicates that most of the data had been used in previous Technical Specification improvement reports (3-7). Since these data were reviewed and accepted previously (8-10, and 12), it is therefore considered adequate for the purposes of this analysis. The failure data provided by GE in reference 14 included time dependent and demand type failure modes as well as test-caused failures. The values for test-caused failure probabilities were not explicitly reported in the GE topical report. Review of the previous Technical Specification improvement reports indicates that the same values have been used for this category of data; therefore we accept them as adequate for this analysis.

GE did not provide any numerical estimates and explanations on the frequency of the initiating events. Review of these data indicates that they are generally consistent with the values used in PRAs. Therefore we accept them as adequate.

To "envelope" the effect of the variation in failure rates and number of components within a logic channel, GE increased the sensor and relay failure rates by a factor of 3 in the "maximum" scenario. In response to our question regarding the apparent arbitrary nature of this "envelope" factor, GE indicated that a cursory review of the isolation functions actuation logic has supported a factor of 2 increase only. However, GE decided to use a factor of 3 increase in order to be conservative. There is no verification supporting the fact that a factor of 3 increase in the failure rate will in fact bound the variation among individual plants within a product line. Although this approach is not consistent with the intent of performing an analysis applicable to an entire product line, we feel that this assumption is adequate for estimating base case "maximum" unavailability values. Since the actuation logic selected for the base case is already considered to be a representative configuration, this increase in failure rates will then only add conservatism to the isolation function trip unavailability value.

During our review of the MSIV isolation function model, we have noticed that GE has increased the individual component failure rate not only by a factor of 3 as stated in the topical report, but also by a factor of 4 for a certain number of components. Although this is inconsistent with GE's statement, it is judged to be acceptable since it only generates results that are more conservative.

3.1.3 Results

As stated earlier, GE developed fault trees for isolation functions for each of the four BWR product lines. Each fault tree was then quantified to determine the effect of STI and AOT changes on the actuation logic unavailability resulting in failure of the isolation function. The isolation function failure frequency was then calculated by multiplying the failure unavailability of the isolation function by the isolation initiating event frequency. The overall isolation function failure frequency for each product line was calculated by adding failure frequencies of the individual representative isolation events.

The results of these calculations for each BWR product lines are presented in Tables 5-1 to 5-4 of the GE topical report. As discussed earlier, the differences presented for each scenario (i.e., "minimum" and "maximum") in these summary tables only reflect the impact due to changes in STIs without taking into account the changes in AOTs.

As indicated by some of the results presented in the above tables, positive improvements can be gained by implementing the proposed STI change. A closer review of these results revealed that the isolation failure unavailability is dominated by the unavailability contribution from testing. Thus, when the STIs are changed from monthly to quarterly, and the sensor/relay test durations are kept unchanged, the impact caused an increase in function failure unavailability due to component failures, but the increase was not sufficient to overcome the decrease in function unavailability due to test related unvailabilities. This results in a negative change which represents only an intermediate result and cannot be used as representative of the overall impact of increasing STIs and the test and repair AOTs. Following our discussion with regard to this observation, GE has provided modified summary tables showing unavailability increases in each of the representative isolation functions (14). These modified summary tables are also given in the proprietary addendum to this review report.

For the purposes of this evaluation, a detailed review of the BWR-3/4 MSIV isolation function was performed. GE provided the fault tree, failure data, and the SOCRATES input and a selected output file (14). Based on the fault tree model and the SOCRATES input file, we performed a set of calculations using the same component and common cause failure data as well as the testing scheme used in the GE report. The calculations were performed using FRANTIC ABC, a PC-based time dependent reliability analysis computer program (15). FRANTIC ABC is an extended version of the NRC's FRANTIC III (16) code. This code was used to simulate the GE testing scheme to the degree possible. Due to differences in the logical algorithms of these two codes, GE's testing scheme (using the SOCRATES code) could not be entirely duplicated using FRANTIC ABC code. Nevertheless, we believe that the FRANTIC ABC code can be used to evaluate the impact of proposed STI and AOT changes and enables us to perform a meaningful assessment of the GE results.

As stated earlier, we used the same data as in GE evaluations. The SOCRATES input file indicates that, for the evaluation of the "maximum" unavailability value, sensor failure rates were multiplied by a factor of 3 and the valve solenoid relay failure rates were multiplied by 4. Other component failure rates were kept unchanged. We also noted that the MSIV fault tree was reduced before the minimal cutsets were generated. For quantification purposes, GE reduced signal failures to two failure events per variable; one is a module, which is a combination of failures of one or two relays, a sensor, and a trip unit, representing the sensor failure, and the second one represents sensor miscalibration. If individual component failure rates were used to estimate the module failure probability, the resulting data would be different from those used in the GE quantification process. However, this discrepancy did not have any impact on the overall results. The reason being that the sensor failures are "ANDed" and their failure contributions to the overall system unavailability are very small (negligible).

Table 3.1 compares the GE results with the audit review results, and indicates that there is very good agreement between the two analyses. In both cases the magnitude of the change in frequency of the MSIV isolation function is very small-- less than 2.0E-08/year. The magnitudes of the frequency changes are the differences between the "base case" frequency associated with current STIs and AOTs, and the "modified TS" frequency, after the implementation of the proposed Technical Specification change. Based on these results the proposed changes in the MSIV Technical Specification requirements are judged to be justifiable.

3.2 Review of the Analysis for Plant-Specific BWRs

Due to the differences in system configuration, the results from the analysis of representative BWR models cannot automatically be used to modify Technical Specification requirements for plant-specific BWRs. However, GE believes that the fault tree model for the representative product line combined with the use of "maximum" failure values will bound the effects of the plant-specific actuation logic differences. A list of plant specific configurations for each of the isolation functions is presented in Appendix C of the GE topical report. A review of this information indicates that, in most cases, the models developed for the isolation function are bounding, i.e., there are more sensor variables available for the trip function than those selected in the representative models. However, there are some instances where the number of sensor variables is less than that modeled in the representative fault trees. For example, in the case of RWCU isolation function for BWR-3/4, the representative model is based on the function of three sensor variables, while there are only two variables for Monticello. According to GE, two of the actual three variables associated with the RWCU isolation function (high area temperature and delta temperature) were combined into one, and as a result, the system was evaluated as a 2 sensor variable system. However, the modeling process was not reviewed in this report.

Table 3.1
Summary of Audit Calculations
Impact of STI and AOT Changes
on MSIV Isolation Function

Source of Quantification	Isolation Function Failure Probability			Increase in Isolation Function Failure Frequency *** (Year^{-1})
	Base Case*	Modified TS **	Impact	
SAIC	2.18E-04	3.51E-04	1.33E-04	1.33E-08
GE	2.27E-04	3.74E-04	1.47E-04	1.47E-08

* "Base Case" value is estimated based on STI = 730 hours, test AOT = 2 hours, repair AOT = 1 hour, and average failure rates for individual relay and sensor channel.

** "Modified TS" value is estimated based on STI = 2190 hours, test AOT = 6 hours, repair AOT = 24 hours, and individual relay and sensor channel failure rates increased by a factor of 3.

***Isolation Function Failure Frequency is calculated using an initiating event frequency of 1.0E-4/yr.

GE has also performed a number of case studies for different types of instrumentation logic and number of sensor. The results were presented in Table 5-5 of the GE topical report.

The information in Table 5.5 of the GE topical report is a compilation of results evaluated for various isolation functions of different BWR product lines. For example, the results presented for 4 sensor variables in 2-out-of-2 logic type configuration are the same as those evaluated as "minimum" and "maximum" values for the MSIV isolation function of the BWR-5/6 (relay) product line. The results for 4 sensor variables in 1-out-of-2 twice logic are for the BWR-2 (minimum value) and BWR-3/4 (maximum value) MSIV isolation function. The results for 1 sensor variable in a 2-out-of-2 logic configuration are from the BWR-3/4 secondary containment isolation function.

Since the information in Table 5.5 of the GE topical report is a collection of results from various isolation functions in the BWR product lines, it is difficult to use this information to assess the applicability of the calculated impact of Technical Specification changes to the plants with different isolation function logic configuration within each BWR product line. It would have been preferable if the results had been generated for the same isolation function but with different configurations. Therefore, we recommend the licensees verify that their plant configuration is consistent with GE's generic models.

4.0 Summary and Conclusion

GE has proposed changes to the Technical Specifications concerning the test requirements for BWR isolation instrumentation which is not common to the RPS and ECCS instrumentation. The changes consist of increasing the surveillance test interval from one to three months and allowed-outage-times for test from two to 6 hours, and for repair from one to 24 hours. These test interval extensions are consistent with the already approved changes to STIs and AOTs for RPS and ECCS instrumentation.

Our review indicates that there will be no significant changes in the failure frequency of the isolation function if these changes are implemented. The results of the CE analyses indicate that the overall impact of the Technical Specification changes on the isolation function failure frequency of the representative plant in each of the BWR product lines is less than 1.0E-07/year on absolute basis. This increase is consistent with the accepted (for this application) criterion set forth by GE for a Technical Specification change.

The GE report did not provide an all-encompassing analysis showing that the variations in the plant actuation logic configuration within a BWR product line will only result in an insignificant impact. Recognizing this, we suggest the licensees verify that their plant configuration is consistent with GE's generic model.

5.0 References

1. Sullivan, W. P., et al., "Technical Specification Improvement Analysis For BWR Isolation Actuation Instrumentation", NEDC-31677P, General Electric Company, June 1989.

2. "BWR Owners' Group Response to NRC Generic Letter 83-28, Item 4.5.3", NEDC-30844, General Electric Company, January 1985.

3. Sullivan, W. P., et al., "BWR Owners' Group Technical Specification Improvement Analysis for BWR Reactor Protection System", NEDC-30851P, General Electric Company, May 1985.

4. Atcheson, D. B., et al., "BWR Owners' Group Technical Specification Improvement Methodology (with Demonstration for BWR ECCS Actuation Instrumentation) Part 1", NEDC-30936P, General Electric Company, November 1985.

5. Visweswaran, S., et al., "Technical Specification Improvement Analysis for BWR Control Rod Block Instrumentation", NEDC-30851P Supplement 1, General Electric Company, June 1986.

6. Frederick, L. G., et al., "Technical Specification Improvement Analysis for BWR Isolation Instrumentation Common to RPS and ECCS Instrumentation", NEDC-30851P Supplement 2, General Electric Company, July 1986.

7. Atcheson, D. B., et al., "BWR Owners' Group Technical Specification Improvement Methodology (with Demonstrations for BWR ECCS Actuation Instrumentation) Part 2", NEDC-30936P, General Electric Company, June 1987.

8. Letter from Thadani, A. C., NRC, to Pickens, T. A., BWR Owners' Group, "General Electric Company (GE) Topical Reports NEDC-30844, BWR Owners Group Response to NRC Generic Letter 83-28, and NEDC-30851P, Technical Specification Improvement Analysis for BWR RPS", July 15, 1987.

9. Letter from Thadani, A. C., NRC, to Grace, D. N., BWR Owners' Group, "General Electric Company (GE) Topical Report NEDC-30936P, BWR Owners Group Technical Specification Improvement Methodology (With Demonstration for BWR ECCS Actuation Instrumentation), Part 1", December 9, 1988.

10. Letter from Rossi, C. E., NRC, to Grace, D. N., BWR Owners' Group, "General Electric Company (GE) Topical Report NEDC-30936P, Supplement 2, Technical Specification Improvement Analysis for BWR Isolation Instrumentation Common to RPS and ECCS Instrumentation", January 6, 1989.

11. EPRI Research Project 2142, "PC-SOCRATES Version 1.02 User's Guide", Draft Report, September 2, 1987.

12. Letter from Rossi, C. E., NRC, to Grace, D. N., BWR Owners' Group, "General Electric Company (GE) Topical Report NEDC-30936P, BWR Owners Group Technical Specification Improvement Methodology (with Demonstration for BWR ECCS Actuation Instrumentation), Part 2", December 9, 1988.

13. "Integrated Plant Safety Assessment, Systematic Evaluation Program, San Onofre Nuclear Generating Station Unit 1," NUREG-0829, April 1985.

14. Letter from Sullivan, W. P., GE Nuclear Energy, to Wohl, M. NRC, "Response to Questions On NEDC-31677P", October 9, 1989.

15. Ginzburg, T., and Vesely, W. E., "FRANTIC-ABC User's Manual Time-Dependent Reliability Analysis, DRAFT," Developed by Applied Biomathematics, Inc. under NRC Contract No. 04-87-367.

ENCLOSURE 2

EXAMPLE OF MODIFIED ISOLATION ACTUATION
INSTRUMENTATION TECHNICAL SPECIFICATION