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September 3, 2008

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Attention: Mr. Jeffrey A. Ciocco

Docket No. 52-021
MHI Ref: UAP-HF-08173

Subject: MHI's Response to US-APWR DCD RAI No.30

References: 1) "Request for Additional Information No. 30 Revision 0, SRP Section: 09.05.01 – Fire Protection Program, Application Section: 9.5.1," dated July 22, 2008.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Responses to Request for Additional Information No.30 Revision 0."

Enclosure 1 provides the responses to the 13 RAIs that are contained within Reference 1.

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has any questions concerning any aspect of enclosed submittal. His contact information is provided below.

Sincerely,

Y. Ogata

Yoshiki Ogata
General Manager- APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

Enclosures:

1. Responses to Request for Additional Information No.30 Revision 0

CC: J. A. Ciocco
C. K. Paulson

Contact Information

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DOB
NEO

Docket No. 52-021
MHI Ref: UAP-HF-08173

Enclosure 1

UAP-HF-08173
Docket Number 52-021

Response to Request for Additional Information No.30 Revision 0

September 2008

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO.30 REVISION 0
SRP SECTION: 09.05.01 – FIRE PROTECTION PROGRAM
APPLICATION SECTION: 09.05.01 FIRE PROTECTION PROGRAM
DATE OF RAI ISSUE: 7/22/2008

QUESTION NO. : 09.05.01-1

Section 9.5.1 of the DCD indicated the use of probabilistic risk assessment (PRA) to identify fire risks and vulnerability. Will the applicant be crediting the fire PRA and fire modeling results to demonstrate acceptable fire hazards or post-fire safe shutdown capabilities for specific fire scenarios? If so, the applicant should provide the NRC staff with details of the specific application of fire PRA and fire models to these fire scenarios. Information should include at the minimum the program name, program revision, input file, key assumptions, and results for staff review.

ANSWER:

No credit is being taken for reduction of fire protection features as a result of the PRA. All fire protection features are being provided in accordance with the prescriptive requirements of NFPA 804 "Standard for Fire Protection for Advanced Light Water Reactor Electric Generating Plants", 2006 Edition and requirements as supplemented and directed by RG 1.189, Rev.1. 10 CFR 52.47 (a) (v) requires license applications submitted under 10 CFR 52 to include a design-specific PRA. However, Appendix B of RG 1.189, Rev.1 states that a detailed fire PRA is not necessarily required for a new reactor Fire Protection Program (FPP). The US-APWR fire PRA is a simplified bounding type analysis that maybe utilized as an additional risk assessment tool to supplement the fire risk evaluations contained in the fire hazard analysis and safe-shutdown evaluation and to enhance the overall quality of the FPP.

Impact on DCD

There is no impact on the DCD

Impact on COLA

There is no impact on the COLA

Impact on PRA

There is no impact on the PRA

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/03/2008

**US-APWR Design Certification
Mitsubishi Heavy Industries
Docket No. 52-021**

RAI NO.: NO.30 REVISION 0
SRP SECTION: 09.05.01 – FIRE PROTECTION PROGRAM
APPLICATION SECTION: 09.05.01 FIRE PROTECTION PROGRAM
DATE OF RAI ISSUE: 7/22/2008

QUESTION NO. : 09.05.01-2

Section 9.5.1.1 of the DCD states that possible fire-induced failures, including multiple spurious actuations, are addressed in the post-fire safe shutdown circuit analysis in accordance with RG 1.189 and NFPA 804. However, since the potential for fire-induced multiple spurious actuations to occur in rapid succession has been demonstrated by industry and NRC cable fire test programs, RG 1.189, Rev 1, noted that the one-at-a-time assumption for multiple spurious actuations as stated in NFPA 804 (2006 Edition) may not adequately address the potential risk attributed to fire. The US-APWR design should not be based on a one-at-a-time assumption for multiple spurious actuations unless MHI can satisfactorily demonstrate that this assumption is valid for the specific fire scenarios to which it is applied. MHI should provide the technical and safety basis for the application of this assumption. MHI should also describe the impact on post-fire safe shutdown capability if multiple spurious actuations were to occur in any area where the one-at-a-time assumption is applied? One approach to addressing multiple spurious actuations is being developed by NEI as guidance document NEI 00-01.

ANSWER:

As stipulated in Section 8.4 of RG 1.189, Rev.1, the fire protection design for the US-APWR conforms to the requirements of NFPA 804 except where RG 1.189, Rev. 1 has a more stringent requirement. For the subject of possible fire induced failures, including multiple spurious actuations, the specific guidance of RG 1.189, Rev.1 has more stringent requirements and states that the post-fire safe-shutdown circuit analysis should address any-and-all possible failures and spurious actuations caused by the failures, including combinations of multiple failures/operations that could prevent safe-shutdown. It is not the intent of the DCD subsection to indicate that the one-at-a-time assumption of NFPA 804 is used for the US-APWR post-fire safe shutdown circuit analysis.

Impact on DCD

The second to last paragraph of DCD subsection 9.5.1.1 will be revised to read,

“Possible fire induced failures, including multiple spurious actuations, are addressed in post-fire safe-shutdown circuit analysis in accordance with ~~RG 1.189 (Ref.0.5.1-12)~~ and ~~NFPA 804 (Ref.0.5.1-14)~~ the guidance of **RG 1.189, Rev.1 (Ref. 9.5.1-12)** which stipulates that **any-and-all possible failures and spurious actuations caused by the failures, including**

combinations of multiple failures/operations that could prevent safe-shutdown be addressed in the analysis."

Impact on COLA

There is no impact on the COLA

Impact on PRA

There is no impact on the PRA

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

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QUESTION NO. : 09.05.01-3

Section 9.5.1.1 of the DCD states that the potential for fire-induced multiple spurious actuations is minimized by the use of digital instrumentation and control circuits. Tests performed on some types of digital equipment have shown that smoke can cause spurious actuations of digital instrumentation and control devices. How will the applicant assess/demonstrate the effects of heat and smoke due to fire on digital equipment, particularly with respect to the potential to cause spurious actuations that could prevent safe shutdown?

ANSWER:

Redundant safety divisions are physically and electrically independent of each other and physically and electrically independent of any non-safety divisions. Physical independence is maintained either by the required distance or by barriers which prevent propagation of fire or electrical faults. Electrical independence is maintained by fiber optic cable communication interfaces or conventional isolators, such as opto-couplers, relays or transformers. Conventional isolators include fault interrupting devices such as fuses or circuit breakers. Conventional and fiber optic isolators prevent propagation of transverse and common cause faults from the maximum credible energy source. Equipment qualification related design features and fire protection analysis are discussed in reference 7.1-2 (section 5.2 and 6.5.8 respectively of MHI Topical Report MUAP-07004) of section 7.1.5 of the DCD. Signal isolation related issue is discussed in section 7.1.3.5 of the DCD. The safe-shutdown design of the US-APWR includes four safety trains of digital circuits each of which are separated by 3-hour fire barriers. This redundancy ensures that safe-shutdown from main control room (MCR) can be accomplished for any postulated fire because the effects of smoke and heat that could potentially destroy digital instrumentation and control circuits and cause multiple spurious actuations in one fire area cannot migrate to another fire area. The remote shutdown console is used for maintaining safe-shutdown before MCR will become not available by any fire which results in catastrophic damage to I&C equipment located in MCR.

Unsuppressed fire can cause electrical faults, which may result in spurious actuations within digital equipment. The independence and isolation features described above ensure that electrical faults and spurious actuations that may result from an unsuppressed fire are limited to a single safety or non-safety train. In most cases, the equipment located in a single fire area is a subset of a train. This is due to cabinet partitioning and geographic distribution of cabinets.

The DCD is being revised in response to RAI 30, question 09.05.01-6 to add a requirement for the final as-built configuration of the US-APWR COL plants to perform a final fire hazard analysis (FHA) and safe-shutdown evaluation based on the final plant cable routing, fire barrier ratings, fire loading, ignition sources, purchased equipment and equipment arrangement that will be submitted. The final FHA and safe-shutdown evaluation will also include a detailed post-fire safe-shutdown circuit analysis performed and documented using a methodology similar to that described in NEI 00-01, "Guidance for Post-Fire Safe-Shutdown Circuit Analysis," using as-built data.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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DATE OF RAI ISSUE: 7/22/2008

QUESTION NO. : 09.05.01-4

Section 9.5.1.2.5 of the DCD specified Novec 1230 fluid in a 5.6% concentration is used for cable raised-floor areas, or equal. What is the concentration used for other areas, especially "energy augmented" areas where energy sources can augment combustion or cause re-ignition? Also, will room integrity testing be included in the initial performance test to ensure the specified concentration can be maintained long enough for fire extinguishment? The DCD should also specify the standard to which the automatic gaseous suppression system is installed or included the appropriate standard in the reference section.

ANSWER:

Novec 1230 fluid is normally used in a concentration of 4.2%. Due to the heavy cable concentration in under floor areas, a higher concentration of 5.6% is deemed appropriate. This higher concentration is appropriate where ever a concern exists for high energy combustion or where re-ignition is considered a possibility. Additionally, a 100% reserve is associated with the installation to provide defense-in-depth for re-ignition potential. The clean agent suppression system is a back-up for a very early warning smoke detection system which assures expedient response from the plant fire brigade. The clean agent is provided as defense-in-depth fire suppression. The clean agent is installed and tested following appropriate requirements of NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*. The initial performance testing will include room integrity to assure the specified concentration can be maintained long enough to ensure fire extinguishment. The DCD will be revised to reference NFPA 2001 as discussed below.

Impact on DCD

The DCD will be changed to incorporate reference to NFPA 2001 in the section 9.5.1.2.5 and in each individual room discussion in Appendix 9A and added to references for section 9.5.1.

Section 9.5.1.2.5, third sentence of the second paragraph will be revised to read,

"Halon and carbon dioxide total flooding systems are not used; however, a clean agent gaseous fire suppression ~~agent~~ **system, per NFPA 2001**, in conjunction with very early warning fire detection is used for selected areas with heavy cable fire loading."

Impact on COLA

There is no impact on the COLA

Impact on PRA

There is no impact on the PRA

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/03/2008

**US-APWR Design Certification
Mitsubishi Heavy Industries
Docket No. 52-021**

RAI NO.: NO.30 REVISION 0
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DATE OF RAI ISSUE: 7/22/2008

QUESTION NO. : 09.05.01-5

In Table 9.5-1, MHI indicated conformance with Regulatory Position 5.3.4. Clarify that the conformance is based on the assumption that multiple spurious actuations can occur in rapid succession or simultaneously per RG 1.189, and NOT based on the "one-at a-time" multiple spurious actuation assumption per NFPA 804, which is not endorsed by the NRC. This RAI is related to RAI 542, Question 1822.

ANSWER:

It is not the intent of the DCD Table 9.5-1 (Table number is changed to Table 9.5.1-1 in DCD Rev.1) to indicate that the one-at-a-time assumption of NFPA 804 is used for the US-APWR post-fire safe-shutdown circuit analysis. Text will be added in the remarks column of Position 5.3.4 in Table 9.5.1-1 to clarify that the post-fire safe-shutdown circuit analysis will be performed utilizing the RG 1.189, Rev.1 criteria of addressing any-and-all possible failures and spurious actuations caused by the failures, including combinations of multiple failures/operations that could prevent safe-shutdown.

Impact on DCD

The DCD will be changed to add the following in the remarks column of Position 5.3.4 in Table 9.5.1-1.

"Conformance with this regulatory position is based on the criteria of RG 1.189, Rev.1 not the one-at-a-time assumption used in NFPA 804 that is not endorsed by the NRC."

Impact on COLA

There is impact on COLA to incorporate the DCD change.

Impact on PRA

There is no impact on the PRA

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO.30 REVISION 0
SRP SECTION: 09.05.01 – FIRE PROTECTION PROGRAM
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DATE OF RAI ISSUE: 7/22/2008

QUESTION NO. : 09.05.01-6

In Table 9.5-1, for compliance with Regulatory Position 1.2, MHI indicated that the COL applicant will update and maintain the Fire Hazards and Safe Shutdown Analysis as required per COL Item 9.5(2). This COL information item should direct the COL applicant to perform a Final Fire Hazards and Safe Shutdown Analyses based on the final plant cable routing, fire barrier ratings, fuel loading, ignition sources, purchased equipment, equipment arrangement, and includes a review against the assumptions and requirements stated in the Initial Fire Hazards and Safe Shutdown Analysis provided in the DCD. The final FHA and Safe Shutdown Analysis should also include a detailed post-fire safe-shutdown circuit analysis performed and documented using a methodology similar to that described in NEI guidance document, NEI 00-01, "Guidance for Post-Fire Safe-Shutdown Circuit Analysis," using as-built data. This COL information item should also direct the applicant to describe how these analyses will be performed and documented, and how will the NRC be made aware of deviations and subsequent changes to the approved design.

ANSWER:

MHI will revise DCD Subsection 9.5.1.3 to add the suggested additional update guidance suggested in RAI question No.09.05.01-6.

Impact on DCD

The DCD will be changed to add the following after the last paragraph in Subsection 9.5.1.3.

"The COL Applicant is responsible to perform a final FHA and safe-shutdown evaluation based on the final plant cable routing, fire barrier ratings, fire loading, ignition sources, purchased equipment and equipment arrangement. The final FHA and safe-shutdown evaluation shall include a review against the assumptions and requirements stated in the initial FHA and safe-shutdown evaluation provided in the DCD. The final FHA and safe-shutdown evaluation shall also include a detailed post-fire safe-shutdown circuit analysis performed and documented using a methodology similar to that described in NEI 00-01, "Guidance for Post-Fire Safe-Shutdown Circuit Analysis," using as-built data. The final FHA shall be performed and documented as an update to the COLA application and maintained in the licensing basis for the specific site located plant (COL Item 9.5(2))."

Impact on COLA

9.5.1-9

There is impact on COLA to incorporate the DCD change.

Impact on PRA

There is no impact on the PRA

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO.30 REVISION 0
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QUESTION NO. : 09.05.01-7

In Table 9.5-1, MHI indicated conformance with Regulatory Position 5.3.1 and referenced the Fire Hazard Analysis (Appendix 9A). Since NEI 00-01 methodology is based on as-built data with final purchased equipment, equipment arrangement, plant cable routing, and detailed control circuitry, it is doubtful that the analysis as presented in Appendix 9A at this early stage of design conforms to Regulatory Position 5.3.1. A detailed safe shutdown analysis using the above prescribed as-built data and a methodology similar to NEI 00-01 must be completed prior to fuel load either by MHI or the COL applicant. This RAI is related to RAI 601, Question 1953.

ANSWER:

The design process and conceptual design for the US-APWR is based on predecessor designs in Japan which are being tailored to fulfill US design and regulatory requirements. As such, at this early stage of design, the primary routing of electrical cable and planned method of installation are known to some degree of accuracy. The FHA in Appendix 9A is based upon this knowledge and identifies the impact on safe-shutdown capability at this stage of design. In response to question 09.05.01-6, COL Item 9.5(2) is being clarified to require a final FHA and safe-shutdown evaluation using final as-built data and guidance or methodology that is similar to that described in NEI 00-01, "Guidance for Post-Fire Safe-Shutdown Circuit Analysis". Table 9.5-1 (Table number is changed to Table 9.5.1-1 in DCD Rev.1) for conformance to Position 5.3.1 will be amended to also include COL Item 9.5(2) in the "Remarks" column.

Impact on DCD

The DCD will be changed to add the following in the conformance and remarks column in Position 5.3.1, Table 9.5.1-1.

"Conform, **COL**" in the conformance column.

"See FHA (Appendix 9A). **The final FHA will be performed per COL Item 9.5(2).**" in remarks column.

Impact on COLA

There is impact on COLA to incorporate the DCD change.

Impact on PRA

There is no impact on the PRA

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO.30 REVISION 0
SRP SECTION: 09.05.01 – FIRE PROTECTION PROGRAM
APPLICATION SECTION: 09.05.01 FIRE PROTECTION PROGRAM
DATE OF RAI ISSUE: 7/22/2008

QUESTION NO. : 09.05.01-8

Tier 1 Table 2.2-4, Item 16 - the acceptance criteria should be revised to clarify that all as-built penetrations and openings are protected with rated components (i.e. fire doors in door openings, fire dampers in ventilation duct openings, and penetration seals) consistent with the fire resistance rating of the associated barrier.

ANSWER:

The DCD will be revised accordingly.

Impact on DCD

The "Acceptance Criteria" column for Item 16 in Table 2.2-4, Tier 1 will be changed to the following.

"All as-built penetrations and openings are protected with rated components (i.e. fire doors in door openings, fire dampers in ventilation duct openings, and penetration seals) **consistent with the fire resistance rating of the associated barrier.**"

Impact on COLA

There is no impact on the COLA

Impact on PRA

There is no impact on the PRA

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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SRP SECTION: 09.05.01 – FIRE PROTECTION PROGRAM
APPLICATION SECTION: 09.05.01 FIRE PROTECTION PROGRAM
DATE OF RAI ISSUE: 7/22/2008

QUESTION NO. : 09.05.01-9

Tier 1 Table 2.6.6-1, Item 6, the acceptance criteria should include the verification or testing of self-contained battery packs to provide at least 8 hours of service upon lost of normal power.

ANSWER:

The DCD will be revised accordingly.

Impact on DCD

The "Acceptance Criteria" column for Item 6 in Table 2.6.6-1, Tier 1 will be changed to the following.

"The as-built self-contained battery pack lighting ~~have self-contained battery pack~~ has the capability to support access, egress, and operations activities for a minimum of 8-hours after the disruption of normal power."

Impact on COLA

There is no impact on the COLA

Impact on PRA

There is no impact on the PRA

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO.30 REVISION 0
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QUESTION NO. : 09.05.01-10

Tier 1 Table 2.9-1, Item 7i, the acceptance criteria for the remote shutdown console (RSC) should include the verification of electrical isolation from Main Control Room (MCR) upon transfer of control.

ANSWER:

The verification of electrical isolation between main control room (MCR) and remote shutdown room (RSR) is described in Tier 1 Table 2.5.2-3, Item 3.
There is no need to add the acceptance criteria for electrical isolation between MCR and RSR in Tier 1 Table 2.9-1, Item 7i.

Impact on DCD

There is no impact on the DCD

Impact on COLA

There is no impact on the COLA

Impact on PRA

There is no impact on the PRA

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/03/2008

**US-APWR Design Certification
Mitsubishi Heavy Industries
Docket No. 52-021**

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DATE OF RAI ISSUE: 7/22/2008

QUESTION NO. : 09.05.01-11

Tier 1, Tables 2.7.5.1-3, 2.7.5.2-3 and 2.7.5.4-2, the acceptance criteria should clarify that fire damper testing is to be performed at design air flow conditions in accordance with RG 1.189, Regulatory Guide 4.2.1.3.

ANSWER:

The verification of fire damper in ductwork that penetrates fire barriers that are required to protect safe-shutdown capability will be added in Tier 1, and an ITAAC to verify the operability of each fire damper under design air flow conditions will be added to each Table.

Impact on DCD

Add the following ITAAC in Tables 2.7.5.1-3, 2.7.5.2-3 and 2.7.5.4-2:

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
The fire dampers in ductwork that penetrates fire barrier that are required to protect safe-shutdown capability close fully when called upon to do so.	Tests of as-built fire dampers will be performed.	Each as-built fire dampers in ductwork that penetrates fire barrier that are required to protect safe-shutdown capability close fully when called upon to do so under design air flow conditions.

Impact on COLA

There is no impact on the COLA

Impact on PRA

There is no impact on the PRA

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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QUESTION NO. : 09.05.01-12

MHI should include an ITAAC to verify the operability of all automatic and manually actuated fixed fire suppression systems in accordance with RG 1.189, Regulatory Position 1.7.5.a.

ANSWER:

An ITAAC to verify the operability of the fire protection systems is included as part of the Tier 1 information in Table 2.7.6.9-2, Additional testing of the fire protections systems is specified in the DCD section 14.2.12.1.90, Fire Protection Preoperational Test. MHI believes that these tests and the other tests mentioned as part of the RAI No. 30 responses, adequately cover testing of the fire protection system.

Impact on DCD

There is no impact on the DCD

Impact on COLA

There is no impact on the COLA

Impact on PRA

There is no impact on the PRA

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/03/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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QUESTION NO. : 09.05.01-13

MHI should include an ITAAC to verify conformance with RG 1.189, Position Number 4.1.7, as indicated in Table 9.5-1 for the fire brigade radio system. If the fire brigade radio system is a site-specific item as indicated in Section 9.5.2.2.5.2, the COL applicant should address the fire brigade radio system requirements in an appropriate COL item. The acceptance criteria should ensure preclusion of interferences with the plant security communication system, fixed repeaters are installed and protected from exposure fire damage to preclude dead zones, and selected radio frequencies will not affect the actuation of protective relays.

ANSWER:

MHI believes that this system does not reach the safety significance threshold for an ITAAC. This is consistent with the assumptions for US-APWR ITAAC described in DCD Chapter 14 and consistent with the NRC staff position on ITAAC for fire protection systems described in SECY 04-0032 specific to fire protection systems regarding the level of programmatic information needed for a COL without an ITAAC. Conformance with RG 1.189, position 4.1.7, and NFPA 804 will be demonstrated as described in COL item 9.5(1) and Table 9.5-2, including a radio system used by the fire brigade.

Impact on DCD

There is no impact on the DCD

Impact on COLA

There is no impact on the COLA

Impact on PRA

There is no impact on the PRA