


MITSUBISHI HEAVY INDUSTRIES, LTD.
16-5, KONAN 2-CHOME, MINATO-KU
TOKYO, JAPAN

June 11th, 2009

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-09309

Subject: MHI's Responses to US-APWR DCD RAI No. 372-2787 Revision 1

Reference: 1) "Request for Additional Information No. 372-2787 Revision 1, SRP Section: 14.03.09 –Human Factor Engineering - Inspections, Tests, Analyses, and Acceptance Criteria Application Section: 14.3.9," dated May 20th, 2009.

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. 372-2787 Revision 1."

Enclosed are the responses to 5 RAIs contained within Reference 1.

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

Sincerely,



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

Enclosure:

1. Responses to Request for Additional Information No. 372-2787 Revision 1

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

DOB /
NRO

Contact Information

C. Keith Paulson, Senior Technical Manager
Mitsubishi Nuclear Energy Systems, Inc.
300 Oxford Drive, Suite 301
Monroeville, PA 15146
E-mail: ck_paulson@mnes-us.com
Telephone: (412) 373-6466

Docket No. 52-021
MHI Ref: UAP-HF-09309

Enclosure 1

UAP-HF-09309
Docket No. 52-021

Responses to Request for Additional Information No.372-2787
Revision 1

June 2009

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

6/11/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO. 372-2787 REVISION 1

SRP SECTION: 14.03.09 – HUMAN FACTOR ENGINEERING -
INSPECTIONS, TESTS, ANALYSES, AND ACCEPTANCE
CRITERIA

APPLICATION SECTION: 14.3.9

DATE OF RAI ISSUE: 5/20/2009

QUESTION NO. 14.03.09-1

HRA

The starting assumptions for the review of Section 2.9 and the ITAACs listed in Table 2.9-1 of Tier 1, were that the implementation plans contained sufficient detail to ensure the COL applicant can complete the respective HFE element, and that each ITAAC would explicitly address the completion of each HFE program element within Section 18.

Please provide clarification for the following:

1. After reviewing ITAAC #3, in Table 2.9-1, it is unclear to the staff how this ITAAC will fulfill the HRA HFE implementation plan given in Chapter 18. Please clarify for the staff whether the statement given for the design commitment column for ITAAC #3 means that, as the DC applicant, the HRA for the HFE process will be implemented in accordance with the HRA HFE implementation plan.

2. In NUREG-0800, Section 14.3, it states that the Inspections, Tests, and Analyses (ITA) column should contain the specific method used to demonstrate that the design commitment in Column 1 has been met. In the US-APWR DCD ITA column of Table 2.9-1 it states that "The HRA will be performed." In terms of the HRA/HFE in the ITA column, the staff believes that the NUREG-0800 guidance means that an inspection, test, analysis, or evaluation of what conducting the implementation plan had accomplished, will take place by the DC applicant or COL applicant. The staff understands that the HRA is a critical analytical step in the design of the plant controls. However, it should be done as part of the HRA/HFE implementation plan and not the ITAAC, as the HRA will give

14.03.09-1-1

input on the risk-important human actions to the other elements of the HFE design process. Please clarify the meaning of "The HRA will be performed" statement for ITAAC #3 in the ITA column of Table 2.9-1.

3. In NUREG-0800 Section 14.3.9, it states that if an implementation plan, rather than a completed element, was accepted as part of the design process then the ITAAC should address the completion of the HFE program element. The Acceptance Criteria column gives no indication that there will be documentation showing the completion of the HRA/HFE implementation plan. Therefore, the staff is unclear how the acceptance criterion for ITAAC #3 addresses completion of the HRA/HFE implementation plan. Please clarify this issue. In addition, please clarify if a report will be available detailing the results of completion of the HRA/HFE implementation plan.

Note:

Using similar context to this RAI, the staff would like clarification for ITAAC 4 (FRA/FA) and ITAAC 6 (Staffing and Qualifications).

ANSWER:

ITAAC #3 for HRA and # 4 for FRA/FA will be deleted. The US-APWR HSI Design Report, which will be submitted by June 30, 2009 will document the HRA Implementation Procedure and completion of the HRA program element. That same report will document the FRA/FA Implementation Procedure and the portion of the FRA/FA program element that has been completed at this time. The report will also identify the portion of the FRA/FA Implementation Procedure that has not been completed, and the additional information that will be submitted to the Staff to complete this program element during the DCD review phase. MHI will submit this additional information to complete the FRA/FA program element by September 2009.

ITAAC #6 for Staffing and Qualifications will be revised as shown below, to ensure this program element is conducted in accordance with the Staffing and Qualification Implementation Plan documented in Tier 2, DCD Chapter 18.5, and the overall HFE Program Implementation Procedure documented in the US-APWR HSI Design Report (to be submitted by June 30, 2009).

Impact on DCD

ITAAC #3 and #4 of US-APWR DCD Tier 1 Table 2.9-1 will be deleted, and ITAAC #6 will be revised, as shown in Attachment 1 page 2.9-8, 9, 11 respectively.

Design Commitment

A staffing and qualifications analysis is performed to ensure that personnel are acceptable to permit realistic response to normal and emergency plant conditions. The analysis is conducted in accordance with an implementation procedure that reflects the requirements of the Staffing and Qualifications Implementation Plan.

Acceptance Criteria

A report exists that documents the staffing and qualifications analysis, demonstrates that the analysis has been performed in compliance with the Staffing and Qualifications Implementation Plan, and concludes from a human factors point of view that the staffing and qualifications of plant personnel are acceptable to perform safety significant tasks for normal and emergency operations.

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

6/11/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO. 372-2787 REVISION 1

SRP SECTION: 14.03.09 – HUMAN FACTOR ENGINEERING -
INSPECTIONS, TESTS, ANALYSES, AND ACCEPTANCE
CRITERIA

APPLICATION SECTION: 14.3.9

DATE OF RAI ISSUE: 5/20/2009

QUESTION NO. 14.03.09-2

OER

After reviewing ITAAC 2, in Table 2.9-1, it is unclear how this ITAAC will fulfill the HRA HFE implementation plan given in Chapter 18. Please clarify for the staff whether the statement given for the design commitment column for ITAAC 2 means that, as the DC applicant, the OER for the HFE process will be implemented in accordance with the OER HFE implementation plan. Also in the design commitment column, please clarify what the term "relevant" means in the context of the second bullet.

ANSWER:

The US-APWR technical report "US-APWR Human System Interface Verification and Validation (Phase 1a) MUAP-08014-P Revision 0" which was submitted in December 2008, documented completion of the OER program element. Therefore, ITAAC #2 will be deleted. MHI's intention to delete this ITAAC was already documented in the response to RAI 196, question 14.03.04-32, as follows;

"The US-APWR technical report "US-APWR Human System Interface Verification and Validation (Phase 1a) MUAP-08014-P Revision 0" has been submitted in December, 2008 which resolves the design acceptance criteria for the design commitment items for 1 and 2.

The ITAAC items 1 and 2 of US-APWR DCD Tier 1 Table 2.9-1 will be deleted."

14.03.09-2-1

Impact on DCD

ITAAC #2 of US-APWR DCD Tier 1 Table 2.9-1 will be deleted as Attachment 1 page 2.9-8.

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

6/11/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO. 372-2787 REVISION 1

SRP SECTION: 14.03.09 – HUMAN FACTOR ENGINEERING -
INSPECTIONS, TESTS, ANALYSES, AND ACCEPTANCE
CRITERIA

APPLICATION SECTION: 14.3.9

DATE OF RAI ISSUE: 5/20/2009

QUESTION NO. 14.03.09-3

V&V

After reviewing ITAAC 8, the staff is unclear how this ITAAC will fulfill the implementation plans for verification and validation activities. The design commitment is not clear, in that, it does not provide a statement that would lead back to the implementation procedures so that they could be implemented or verified. Please clarify for the staff whether the statement given for the design commitment column for ITAAC 8 means the V&V activities for the HFE process will be implemented in accordance with V&V implementation plan.

Also, in the Acceptance Criteria column, the wording appears to be the same as each of their respective design commitments. This approach to ITAAC does not seem to be consistent with the NUREG-0800 Section 14.3 description for acceptance criteria. Where it states that:

...In some cases, the acceptance criteria may be more general because the detailed supporting information in Tier 2 does not lend itself to concise verification...

NUREG-0800 Section 14.3 goes on to give an example of how, in these types of situations, the applicant will specify a method (usually a report of some sort) to verify that the commitments are met. It also states that Tier 2 is where the detailed supporting information would be provided to validate the report. The acceptance criteria wording does not provide information that a report will be available. Please clarify if a report that documents the results of conducting the V&V implementation plan, and the results of the analyses and inspections for ITAAC 8, will be provided.

14.03.09-3-1

ANSWER:

ITAAC #8 for Verification and Validation will be revised as shown below, to ensure this program element is conducted in accordance with the V&V Implementation Plan documented in Tier 2, DCD Chapter 18.10, and the overall HFE Program Implementation Procedure documented in the US-APWR HSI Design Report (to be submitted by June 30, 2009). This revision also eliminates the duplication between the Design Commitment and the Acceptance Criteria.

Impact on DCD

ITAAC #8 in Table 2.9-1 will be revised as Attachment 1 page 2.9-16.

Design Commitment

The HFE verification and validation (V&V) program ensures the following:

- 1) HSI task analysis encompasses a representative range of risk important operational scenarios, events, transients and accidents
- 2) The inventory and characteristics of the alarms, information, and controls support the tasks generated by the function-based task analyses and the operational sequence analyses, and the HSI design is consistent with the HSI design style guide.
- 3) The integrated HSI system supports the safe operation of the plant.

The V&V activities are conducted in accordance with an implementation procedure that reflects the requirements of the V&V Implementation Plan.

Acceptance Criteria

~~The as-built V&V program includes the following activities:~~

- ~~1) HSI task support verification for risk important operational scenarios, events, transients and accidents.~~
- ~~2) HSI design verification demonstrates that the alarms, information, and controls match the display and control requirements generated by the function-based task analyses and the operational sequence analyses, and the HSI design is consistent with the HSI design style guide.~~
- ~~3) Integrated system validation demonstrates that the HSI system supports the safe operation of the plant.~~

A report exists that documents the V&V activities, demonstrates that the V&V has been performed in compliance with the V&V Implementation Plan, and concludes that the HSI has been adequately verified and validated.

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

6/11/2009

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

RAI NO.: NO. 372-2787 REVISION 1

SRP SECTION: 14.03.09 – HUMAN FACTOR ENGINEERING -
INSPECTIONS, TESTS, ANALYSES, AND ACCEPTANCE
CRITERIA

APPLICATION SECTION: 14.3.9

DATE OF RAI ISSUE: 5/20/2009

QUESTION NO. 14.03.09-4

DESIGN IMPLEMENTATION

Please clarify how the design implementation ITAAC will be conducted in accordance with its associated implementation plan. The current wording in ITAAC #9 design commitment column does not clearly connect the two.

NUREG-0800, Section 14.3 guidance gives this example for acceptance criteria:

In general, the acceptance criteria should be objective and unambiguous. In some cases, the acceptance criteria may be more general because the detailed supporting information in Tier 2 does not lend itself to concise verification. For example, the acceptance criteria for the design integrity of piping and structures may be that a report "exists" that concludes the design commitments are met. In these cases, Tier 2 provides the detailed supporting information on multiple interdependent parameters that should be provided in order to demonstrate that a satisfactory report exists.

The ITAAC 9 acceptance criteria wording is unclear in 1) ensuring that the design implementation process is conducted by the implementation plan and 2) describing that the output of conducting the design implementation procedure will yield results that are consistent with the implementation plan.

In the acceptance criteria column of ITAAC 9, the staff notes that two of the three criteria from section 12.4.6 are included, but the third criteria (#2, in section 12.4.6) has not been included. Please clarify why this acceptance criterion has omitted the need to verify that the final HSIs, procedures and training match the design that is a result of the HFE process and V&V activities. Also, please clarify the reason for including the second bullet point in the design implementation ITAAC acceptance criteria column that deals with

14.03.09-4-1

assigning a risk significance level to HAs.

ANSWER:

The ITAAC #9 acceptance criterion is modified for clarification of;

- 1) ensuring that the design implementation process is in accordance with the Design Implementation Plan, documented in Tier 2, DCD Chapter 18.11, and the overall HFE Program Implementation Procedure documented in the US-APWR HSI Design Report (to be submitted by June 30, 2009)
- 2) ensuring that the design that is implemented (i.e., the "as-built" design) accurately reflects the verified and validated design.

The current second bullet regarding assigning a risk significance level to HAs will be deleted.

Impact on DCD

ITAAC #9 of Tier 1 Table 2.9-1 will be revised as Attachment 1 page 2.9-18.

Design Commitment

The design that is implemented (i.e., the "as-built" HSI design, including procedures) accurately reflects the verified and validated design, with appropriate modifications. Conformance to the verified and validated design is confirmed in accordance with an implementation procedure that reflects the requirements of the Design Implementation Plan. Modifications from the verified and validated design, such as resolution of outstanding HFE-related issues from the verification and validation program, changes from the verified and validated design or other design features that were not included in the simulator verification and validation, are evaluated using an appropriate V&V method.

Acceptance Criteria

~~The as-built HSI design reflects the verified and validated design. For any changes from that design, an HSI design implementation process is performed and documented as described below.~~

- ~~• Aspects of the HSI design that were not addressed in the HSI design V&V are evaluated using an appropriate V&V method. Aspects of the design addressed by this criterion may include design characteristics such as new or modified displays for plant~~

~~specific design features and features that cannot be evaluated in a simulator, such as control room lighting and noise~~

- ~~• The potential impact on HAs is assessed and a risk significance level is assigned according to the potential impact on plant safety functions~~
- ~~• In addition, all issues documented in the HFE issue tracking system are verified to be adequately addressed. A report exists that documents the as-built HSI design, demonstrates that the HSI design has been implemented in accordance with the Design Implementation Plan, and concludes that the as-built HSI design is the same as the design verified and validated in the simulator, or that any changes from the simulator design have been confirmed using adequate supplemental V&V methods.~~

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

6/11/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.: NO. 372-2787 REVISION 1

SRP SECTION: 14.03.09 – HUMAN FACTOR ENGINEERING -
INSPECTIONS, TESTS, ANALYSES, AND ACCEPTANCE
CRITERIA

APPLICATION SECTION: 14.3.9

DATE OF RAI ISSUE: 5/20/2009

QUESTION NO. 14.03.09-5

HSI/PROCEDURES/TRAINING

The starting assumptions for the review of Section 2.9 and the ITAACs listed in Table 2.9-1 of Tier 1, were that the implementation plans contained sufficient detail to ensure the COL applicant can complete the respective HFE element, and that each ITAAC would explicitly address the completion of each HFE program element within Section 18.

Please provide clarification for the following:

1. The design commitment for ITAAC #7 in Table 2.9-1 states:

The scope of HSI design, procedures and training, which are developed and/or evaluated by the HFE program, includes operations, accident management, maintenance, tests, inspections and surveillances that are important to safety.

After reviewing ITAAC #7, in conjunction with section 2.9.1.3 of the US-APWR DCD, the staff is unclear how this ITAAC will fulfill the implementation plans for HSI design, procedure development and training development. The design commitment does not relate to how the HSI design (or procedures and training) has been developed in accordance with approved implementation plans; the commitment is merely limited to describing the "scope" of the HSI design, etc., which is only part of an overall HSI design methodology.

Please clarify for the staff whether the statement given for the design commitment column for ITAAC #7 means the HSI design, procedures development, and training development for the HFE process will be implemented in accordance with their respective implementation plans.

As well, it is suggested that, for clarity and conformity, the current single ITAAC commitment should be separated into three statements, HSI design, procedures, and training, as these are three distinct HFE elements.

2. The acceptance criteria for 7a states:

The design documentation exists to verify that panels and associated instrumentation, within the scope of the HFE program, comply with General Design Criteria 1 in Appendix A to 10 CFR 70 for quality standards and records.

Please clarify why 10 CFR 70 was referenced and not 10 CFR 50.

3. ITAAC #7 provides fourteen design commitments, or parts (a through n), that include HSI design, procedures, and training. In the Acceptance Criteria column, the wording appears to be the same as each of their respective design commitments. This approach to ITAAC does not seem to be consistent with the NUREG-0800 Section 14.3 description for acceptance criteria. Where it states that:

...In some cases, the acceptance criteria may be more general because the detailed supporting information in Tier 2 does not lend itself to concise verification...

NUREG-0800 Section 14.3 goes on to give an example of how, in these types of situations, the applicant will specify a method (usually a report of some sort) to verify that the commitments are met. It also states that Tier 2 is where the detailed supporting information would be provided to validate the report. The acceptance criteria wording does not indicate that a report will be available. Please clarify if a report will be provided that documents the results of conducting the HSI implementation plan (and for procedures and training), and the results of the analyses and inspections for ITAAC 7.

ANSWER:

1. The current ITAAC #7 will be divided into "7. HSI Design", "8. Procedure Development", and "9. Training Program Development". The current 7m and 7n is moved and renamed as "8a" and "9a" of "8. Procedure Development" and "9. Training Program Development", respectively. In addition, each ITAAC will be revised to clearly commit to an HFE process for the HSI design (or procedures or training) that is in accordance with approved implementation plans.

2. "10 CFR 70" in the acceptance criteria for 7a should have been stated "10 CFR 50". That was an editorial error so that MHI will make editorial change of "10 CFR 70" to "10 CFR 50" in the acceptance criteria for 7a.

3. The Acceptance Criteria will be revised to clearly state that reports will be available for ITAAC #7, and for new ITAAC #8 and #9 (procedures and training, respectively).

Impact on DCD

1. The current ITAAC #7 will be divided into "7. HSI Design", "8. Procedure Development", and "9. Training Program Development". The current 7m and 7n is moved and renamed as "8a" and "9a" of "8. Procedure Development" and "9. Training Program Development", respectively. In addition, each ITAAC will be revised to clearly commit to an HFE process for the HSI design (or procedures or training) that is in accordance with approved implementation plans and with clarification of statement that reports will be available, as the Attachment 1 page 2.9-11, 2.9-15 to 2.9-19 including editorial changes (Section number renaming).

ITAAC #7 (HSI Design)

Design Commitment

The scope of HSI design, procedures and training, which are is developed and/or evaluated by the HFE program, includes operations, accident management, maintenance, tests, inspections and surveillances that are important to safety. The HSI design process is conducted in accordance with an implementation procedure that reflects the requirements of the HSI Design Implementation Plan.

Inspection, Test, Analysis

An analysis inspection will be performed of the HSI design, procedures, and training for operations, accident management, maintenance, tests, inspections and surveillances.

Acceptance Criteria

The HSI design, procedures, and training A report exists that documents the HSI design for operations, accident management, maintenance, tests, inspections and surveillances that are important to safety, and demonstrates that the design process has been conducted in compliance with the HSI Design Implementation Plan. have been developed and/or evaluated by the HFE program.

ITAAC #8 (Procedures)

Design Commitment

The scope of procedures, which is developed and/or evaluated by the HFE program, includes operations, accident management, maintenance, tests, inspections and surveillances that are important to safety. The procedures guide and support human interactions with plant systems and control plant-related events and activities. The procedure development is conducted in accordance with an implementation procedure that reflects the requirements of the Procedure Development Implementation Plan.

Inspection, Test, Analysis

An inspection of the as-built procedures will be performed for operations, accident management, maintenance, tests, inspections and surveillances.

Acceptance Criteria

A report exists that documents the procedures for accident management, maintenance, tests, inspections and surveillances that are important to safety. The report demonstrates that the procedure development process has been conducted in compliance with the Procedure Development Implementation Plan.

ITAAC #9 (Training)

Design Commitment

The scope of training, which is developed and/or evaluated by the HFE program, includes operations, accident management, maintenance, tests, inspections and surveillances that are important to safety. The training provided to operations and maintenance personnel is acceptable to maintain plant safety and respond to abnormal plant conditions. The training program has been development in accordance with an implementation procedure that reflects the requirements of the Training Program Development Implementation Plan.

Inspection, Test, Analysis

An inspection of the as-built training program will be performed for operations, accident management, maintenance, tests, inspections and surveillances.

Acceptance Criteria

A report exists that documents the training program for accident management, maintenance, tests, inspections and surveillances that are important to safety. The report demonstrates that the training program has been developed in compliance with the Training Program Development Implementation Plan.

2. "10 CFR 70" in the acceptance criteria for 7a will be revised "10 CFR 50" as the Attachment 1 page 2.9-11

Impact on COLA

There is no impact on the COLA

Impact on PRA

There is no impact on the PRA

This completes MHI's responses to the NRC's questions.

Attachment 1

US-APWR DCD Tier 1 Section 2.9 Mark-up

RESPONSE TO RAI No. 372-2787 Revision 1

Table 2.9-1 Human Factors Engineering Inspections, Tests, Analyses, and Acceptance Criteria (Sheet 142 of 78)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
<p>1. HFE program is implemented by a qualified HFE design team.Deleted.</p>	<p>1. An analysis will be performed of the experience and training records of HFE design team.Deleted.</p>	<p>1. HFE program is implemented by a qualified HFE design team.Deleted.</p>
<p>2. Operating experience review (OER) implements the following process: — Extracting and screening HFE-related issues to identify those relevant to HSI System. — Evaluating relevant issues. Conducting HFE issues resolution process.Deleted.</p>	<p>2. An analysis of the OER process will be performed.Deleted.</p>	<p>2. The OER evaluation is performed, and associated HFE issues and resolutions have been entered into the HFE Issues tracking system.Deleted.</p>
<p>3. Human reliability analysis (HRA) is conducted as an integrated activity to support both the HFE design process and Probabilistic Risk Assessment (PRA) activities.Deleted.</p>	<p>3. The HRA will be performed.Deleted.</p>	<p>3. An HRA report exists which contains the following: — Critical Human Actions (HAs) extracted from the PRA results — An evaluation of these HAs which concludes one of the following: • The assumptions in the PRA regarding the HSI design and the operating procedures are correct and therefore form a sound basis for human error probabilities. • The assumptions in the PRA are not correct. The HFE issue tracking system manages these issues as further evaluation items (see ITAAC #9). — In addition the HRA report provides requirements for subsequent HFE program elements (e.g., detailed HSI design, validation testing, human performance monitoring) to ensure these HAs are properly considered throughout the HSI design life cycle. The HRA provides inputs for other HFE design process elements and the optimization of the HSI design.Deleted.</p>

Table 2.9-1 Human Factors Engineering Inspections, Tests, Analyses, and Acceptance Criteria (Sheet 212 of 78)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
<p>4. A functional allocation and functional requirements analysis (FA/FRA) is performed to ensure that safety functions are assigned properly as human actions (HAs) or to automated systems. Deleted.</p>	<p>4. The FA/FRA will be performed. Deleted.</p>	<p>4. A FA/FRA report exists in which the safety function allocations are evaluated according to human factor perspective using past experience and/or engineering analysis to conclude one of the following: The safety function is properly assigned as HAs or to automated systems. The safety function is not properly assigned. The HFE issue tracking system manages these issues as further evaluation items (see ITAAC #9). The safety functions is properly assigned as the HAs or to automated systems. Deleted.</p>

Table 2.9-1 Human Factors Engineering Inspections, Tests, Analyses, and Acceptance Criteria (Sheet 412 of 78)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
<p>6. A staffing and qualifications analysis is performed to ensure that personnel are acceptable to permit realistic response to normal and emergency plant conditions. <u>The analysis is conducted in accordance with an implementation procedure that reflects the requirements of the Staffing and Qualifications Implementation Plan.</u></p>	<p>6. The staffing and qualifications analysis will be performed.</p>	<p>6. <u>A report exists that documents the staffing and qualifications analysis, demonstrates that the analysis has been performed in compliance with the Staffing and Qualifications Implementation Plan, and concludes from a human factors point of view that the staffing and qualifications of plant personnel are acceptable to perform safety significant tasks for normal and emergency operations.</u> A staffing report exists which concludes from a human factors point of view that the staffing and qualifications of plant personnel are acceptable to perform safety significant tasks for normal and emergency operations. The staffing and qualifications of plant personnel are acceptable for normal and emergency operations.</p>
<p>7. The scope of HSI design, procedures and training, which is developed and/or evaluated by the HFE program, includes operations, accident management, maintenance, tests, inspections and surveillances that are important to safety. <u>The HSI design process is conducted in accordance with an implementation procedure that reflects the requirements of the HSI Design Implementation Plan.</u></p>	<p>7. An analysis <u>inspection</u> will be performed of the HSI design, procedures, and training for operations, accident management, maintenance, tests, inspections and surveillances.</p>	<p>7. The HSI design, procedures, and training A report exists that documents the HSI design for operations, accident management, maintenance, tests, inspections and surveillances that are important to safety, and demonstrates that the design process has been conducted in compliance with the HSI Design Implementation Plan. <u>have been developed and/or evaluated by the HFE program.</u></p>
<p>7a. HSI panels and associated instrumentation, within the scope of the HFE program, comply with quality standards and records.</p>	<p>7a. An analysis will be performed of the panels and associated instrumentation within the scope of the HFE program.</p>	<p>7a. The design documentation exists to verify that panels and associated instrumentation, within the scope of the HFE program, comply with General Design Criteria 1 in Appendix A to 40 CFR 7010 CFR 50 for quality standards and records.</p>

Table 2.9-1 Human Factors Engineering Inspections, Tests, Analyses, and Acceptance Criteria (Sheet 842 of 78)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
<p>8. <u>The scope of procedures, which is developed and/or evaluated by the HFE program, includes operations, accident management, maintenance, tests, inspections and surveillances that are important to safety. The procedures guide and support human interactions with plant systems and control plant-related events and activities. The procedure development is conducted in accordance with an implementation procedure that reflects the requirements of the Procedure Development Implementation Plan.</u></p>	<p>8. <u>An inspection of the as-built procedures will be performed for operations, accident management, maintenance, tests, inspections and surveillances.</u></p>	<p>8. <u>A report exists that documents the procedures for accident management, maintenance, tests, inspections and surveillances that are important to safety. The report demonstrates that the procedure development process has been conducted in compliance with the Procedure Development Implementation Plan.</u></p>
<p>8a7m. <u>The procedures development process ensures that procedures guide and support human interactions with plant systems and control plant-related events and activities.</u></p>	<p>8a7m. <u>An inspection of the as-built procedures development process will be performed.</u></p>	<p>8a7m. <u>The as-built procedures exist to support functions important to ensuring plant safety during normal and abnormal operating conditions. These procedures conform to the Procedure Writer's Guide.</u></p>
<p>9. <u>The scope of training, which is developed and/or evaluated by the HFE program, includes operations, accident management, maintenance, tests, inspections and surveillances that are important to safety. The training provided to operations and maintenance personnel is acceptable to maintain plant safety and respond to abnormal plant conditions. The training program has been development in accordance with an implementation procedure that reflects the requirements of the Training Program Development Implementation Plan.</u></p>	<p>9. <u>An inspection of the as-built training program will be performed for operations, accident management, maintenance, tests, inspections and surveillances.</u></p>	<p>9. <u>A report exists that documents the training program for accident management, maintenance, tests, inspections and surveillances that are important to safety. The report demonstrates that the training program has been developed in compliance with the Training Program Development Implementation Plan.</u></p>

Table 2.9-1 Human Factors Engineering Inspections, Tests, Analyses, and Acceptance Criteria (Sheet 942 of 78)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
<p>9a7a. The training development process ensures that training provided to operations and maintenance personnel is acceptable to maintain plant safety and respond to abnormal plant conditions.</p>	<p>9a7a. An inspection of the as-built training development process will be performed.</p>	<p>9a7a. The as-built training program includes <u>plant operations and maintenance activities which are important to maintain plant safety and respond to abnormal plant conditions. The training material conforms the Training Developer's Guide, exists to support functions important to ensuring plant safety during normal and abnormal operating conditions.</u></p>
<p>108. The HFE verification and validation (V&V) program ensures the following:</p> <ol style="list-style-type: none"> 1) HSI task analysis encompasses a representative range of risk important operational scenarios, events, transients and accidents 2) The inventory and characteristics of the alarms, information, and controls support the tasks generated by the function-based task analyses and the operational sequence analyses, and the HSI design is consistent with the HSI design style guide. 3) The integrated HSI system supports the safe operation of the plant. <p><u>The V&V activities are conducted in accordance with an implementation procedure that reflects the requirements of the V&V Implementation Plan.</u></p>	<p>108. An inspection of the as-built HFE V&V activities will be performed.</p>	<p>108. The as-built HFE V&V program includes the following activities:</p> <ol style="list-style-type: none"> 1) HSI task support verification includes plant operations and maintenance activities which are important to maintain plant safety and respond to abnormal plant conditions. The training material conforms the Training Developer's Guide, for risk important operational scenarios, events, transients and accidents. 2) HSI design verification demonstrates that the alarms, information, and controls match the display and control requirements generated by the function-based task analyses and the operational sequence analyses, and the HSI design is consistent with the HSI design style guide. 3) Integrated system validation demonstrates that the HSI system supports the safe operation of the plant. <u>A report exists that documents the V&V activities, demonstrates that the V&V has been performed in compliance with the V&V Implementation Plan, and concludes that the HSI has been adequately verified and validated.</u>

Table 2.9-1 Human Factors Engineering Inspections, Tests, Analyses, and Acceptance Criteria (Sheet 1012 of 78)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
108a. HED resolution during V&V is performed iteratively throughout all V&V activities.	108a. An inspection of the as-built implementation of HED resolution during the HFE as-built V&V process will be performed.	108a. HEDs are identified and addressed iteratively throughout all V&V activities and there are no safety significant unresolved HEDs in the final design. The as-built HEDs is identified and addressed in the final design.
108b. HSI in the MCR permits execution of tasks by operators to establish operations, accident management, maintenance, test, inspection and surveillances for those systems that are important to safety.	108b. Tests will be performed on the execution of representative tasks by the actual MCR operators.	108b. Test results demonstrate that the as-built MCR HSI can establish operations, accident management, maintenance, test, inspection and surveillances for those systems that are important to safety.
108c. HSI at the RSC permits execution of tasks by operators to establish and maintain cold shutdown.	108c. Tests will be performed on the execution of tasks for the as-built RSC.	108c. Test results demonstrate that actual operators can establish and maintain cold shutdown from the as-built RSC.

Table 2.9-1 Human Factors Engineering Inspections, Tests, Analyses, and Acceptance Criteria (Sheet 1142 of 78)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
<p>119. The HSI design that is implemented (i.e., the "as-built" design, including procedures) accurately reflects the verified and validated HSI design, with appropriate modifications. Conformance to the verified and validated design is confirmed in accordance with an implementation procedure that reflects the requirements of the Design Implementation Plan. Modifications from the verified and validated design, such as resolution of outstanding HFE-related issues from the verification and validation program, changes from the verified and validated design or other design features that were not included in the simulator verification and validation, are evaluated using an appropriate V&V method.</p>	<p>119. An inspection of the as-built HFE-HSI design implementation process will be performed.</p>	<p>119. The as-built HSI design reflects the verified and validated design. For any changes from that design, an HSI-A HFE design implementation process is performed and documented as described below:</p> <ul style="list-style-type: none"> — The as-built design implementation methodology includes the following criteria: • Aspects of the HSI design that were not addressed in the HSI design V&V are evaluated using an appropriate V&V method. Aspects of the design addressed by this criterion may include design characteristics such as new or modified displays for plant-specific design features and features that cannot be evaluated in a simulator, such as control room lighting and noise • The potential impact on HAs is assessed and a risk significance level is assigned according to the potential impact on plant safety functions in accordance with the criteria in Reference 18.11-1 • In addition, All HFE-related issues documented in the HFE issue tracking system are verified to be adequately addressed. <p><u>A report exists that documents the as-built HSI design, demonstrates that the HSI design has been implemented in accordance with the Design Implementation Plan, and concludes that the as-built HSI design is the same as the design verified and validated in the simulator, or that any changes from the simulator design have been confirmed using adequate supplemental V&V methods.</u></p>

Table 2.9-1 Human Factors Engineering Inspections, Tests, Analyses, and Acceptance Criteria (Sheet 1242 of 78)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
<p>1240. Human Performance issues are identified as HEDs and are tracked and dispositioned in accordance with the site specific QA program..</p>	<p>1240. An inspection of the as-built human performance monitoring process will be performed.</p>	<p>1240. A human performance monitoring strategy is developed and documented. The US-APWR HFE procedure guides the human performance monitoring for the life of the plant and the process to identify and disposition human performance issues. This human performance monitoring procedure is applicable after the completion of integrated HSI validation and operator training. This process evaluates the impact of facility design and operating changes and addresses the following topics:</p> <ul style="list-style-type: none"> • Human performance monitoring includes confirmation of the following criteria: <ul style="list-style-type: none"> - Effectiveness of HSIs - Personnel performance impacts of HSI, procedure, and training changes - Operator actions meet time and performance criteria - Human performance criteria established during integrated system validation are maintained • Human Performance Trending includes the following: <ul style="list-style-type: none"> - Performance degradation - Failures - Detection sensitivity - Safety Importance • Human performance evaluation criteria includes the following: <ul style="list-style-type: none"> - Specific cause determination - Safety Importance - Feedback of information - Corrective actions