



HITACHI

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Proprietary Notice

This letter forwards proprietary information in accordance with 10 CFR 2.390. Upon the removal of Enclosure 2, the balance of this letter may be considered non-proprietary.

MFN 09-263

Docket No. 52-010

May 7, 2009

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

Subject: Submittal of Response to Portion of NRC Request for Additional Information Letter No. 310 Related to ESBWR Design Certification Application Chapter 18 - Human Factors Engineering - RAI Numbers 18.8-2 S03, 18.8-35 S04, 18.8-50 S02, 18.8-51 S02, 18.8-52 S02, 18.8-53 S01, 18.8-54 S01, 18.8-55 S01, 18.8-56 S01, 18.8-57 S01, 18.8-58 S01, 18.8-59 S02.

The purpose of this letter is to submit the GE Hitachi Nuclear Energy (GEH) responses to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAIs) sent by NRC letter No. 310, dated February 26, 2009 (Reference 1). Verified LTR changes associated with this RAI response are identified in the enclosed markups by enclosing the text within a black box.

Enclosure 1 provides the GEH responses to the subject RAIs as requested in Reference 1. Enclosures 2 and 3 provide the associated document markups.

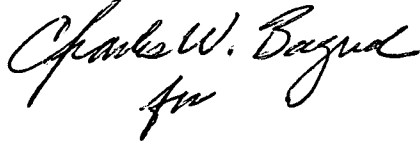
Enclosure 2 contains GE Hitachi Nuclear Energy (GEH) proprietary information as defined by 10 CFR 2.390. GEH customarily maintains this information in confidence and withholds it from public disclosure. A non-proprietary version is provided in Enclosure 3.

The affidavit contained in Enclosure 4 identifies that the information contained in Enclosure 2 has been handled and classified as proprietary to GEH. GEH hereby requests that the information of Enclosure 2 be withheld from public disclosure in accordance with the provisions of 10 CFR 2.390 and 9.17.

DRB
HRW

If you have any questions or require additional information, please contact me.

Sincerely,

A handwritten signature in cursive script, appearing to read "Charles W. Bayard".

Richard E. Kingston
Vice President, ESBWR Licensing

References:

1. MFN 09-151 - Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request For Additional Information Letter No. 310 Related To ESBWR Design Certification Application, dated February 26, 2009*

Enclosures:

1. MFN 09-263 – Response to Portion of NRC Request for Additional Information Letter No. 310 Related to ESBWR Design Certification Application Chapter 18 - Human Factors Engineering - RAI Numbers 18.8-2 S03, 18.8-35 S04, 18.8-50 S02, 18.8-51 S02, 18.8-52 S02, 18.8-53 S01, 18.8-54 S01, 18.8-55 S01, 18.8-56 S01, 18.8-57 S01, 18.8-58 S01, 18.8-59 S02
2. MFN 09-263 - Markups for Response to Portion of NRC Request for Additional Information Letter No. 310 Related to ESBWR Design Certification Application Chapter 18 - Human Factors Engineering - RAI Numbers 18.8-2 S03, 18.8-35 S04, 18.8-50 S02, 18.8-51 S02, 18.8-52 S02, 18.8-53 S01, 18.8-54 S01, 18.8-55 S01, 18.8-56 S01, 18.8-57 S01, 18.8-58 S01, 18.8-59 S02 – Proprietary Version
3. MFN 09-263 – Markups for Response to Portion of NRC Request for Additional Information Letter No. 310 Related to ESBWR Design Certification Application Chapter 18 - Human Factors Engineering - RAI Numbers 18.8-2 S03, 18.8-35 S04, 18.8-50 S02, 18.8-51 S02, 18.8-52 S02, 18.8-53 S01, 18.8-54 S01, 18.8-55 S01, 18.8-56 S01, 18.8-57 S01, 18.8-58 S01, 18.8-59 S02 – Non-Proprietary Version
4. Affidavit – Larry J. Tucker

cc: AE Cubbage USNRC (with enclosure)
JG Head GEH/Wilmington (with enclosures)
DH Hinds GEH/Wilmington (with enclosures)
RE Kingston GEH/Wilmington (with enclosures)
eDRF Section 0000-0099-4588

Enclosure 1

MFN 09-263

**Response to Portion of NRC Request for
Additional Information Letter No. 310
Related to ESBWR Design Certification Application**

Chapter 18 - Human Factors Engineering

**RAI Numbers 18.8-2 S03, 18.8-35 S04, 18.8-50 S02,
18.8-51 S02, 18.8-52 S02, 18.8-53 S01, 18.8-54 S01,
18.8-55 S01, 18.8-56 S01, 18.8-57 S01, 18.8-58 S01,
18.8-59 S02**

NRC RAI 18.8-2 S03

For RAI 18.8-2 S02, related to the HSI Design Review Element, HSI Detailed Design and Integration Review Criteria, Criterion 1 (NUREG-0711 Section 8.4.5) GEH provided acceptable additional information in the response, but did not incorporate the information into the DCD. However, when an RAI response contains direction on how work will be done, then that information needs to be included in the DCD (or a document incorporated by reference). Therefore, the staff requests that GEH incorporate the information contained in the MFN into an appropriate source document. One acceptable way to accomplish this expeditiously is to incorporate the information verbatim from the RAI response as an appendix in the HSI Design implementation plan.

GEH Response

Appendix A will be added to NEDO 33268; it incorporates the content of the RAI 18.8-2 S02 response needed to support HSI Detailed Design and Integration Review Criteria, Criterion 1 (NUREG-0711 Section 8.4.5). The following is a summary of the changes to Appendix A from RAI 18.8-2 S02 response:

- Added a note that a basis for each requirement is documented.
- Added a note that the team performing the process is assigned per NEDE/NEDO 33217P.
- Format is modified eliminating the "Responsibility" column in favor of the team note above.
- Added sub-paragraph to include identification of constraints related to minimum inventory information from DCD Chapter 18. This change was made based on GEH response to RAI 18.5-27 S03.
- Added consideration of crewmembers' roles and responsibilities to the section related to laying out HSIs on the control panels. This change was made in response to RAI 18.8-54 S01.
- Several minor wording changes to make the response more appropriate as an Appendix to NEDO 33268.

DCD Impact

No DCD changes will be made in response to this RAI.

LTR NEDO-33268, Rev 3 will be revised as noted in the attached markups.

NRC RAI 18.8-35 S04

In RAI 18.8-35, the staff requested additional detail on how human-system interface (HSI) tests and evaluations are performed. A significant amount of information was provided addressing many of the criteria in NUREG-0711 Section 8.4.6. However, the methods to be used to address the following aspects of performance-based tests were not discussed:

- The specific design features or characteristics of design features should be carefully defined. If the characteristics are to be manipulated in the test, i.e., systematically varied, the differences between test conditions should be specified in detail. (NUREG-0711 section 8.4.6.2(3))*
- The selection of testbeds for the conduct of performance-based tests should be based upon the requirements imposed by the test hypotheses and the maturity of the design. (Section 8.4.6.2(4))*
- The test design should permit the observation of performance in a manner that avoids or minimizes bias, confounds, and error variance (noise). (Section 8.4.6.2(7))*
- Design solutions, such as modifications of the HSIs or user training requirements, should be developed to address problems that are identified during the testing and evaluation of the HSI detailed design.*
- Please provide information on the methodology to address these aspects of performance-based tests. (Section 8.4.6.2(9))*

Please provide information pertaining to these aspects of the tests.

Note that since this RAI requests direction on how work will be done, then that information needs to be included in the DCD (or a document incorporated by reference). Therefore, the staff requests that GEH incorporate the information contained in MFN 08-655 as augmented or modified by this supplement into an appropriate source document. One acceptable way to accomplish this expeditiously is to incorporate the information as an appendix in the HSI Design implementation plan.

GEH Response

Appendix B will be added to NEDO 33268 to incorporate the content of the RAI 18.8-35 S03 response needed to support the review criteria in NUREG-0711 Section 8.4.6.

Included in Appendix B are the methods to be used to address the aspects of performance-based tests requested in this supplement to the RAI. These additions are described as follows:

- | | |
|---------|--|
| Aspect: | <i>The specific design features or characteristics of design features should be carefully defined. If the characteristics are to be manipulated in the test, i.e., systematically varied, the differences between test conditions should be specified in detail. (NUREG-0711 section 8.4.6.2(3))</i> |
|---------|--|

Response: Revised paragraph B.1(1) in Appendix B to include evaluation of specific design features and characteristics to be tested and systematically varied, if applicable. In addition, revised the Evaluation Request Form, Figure B-1, to require that the specific design features or characteristics to be tested are documented. Paragraph B.3, Performance Based Evaluation Option, uses the inputs to establish the test design. The HFE Performance Test Methods and Measures Form, Figure B-4, contains additional steps to describe specific variations in design features or characteristics, and test conditions to be tested.

Aspect: *The selection of testbeds for the conduct of performance-based tests should be based upon the requirements imposed by the test hypotheses and the maturity of the design. (Section 8.4.6.2(4))*

Response: Added paragraph B3.4 in Appendix B to select a testbed considering the hypothesis created in conjunction with the maturity of the design including several indicators to consider. The hypothesis is established in Figure B-4.

Aspect: *The test design should permit the observation of performance in a manner that avoids or minimizes bias, confounds, and error variance (noise). (Section 8.4.6.2(7))*

Response: Added information describing methods to be used to reduce bias, confounds, and error variance in paragraph B.3(10) of Appendix B. Also added a note in that section describing differences between early testing used to develop the design and later testing used to assess the design with less bias.

Aspect: *Design solutions, such as modifications of the HSIs or user training requirements, should be developed to address problems that are identified during the testing and evaluation of the HSI detailed design.*

Response: Issues identified during testing are resolved during the design process as described in Appendix A paragraphs A.6(3), A.7(16), A.8(8), and A.8(12) to NEDO 33268 (See Appendix A in the enclosure related to GEH response to RAI 18.8-2 S03). Added a statement to Appendix B paragraph B.3(13) to include recommendations from the results of performance based tests in the test report.

The following is a summary of changes to Appendix B from the RAI 18.8-35 S03 response:

- Added a note that the team performing the process is assigned per NEDE/NEDO 33217P.
- Format is modified eliminating the "Responsibility" column in favor of the team note above.
- Revised discussion of how sample sizes are chosen to better reflect ESBWR design development expectations see paragraph B.3(9) of the enclosure.

- Added section to document participant population pool to figure B-4
- Attachments 1 through 7 from RAI 18.8-35 S03 are now Figures B-1 through B-7 respectively in the enclosure.
- Several minor wording changes to make the incorporation into NEDO 33268 as an appendix more appropriate.

DCD Impact

No DCD changes will be made in response to this RAI.

LTR NEDO-33268, Rev 3 will be revised as noted in the attached markups.

NRC RAI 18.8-50 S02

For RAI 18.8-50 S01, related to the HSI Design Review Element, Concept of Operations Review Criteria, Criterion 1 (NUREG-0711 Section 8.4.2) GEH provided acceptable additional information in the response, but did not incorporate the information into the DCD. However, when an RAI response contains direction on how work will be done, then that information needs to be included in the DCD (or a document incorporated by reference). Therefore, the staff requests that GEH incorporate the information contained in the MFN into an appropriate source document. One acceptable way to accomplish this expeditiously is to incorporate the information verbatim from the RAI response as an appendix in the HSI Design implementation plan.

GEH Response

Appendix A will be added to NEDO 33268 per RAI 18.8-2 S03. This Appendix includes work process paragraphs similar to those used in response to RAI 18.8-50 S01. For reference, the paragraphs of Appendix A that apply to this RAI are A.1 (1) through (8).

DCD Impact

No DCD changes will be made in response to this RAI.

LTR NEDO-33268, Rev 3 will be revised as noted in the attached markups.

NRC RAI 18.8-51 S02

NEDO-33268, Revision 3, Section 3.1.3 discusses HSI functional requirements for the HSIs in terms of their bases and application to HSIs reflecting the two review criteria in this section. Figure 2 graphically illustrates the relationship between HSI functional requirements and other HSI design activities. Inputs to HSI functional requirements development are shown as functional requirements analysis (FRA), allocation of function (AOF), task analysis (TA) and staffing and qualifications analyses. Additional information is provided in Section 4.1.2 in terms of the contributions of FRA, AOF, TA and staffing and qualifications analyses to requirements development. In MFN 08-655, GEH provided an example of one input to the requirements development – Operating Experience Review (OER). However, OER is not identified in Section 3.1.3 or in Figure 2. OER is discussed in Section 4.2.2 as an appropriate input to concept design development, but not to HSI requirements. Clarification is needed.

Note that since this RAI requests direction on how work will be done, then that information needs to be included in the DCD (or a document incorporated by reference). Therefore, the staff requests that GEH incorporate the information contained in MFN 08-655 as augmented or modified by this supplement into an appropriate source document. One acceptable way to accomplish this expeditiously is to incorporate the information as an appendix in the HSI Design implementation plan.

GEH Response

To address the OER input to HSI requirements the following changes are provided in the markup enclosure:

- Section 3.1.3 will be revised to better indicate the OER input directly into the HSI requirements.
- Section 4.1.2 will be revised to indicate that OER is used to support development of HSI design requirements.
- Figure 2 will be revised to show OER input into the HSI functional requirements.

The response to RAI 18.8-51 S01 included paragraphs showing an example of how functional requirements are specified. Paragraphs similar to these are incorporated into NEDO 33268 via RAI 18.8-2 S03. For reference, the paragraphs of Appendix A that best apply to this RAI are A.2 (1), (2), (10), A.3 (7), A.4 (3), A.5 (6) A.6 (13) A.7 (18) A.8 (6), and A.8 (14). These paragraphs indicate development of functional requirements for the HSIs and recording them in the ESBWR requirements tracking database. Many of the attachments originally planned as a part of the HSI development work process, and mentioned in response to RAI 18.8-51 S01, have been eliminated in favor of recording information directly into the ESBWR requirements tracking database that contains the functional requirements. This was done to improve the efficiency of the work process.

DCD Impact

No DCD changes will be made in response to this RAI.

LTR NEDO-33268, Rev 3 will be revised as noted in the attached markups.

NRC RAI 18.8-52 S02

For RAI 18.8-52 S01, related to the HSI Design Review Element, HSI Detailed Design and Integration Review Criteria, Criterion 3 (NUREG-0711 Section 8.4.5) GEH provided acceptable additional information in the response but did not incorporate the information into the DCD. However, when an RAI response, contains direction on how work will be done, then that information needs to be included in the DCD (or a document incorporated by reference). Therefore, the staff requests that GEH incorporate the information contained in the MFN into an appropriate source document. One acceptable way to accomplish this expeditiously is to incorporate the information verbatim from the RAI response as an appendix in the HSI Design implementation plan.

GEH Response

Appendix A will be added to NEDO 33268 per RAI 18.8-2 S03. This Appendix includes work process paragraphs similar to those used in response to RAI 18.8-52 S01. For reference, the paragraphs of Appendix A that apply to this RAI are A.2 (4) through (6).

The response to RAI 18.8-52 S01 included responses related to RAIs 18.8-53 through 58. The process steps related to RAIs 18.8-53 S01 through 58 S01 are now included with their individual responses and not within this RAI response.

DCD Impact

No DCD changes will be made in response to this RAI.

LTR NEDO-33268, Rev 3 will be revised as noted in the attached markups.

NRC RAI 18.8-53 S01

The response to RAI 18.8-52 S01 in MFN 08-655 provided information related RAI 18.8-53. For RAI 18.8-53, related to the HSI Design Review Element, HSI Detailed Design and Integration Review Criteria, Criterion 4 (NUREG-0711 Section 8.4.5) GEH provided acceptable additional information in the response, but did not incorporate the information into the DCD. However, when an RAI response contains direction on how work will be done, then that information needs to be included in the DCD (or a document incorporated by reference). Therefore, the staff requests that GEH incorporate the information contained in the MFN into an appropriate source document. One acceptable way to accomplish this expeditiously is to incorporate the information verbatim from the RAI response as an appendix in the HSI Design implementation plan.

GEH Response

Appendix A will be added to NEDO 33268 per RAI 18.8-2 S03. This Appendix includes work process paragraphs similar to those used in response to RAI 18.8-52 S01 related to 18.8-53. For reference, the paragraphs of Appendix A that apply to this RAI, in the order presented in the original response, are A.1 (4), A.5 (3), A.1(8), A.2.(8), A.6(2), A.6 (3), A.6 (13), A.3 (6), A.6 (2), A.6 (6) through (8), A.2 (4) through (6), and A.6 (5) .

DCD Impact

No DCD changes will be made in response to this RAI.

LTR NEDO-33268, Rev 3 will be revised as noted in the attached markups.

NRC RAI 18.8-54 S01

In RAI 18.8-52 S01, GEH provided information on the layout of HSIs within consoles, panels, and workstations, which is related to RAI 18.8-54. With respect to consideration of operator roles, GEH indicated that crew member roles and responsibilities will be established for each functional task. However, no information is provided as to how that information will be used to support the determination of HSI layout. Please clarify.

Note that since this RAI requests direction on how work will be done, then that information needs to be included in the DCD (or a document incorporated by reference). Therefore, the staff requests that GEH incorporate the information contained in MFN 08-655 as augmented or modified by this supplement into an appropriate source document. One acceptable way to accomplish this expeditiously is to incorporate the information as an appendix in the HSI Design implementation plan.

GEH Response

Appendix A will be added to NEDO 33268 per RAI 18.8-2 S03. This Appendix includes work process paragraphs similar to those used in response to RAI 18.8-52 S01 related to RAI 18.8-54. For reference, the paragraphs of Appendix A that apply to this RAI are A.1 (3), A.6 (5), and A.6 (4). In addition, paragraph A.6 (5) in Appendix A includes consideration of the crewmembers' roles and responsibilities related to the HSI layout as follows:

"Establish the layout of equipment the operator will interface with on the control room panels considering, sequence of use, importance, historical layouts and frequency of use as guiding considerations. Also consider the crewmembers' roles and responsibilities to assure required sequential and parallel functional tasks can be performed in concert without confusion or interference. Use trade off studies (described in Appendix B), as appropriate, when several options present themselves."

DCD Impact

No DCD changes will be made in response to this RAI.

LTR NEDO-33268, Rev 3 will be revised as noted in the attached markups.

NRC RAI 18.8-55 S01

The response to RAI 18.8-52 S01 in MFN 08-655 provided information related RAI 18.8-55. For RAI 18.8-55, related to the HSI Design Review Element, HSI Detailed Design and Integration Review Criteria, Criterion 6 (NUREG-0711 Section 8.4.5) GEH provided acceptable additional information in the response, but did not incorporate the information into the DCD. However, when an RAI response contains direction on how work will be done, then that information needs to be included in the DCD (or a document incorporated by reference). Therefore, the staff requests that GEH incorporate the information contained in the MFN into an appropriate source document. One acceptable way to accomplish this expeditiously is to incorporate the information verbatim from the RAI response as an appendix in the HSI Design implementation plan.

GEH Response

Appendix A will be added to NEDO 33268 per RAI 18.8-2 S03. This Appendix includes work process paragraphs similar to those used in response to RAI 18.8-52 S01 related to RAI 18.8-55. For reference, the paragraphs of Appendix A that apply to this RAI are A.5 (1), A.5 (2), and A.6 (2)

DCD Impact

No DCD changes will be made in response to this RAI.

LTR NEDO-33268, Rev 3 will be revised as noted in the attached markups.

NRC RAI 18.8-56 S01

The response to RAI 18.8-52 S01 in MFN 08-655 provided information related RAI 18.8-56. For RAI 18.8-56, related to the HSI Design Review Element, HSI Detailed Design and Integration Review Criteria, Criterion 7 (NUREG-0711 Section 8.4.5) GEH provided acceptable additional information in the response, but did not incorporate the information into the DCD. However, when an RAI response contains direction on how work will be done, then that information needs to be included in the DCD (or a document incorporated by reference). Therefore, the staff requests that GEH incorporate the information contained in the MFN into an appropriate source document. One acceptable way to accomplish this expeditiously is to incorporate the information verbatim from the RAI response as an appendix in the HSI Design implementation plan.

GEH Response

Appendix A will be added to NEDO 33268 per RAI 18.8-2 S03. This Appendix includes work process paragraphs similar to those used in response to RAI 18.8-52 S01 related to RAI 18.8-56. For Reference, the paragraph of Appendix A that applies to this RAI is A.6 (2).

DCD Impact

No DCD changes will be made in response to this RAI.

LTR NEDO-33268, Rev 3 will be revised as noted in the attached markups.

NRC RAI 18.8-57 S01

The response to RAI 18.8-52 S01 in MFN 08-655 provided information related RAI 18.8-57. For RAI 18.8-57, related to the HSI Design Review Element, HSI Detailed Design and Integration Review Criteria, Criterion 8 (NUREG-0711 Section 8.4.5) GEH provided acceptable additional information in the response, but did not incorporate the information into the DCD. However, when an RAI response contains direction on how work will be done, then that information needs to be included in the DCD (or a document incorporated by reference). Therefore, the staff requests that GEH incorporate the information contained in the MFN into an appropriate source document. One acceptable way to accomplish this expeditiously is to incorporate the information verbatim from the RAI response as an appendix in the HSI Design implementation plan.

GEH Response

Appendix A will be added to NEDO 33268 per RAI 18.8-2 S03. This Appendix includes work process paragraphs similar to those used in response to RAI 18.8-52 S01 related to RAI 18.8-57. For reference, paragraphs of Appendix A that apply to this RAI are A.3 (6), A.6 (13), and A.6 (2).

DCD Impact

No DCD changes will be made in response to this RAI.

LTR NEDO-33268, Rev 3 will be revised as noted in the attached markups.

NRC RAI 18.8-58 S01

The response to RAI 18.8-52 S01 in MFN 08-655 provided information related RAI 18.8-58. For RAI 18.8-58, related to the HSI Design Review Element, HSI Detailed Design and Integration Review Criteria, Criterion 9 (NUREG-0711 Section 8.4.5) GEH provided acceptable additional information in the response, but did not incorporate the information into the DCD. However, when an RAI response contains direction on how work will be done, then that information needs to be included in the DCD (or a document incorporated by reference). Therefore, the staff requests that GEH incorporate the information contained in the MFN into an appropriate source document. One acceptable way to accomplish this expeditiously is to incorporate the information verbatim from the RAI response as an appendix in the HSI Design implementation plan.

GEH Response

Appendix A will be added to NEDO 33268 per RAI 18.8-2 S03. This Appendix includes work process paragraphs similar to those used in response to RAI 18.8-52 S01 related to RAI 18.8-58. For reference, the paragraphs of Appendix A that apply to this RAI are A.6 (6) through (8).

DCD Impact

No DCD changes will be made in response to this RAI.

LTR NEDO-33268, Rev 3 will be revised as noted in the attached markups.

NRC RAI 18.8-59 S02

For RAI 18.8-59, related to the HSI Design Review Element, Trade-Off Evaluations Review Criteria, Criteria 1 and 2 (NUREG-0711 Section 8.4.6.1), GEH provided acceptable additional information in the response, but did not incorporate the information into the DCD. However, when an RAI response contains direction on how work will be done, then that information needs to be included in the DCD (or a document incorporated by reference). Therefore, the staff requests that GEH incorporate the information contained in the MFN into an appropriate source document. One acceptable way to accomplish this expeditiously is to incorporate the information verbatim from the RAI response as an appendix in the HSI Design implementation plan.

GEH Response

Appendix B will be added to NEDO 33268 per RAI 18.8-35 S04. This Appendix includes work process paragraphs and figures or forms similar to those used in response to RAI 18.8-59 S01. For reference, the paragraphs and figures of Appendix B that apply to this RAI are the introductory paragraphs, all of section B.1, all of section B.2, and Figures B-1 through B-3.

DCD Impact

No DCD changes will be made in response to this RAI.

LTR NEDO-33268, Rev 3 will be revised as noted in the attached markups.

MFN 09-263

Enclosure 3

**Markups for Response to Portion of NRC Request for
Additional Information Letter No. 310 Related to ESBWR
Design Certification Application**

Chapter 18 - Human Factors Engineering

**RAI Numbers 18.8-2 S03, 18.8-35 S04, 18.8-50 S02,
18.8-51 S02, 18.8-52 S02, 18.8-53 S01, 18.8-54 S01,
18.8-55 S01, 18.8-56 S01, 18.8-57 S01, 18.8-58 S01,
18.8-59 S02**

Non-Proprietary Version

The training, procedures, V&V, and HPM processes provide feedback inputs that can result in revisions to the lists of allowable elements and their specifications and requirements contained in the style guide.

4.2.3 Process

The style guide is created using input from similar guides from previous designs such as the ABWR, HSI style guides from other industries, NUREG-0700, and other applicable documents. As operational analysis requirements are processed for implementation in the HSI design, the HSI design team will consider existing alternatives contained in the style guide. If style guide alternatives do not adequately address the requirement being considered or if potential enhancements to options are proposed, then additional HSI element options are evaluated for use in the ESBWR HSI. If approved, the new element options are incorporated into the style guide and are made available for use by HSI design team. The style guide is a compilation of HSI equipment, control, display, interface, and structures from which designers can select the most appropriate alternative for a given application. Additionally, the style guide sets requirements for when and how to incorporate the various hardware alternatives.

Similar guidance is provided in the area of HSI software including workstation design and presentation content, format, and logic. Style guide requirements maintain consistency in presentation, navigation, and interface mechanisms between various portions of the HSI.

This iterative process continues throughout the HSI design process.

4.2.4 Outputs

The output of the style guide design activity is a document presenting hardware, software, and usage alternatives from which the HFE design team constructs the ESBWR HSI. Additionally, the guide outlines the basic requirements and formatting specifications associated with each alternative incorporated into the HSI. The guide is a living document that takes input from the conceptual design process (HSI design elements being considered). The guide in turn provides input back into the conceptual design process in the form of approved human factors alternatives and usage specifications. Through this iterative process, the HSI design team is provided the flexibility and the HFE guidance to create an HSI that meets ESBWR goals.

The ESBWR style guide information is specific to the project and typically is more detailed than that contained in HFE guidance documents such as NUREG-0700. Appendix A provides the work process that develops the ESBWR style guide. Figure A-1 provides examples of the type of information that is contained in the ESBWR style guide.

4.3 HSI DETAILED DESIGN

The detailed design uses the alternatives and features selected in the conceptual design process and the guidance contained in the style guide to generate detailed HSI designs. The detailed design process addresses hardware, software, layout, formatting, and features incorporated into the HSI design to meet ESBWR human centered design goals.

APPENDIX A: HSI DEVELOPMENT WORK PROCESS

NOTES:

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A.1 DEVELOP A CONCEPT OF OPERATIONS

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A.2 OBTAIN DESIGN INPUTS

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II

A.3 HSI CONTROL ROOM CONCEPT DESIGN

II

II

A.4 HSI CONTROL ROOM CONCEPT PANEL PLACEMENT

II

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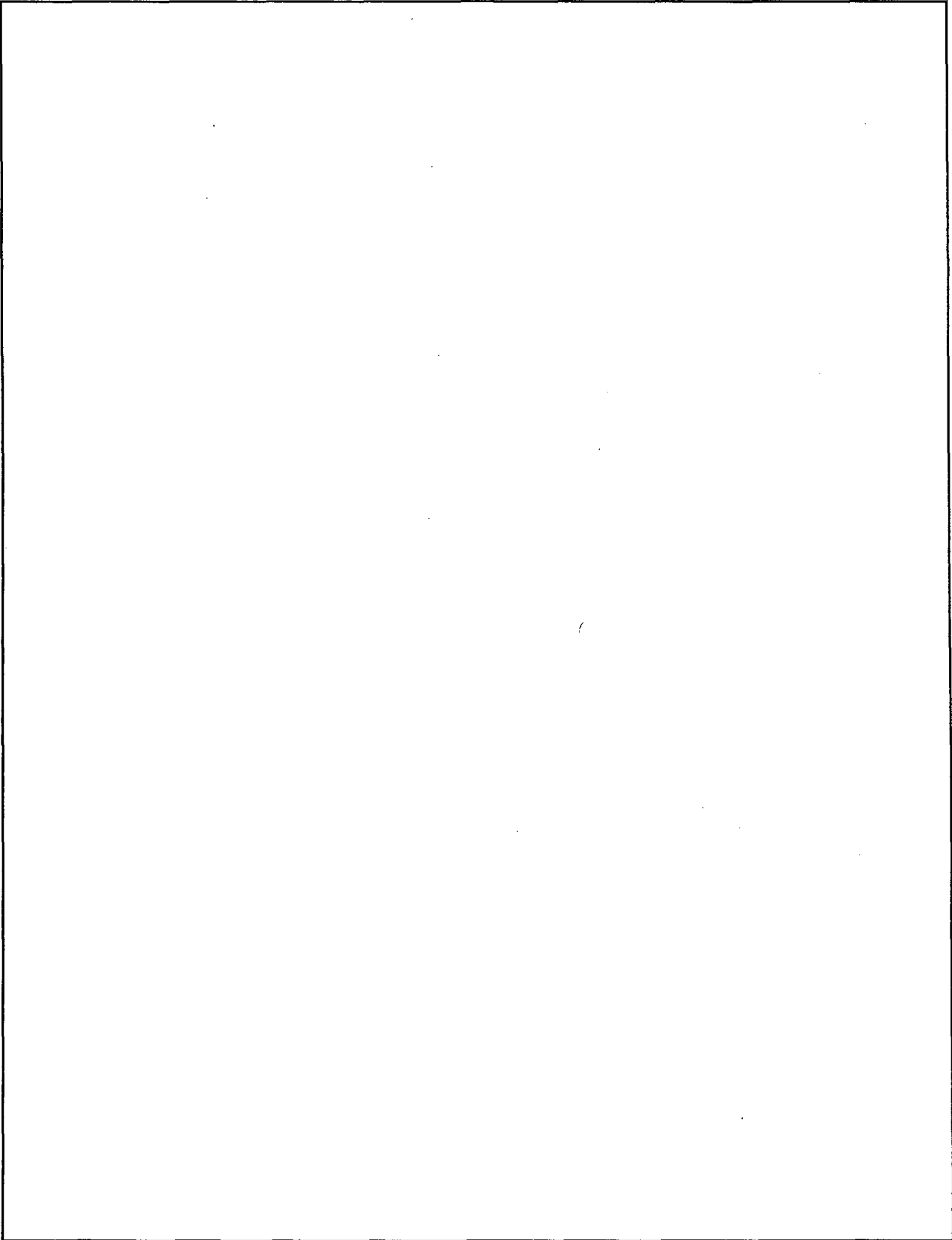
A.5 HSI DETAILED DESIGN AND HARDWARE INTEGRATION

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A.6 HSI DETAILED DESIGN AND HARDWARE INTEGRATION

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II

A.7 HSI SCREEN FUNCTIONAL REQUIREMENTS CONCEPT DESIGN

II

II

**A.8 HSI SCREEN FUNCTIONAL REQUIREMENTS DETAILED DESIGN AND
INTEGRATION**

II

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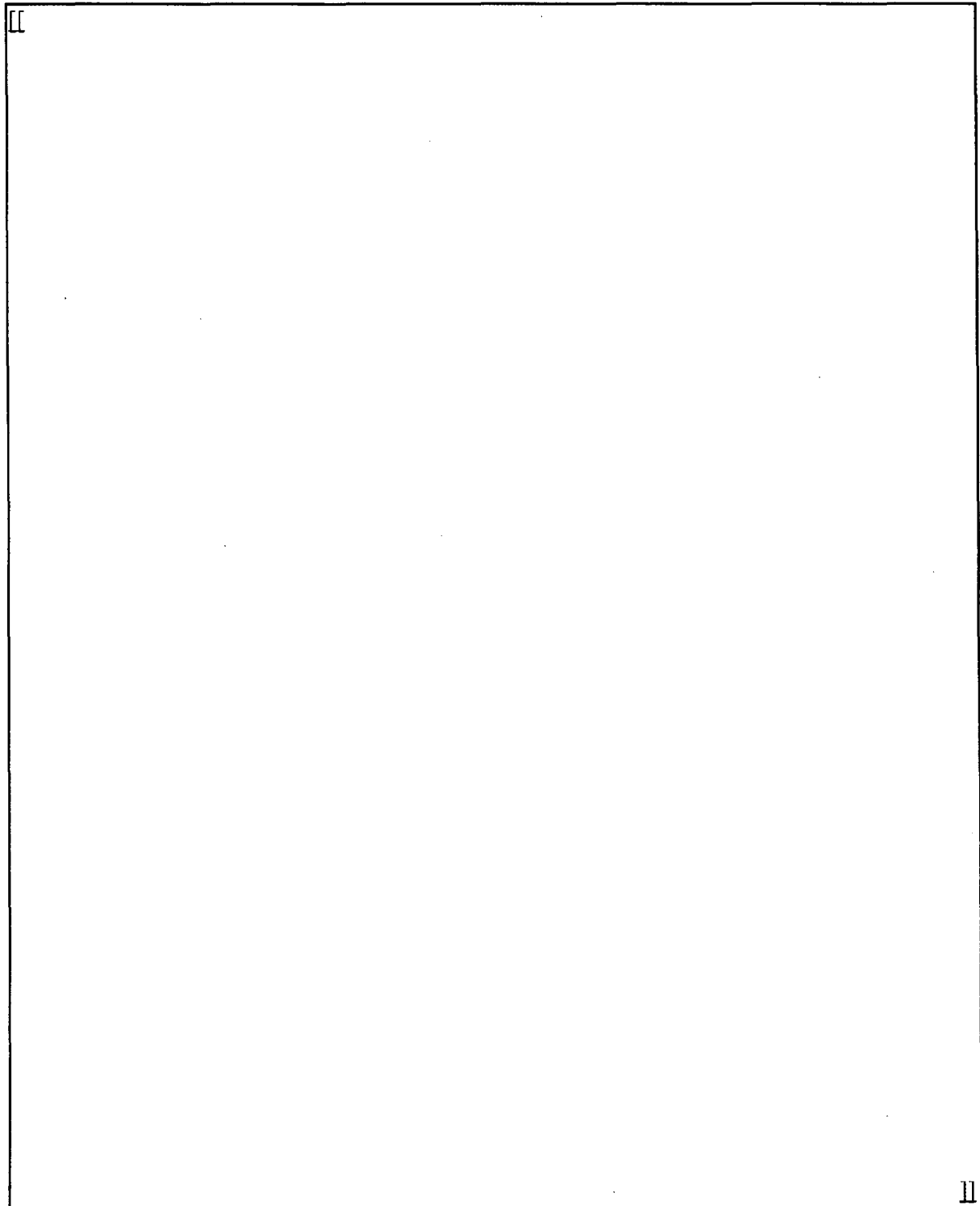


Figure A-1. Type of Information and Specificity Contained in the ESBWR Style Guide
Sheet 1 of 2

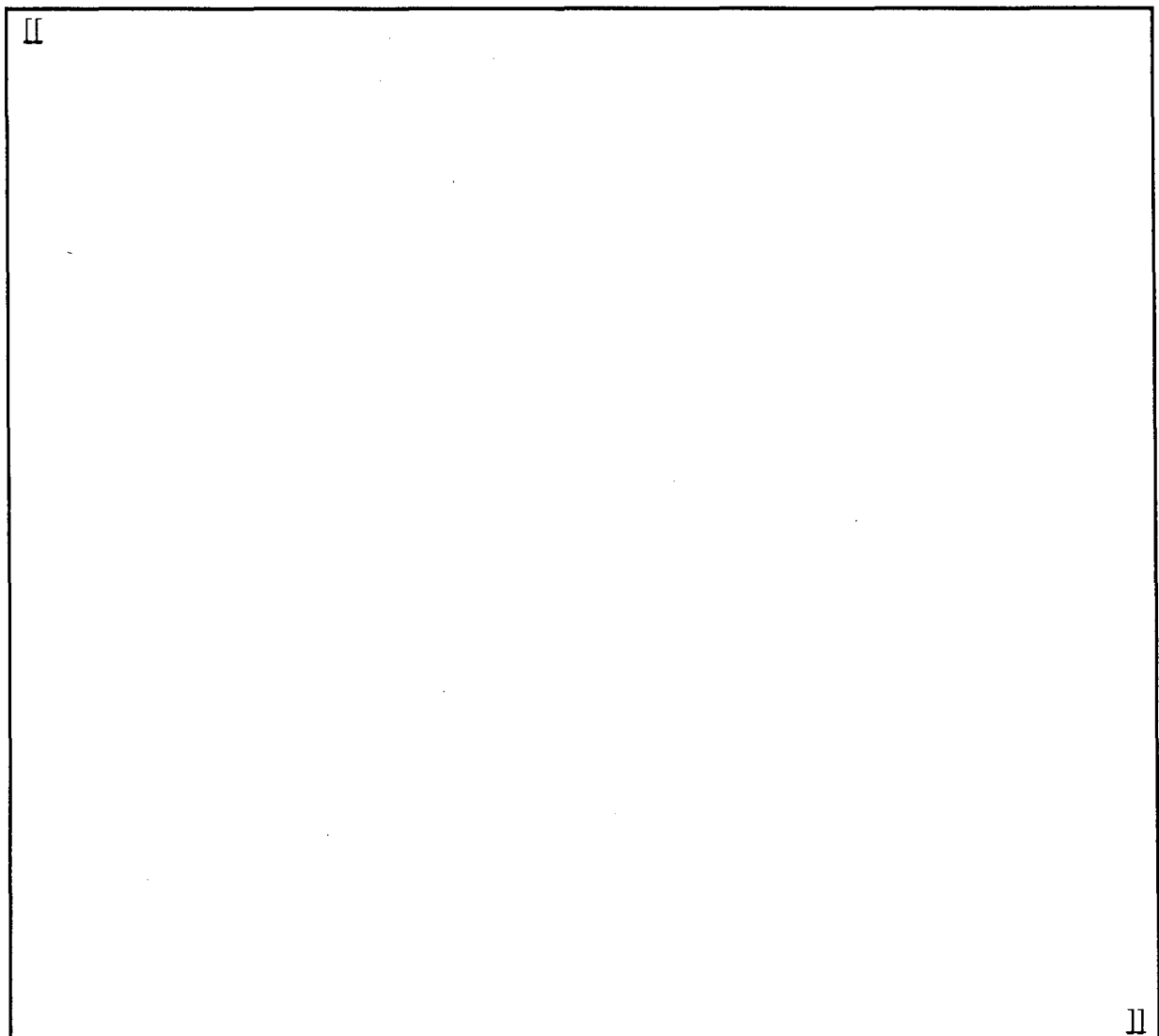


Figure A-1. Type of Information and Specificity Contained in the ESBWR Style Guide
Sheet 2 of 2

4.3.4.6 Tests and Evaluations

Appropriate design tools and techniques are selected to analyze the HSI design, depending on the nature of the aspect being evaluated. There are two main types of HSI analysis. The first analysis verifies that the HSI design meets established human factors criteria. The second analysis verifies that the HSI meets other technical requirements established as design requirements from TA, operator evaluation, and applicable plant procedures.

- (1) Techniques that are appropriate for the evaluation of HSI include, but are not limited to:
 - a. Checklists
 - b. Structured interviews
 - c. Direct observation of operator behavior
 - d. Analysis of historical records of operational problems with similar equipment
 - e. Physical measurement
 - f. Experiments
 - g. SME rating of alternative designs
- (2) Criteria that may be used in selecting HFE techniques are the following:
 - a. Safety and/or risk significance
 - b. Type of design (taking into account the type of design, there are some techniques that may not apply)
 - c. Type of technology
 - d. Relative time to perform
 - e. Relative complexity
 - f. Relative cost
 - g. Relative cost effectiveness
 - h. Demonstrated by use of dynamic displays, simulator, etc.

The design evaluation is based on the objectives of the systems design. What should the system do, who will use it, where will it be used and when will it be used? Numerous methods are available for evaluation of designs. See Appendix B for more detailed test and evaluation work process.

4.3.4.7 Procedures

An implicit design goal in most discussions of human-system interfaces is that system design enables users, to be in control of the technology.

Procedures enable users to accomplish daily tasks adequately. However, without at least a common-sense understanding of how the procedures relate to the underlying system, users are unable to adapt them to new situations, to deal with either system malfunctions or the consequences of their own errors, or to adapt to new or evolving systems.

APPENDIX B:HSI TEST AND EVALUATION WORK PROCESS

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B.1 EVALUATION GOAL ESTABLISHMENT

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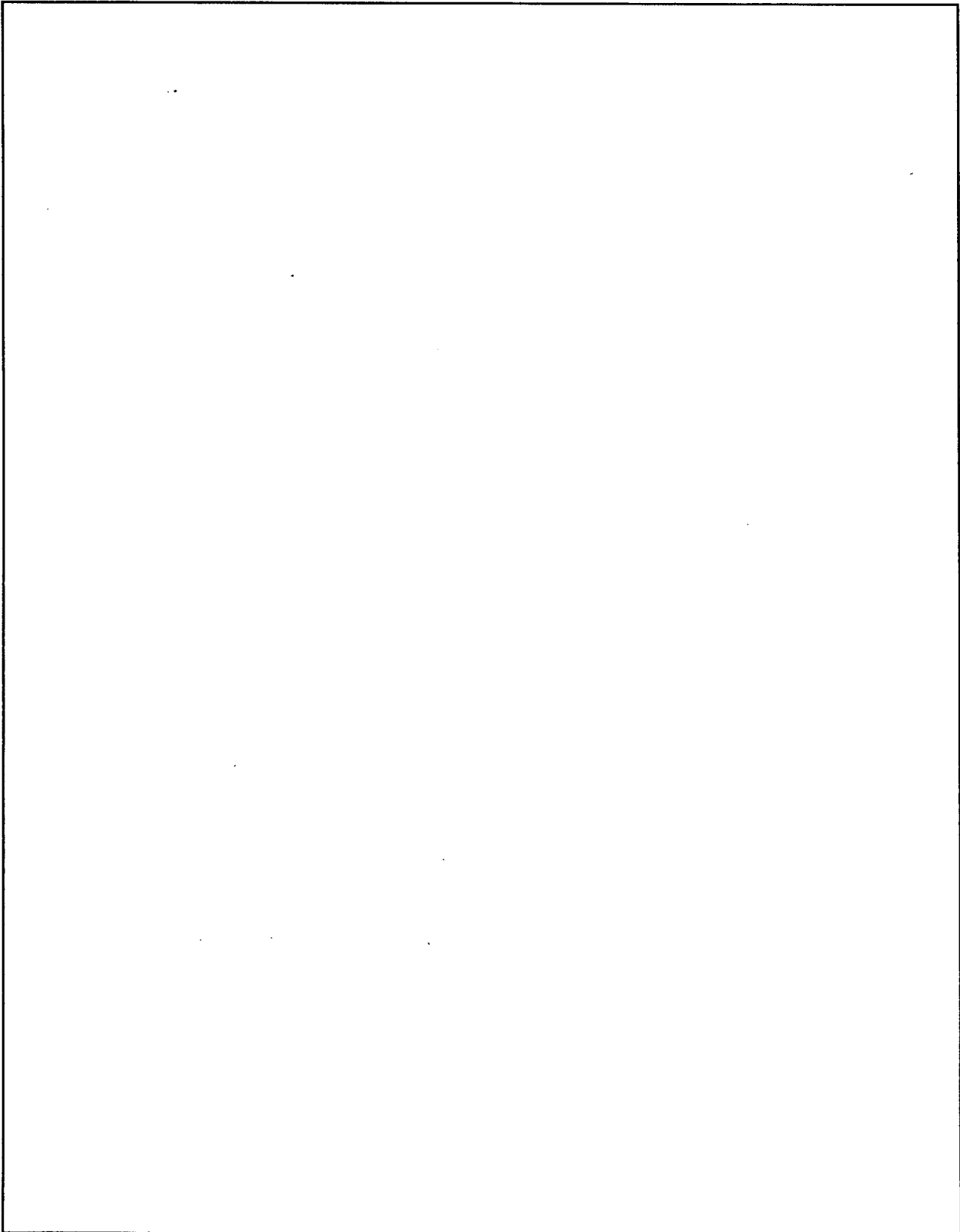
B.2 TRADE OFF EVALUATION OPTION

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B.3 PERFORMANCE BASED EVALUATION OPTION

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Figure B-1. HFE Evaluation Request Form
Sheet 1 of 2

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Figure B-1. HFE Evaluation Request Form

Sheet 2 of 2

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Figure B-2. Trade off Study Key Criteria Example List

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Figure B-3. Pugh Matrix

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Figure B-4. HFE Performance Test Methods and Measures

Sheet 1 of 2

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Figure B-4. HFE Performance Test Methods and Measures

Sheet 2 of 2

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Figure B-5. Evaluation Observation Form

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Figure B-6. Usability Questionnaire
Sheet 1 of 2

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Figure B-6. Usability Questionnaire
Sheet 2 of 2

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Figure B-7. Modified Cooper Harper Workload Assessment

APPENDIX A: HSI DEVELOPMENT WORK PROCESS

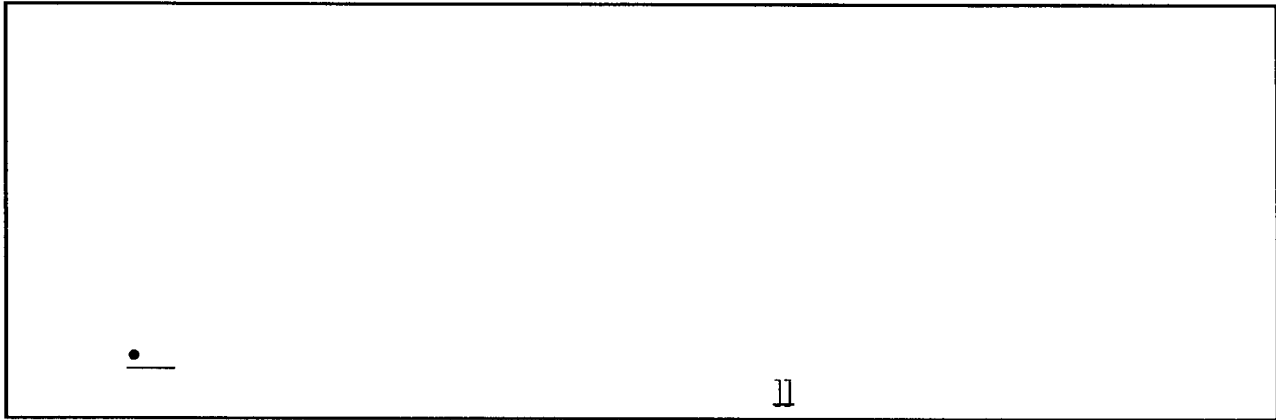
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A.1 DEVELOP A CONCEPT OF OPERATIONS

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A.2 OBTAIN DESIGN INPUTS

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design process that incorporates industry-accepted HFE principles is used to achieve this objective.

3.1.3 Basis and Requirements

The HFE team develops functional requirements for the HSI to address the concept of operations. The requirements are based on the:

- Personnel functions and tasks defined in the operations analysis

<ul style="list-style-type: none"> • OER/BRR

- S&Q analysis

- Requirements for a safe, comfortable working environment

The HSI requirements address the various types of HSIs, for example, alarms, displays, and controls.

The three components of HSI design, concept design, style guide, and detailed design share similar bases and requirements.

The concept design uses human factor elements, as defined in the DCD Chapter 18 and the MMIS and HFE Implementation Plan, to address HFE issues during the HSI design process. The HSI design, hardware, software, logic, controls, indications and the style guide that governs their creation conform to the principles set forth in regulations including:

- NUREG-0700
- NUREG-0711
- Reg. Guide 1.206, Section C.I.18

In addition, the HSI design for the control room and applicable facilities addresses the guidance for the following sevensix key aspects of the plant HSI:

- The minimum inventory of alarms, displays, and controls presented in DCD Table 18.1-1a and Table 18.1-1b are included in the designs of the MCR and RSS, respectively.
- Provision for periodic testing of protection systems actuation functions, as described in Regulatory Guide 1.22
- Bypassed and inoperable status indication for NPP safety systems, as described in Regulatory Guide 1.47
- Manual initiation of protective actions, as described in Regulatory Guide 1.62
- Accident monitoring instrumentation for nuclear power plants~~Instrumentation for light-water-cooled nuclear power plants to access plant and environmental conditions during and following an accident,~~ as described in Regulatory Guide 1.97
- Instrumentation setpoints, as described in Regulatory Guide 1.105
- HSIs for the emergency response facilities (TSC & EOF), as described in NUREG-0696

The SFRA determines the performance requirements and design considerations of the HSI design and establishes the functions, which are accomplished to meet these requirements.

The allocation of functions to personnel, systems or personnel-system combinations is made to reflect: sensitivity, precision, time and safety requirements, required reliability of system performance, and the number and level of skills of personnel required to operate each system.

The TA identifies the behavioral requirements of the tasks associated with individual functions.

Types of requirements identified in the TA include:

- a. Information and Decision-Making Requirements
- b. Response Requirements
- c. Feedback required for monitoring and evaluating the adequacy of actions taken
- d. Cognitive and physical workload demands
- e. Task Support Requirements
- f. Workplace Factors
- g. Staffing and Communication Requirements
- h. Potential Hazard Identification
- i. A minimum list of critical parameters for design

The HSI design is based on the staffing requirements defined in the S&Q plan. The MCR staff size and roles are finalized after the completion of the V&V activities.

Operating Experience Review of Previous NPP MMIS Designs

Operating experience lessons learned from events, operational problems, and enhancement opportunities from previous plant HSI designs is gathered, categorized, and provided to HSI designers. This information has been gathered and maintained in the OER/BRR database for generating lessons learned involving HFE issues. It is used to correct and enhance HSI design issues to improve overall HSI effectiveness. This process also provides for the continuous review and improvement of the HSI as ESBWR specific operating experience is gathered over time.

Both updated domestic and modern foreign nuclear power plants operating experience are reviewed as available. The operating experience information is used by engineers and designers to support the development of HSI design requirements and features that mitigate human error.

Other Industries

The HFE Design Team reviews HSIs being used in other industries such as fossil plants, aerospace, petrochemical, etc., for features and approaches applicable to the ESBWR. Some design features used in other industries and considered for use in the ESBWR HSI include:

- Use of flat panel and Video Display Unit (VDU) displays
- Use of electronic on-screen controls

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A.2 OBTAIN DESIGN INPUTS

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A.3 HSI CONTROL ROOM CONCEPT DESIGN

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A.4 HSI CONTROL ROOM CONCEPT PANEL PLACEMENT

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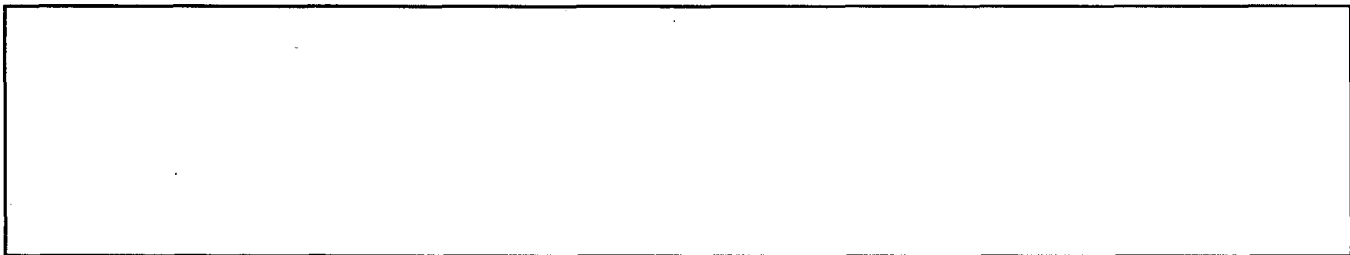
A.5 HSI DETAILED DESIGN AND HARDWARE INTEGRATION

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A.6 HSI DETAILED DESIGN AND HARDWARE INTEGRATION

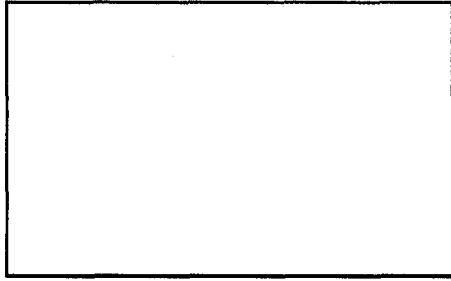
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A.7 HSI SCREEN FUNCTIONAL REQUIREMENTS CONCEPT DESIGN

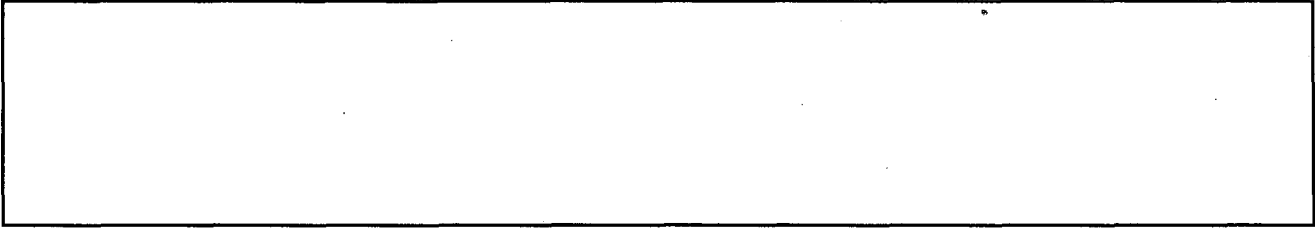
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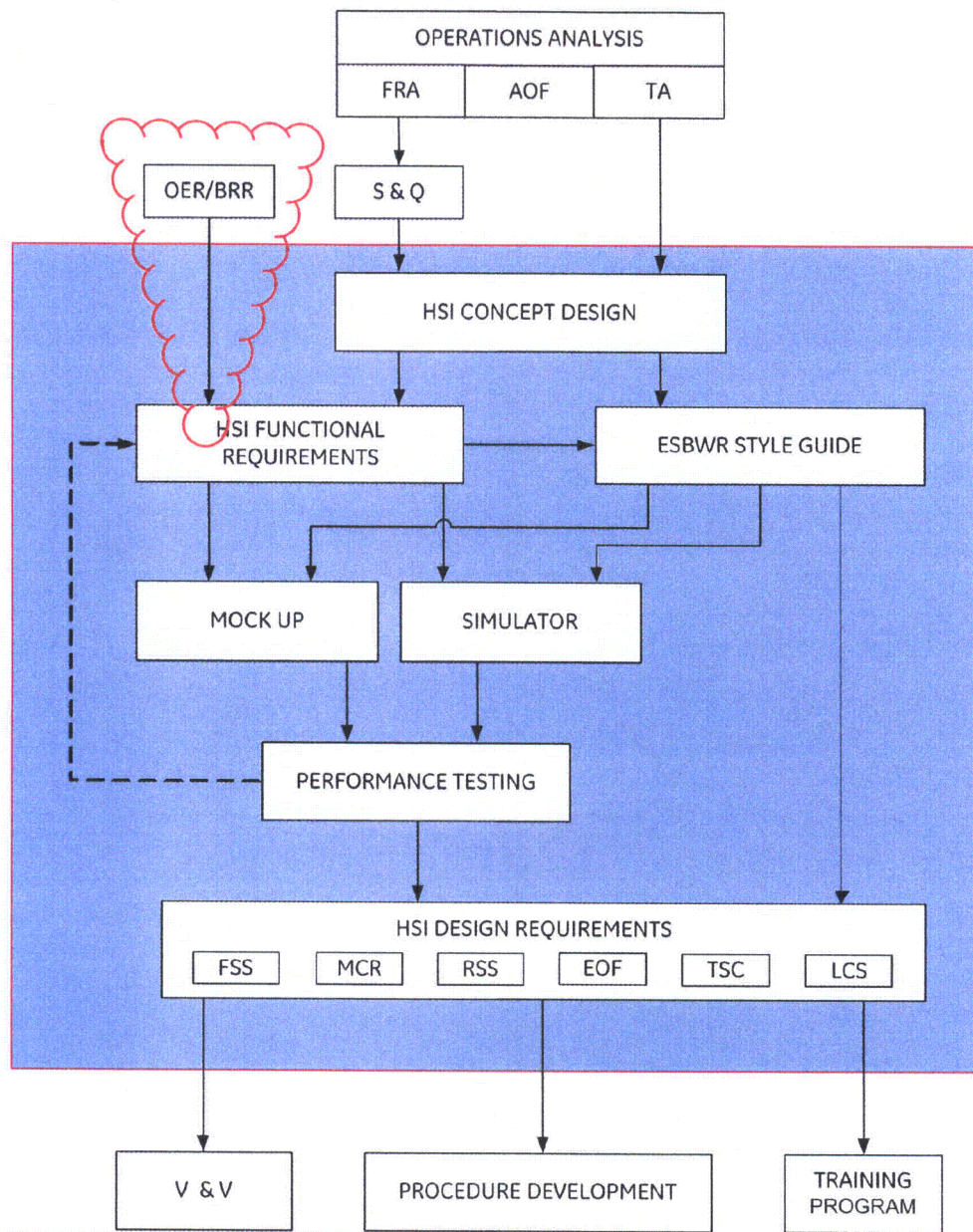
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**A.8 HSI SCREEN FUNCTIONAL REQUIREMENTS DETAILED DESIGN AND
INTEGRATION**

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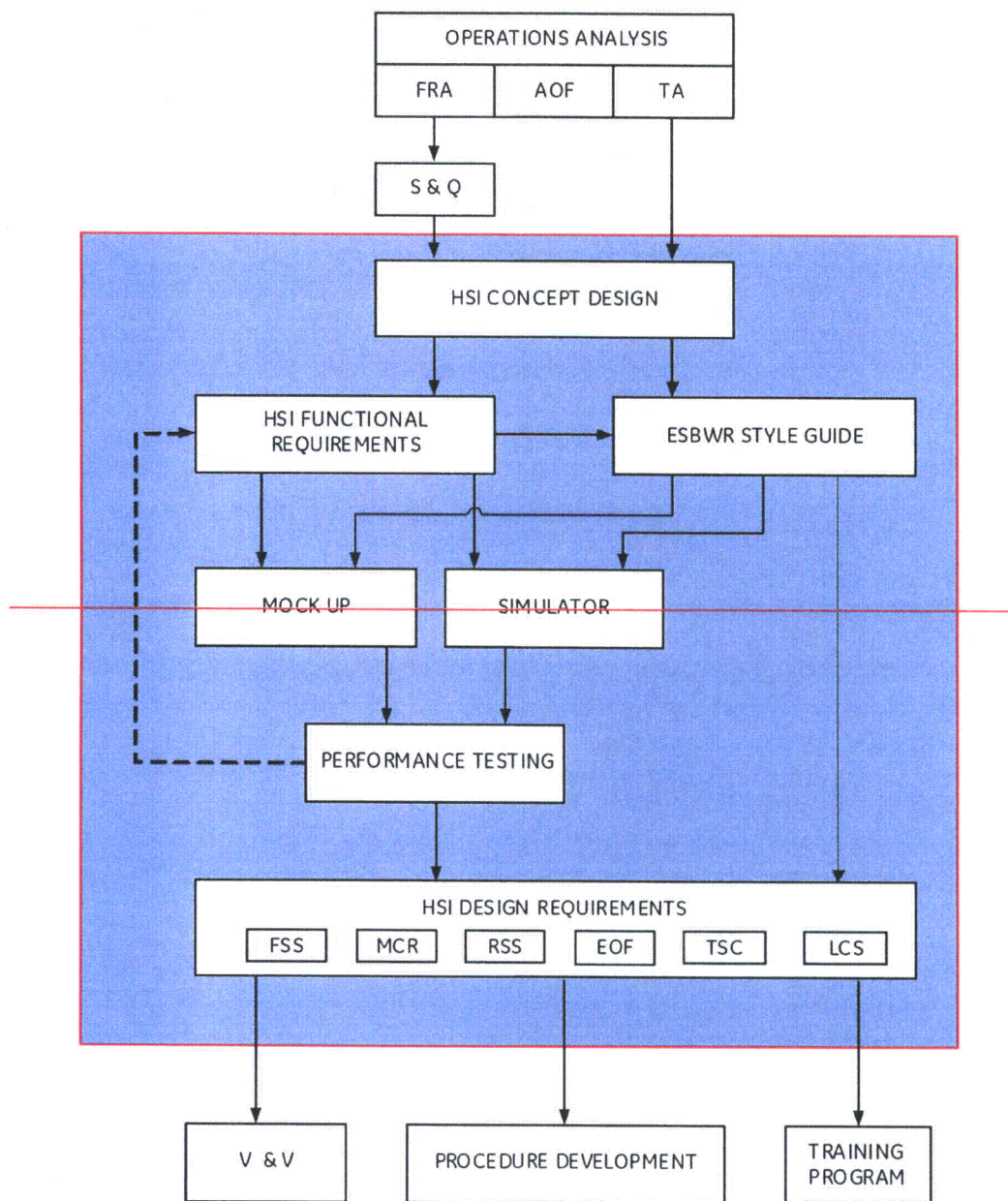


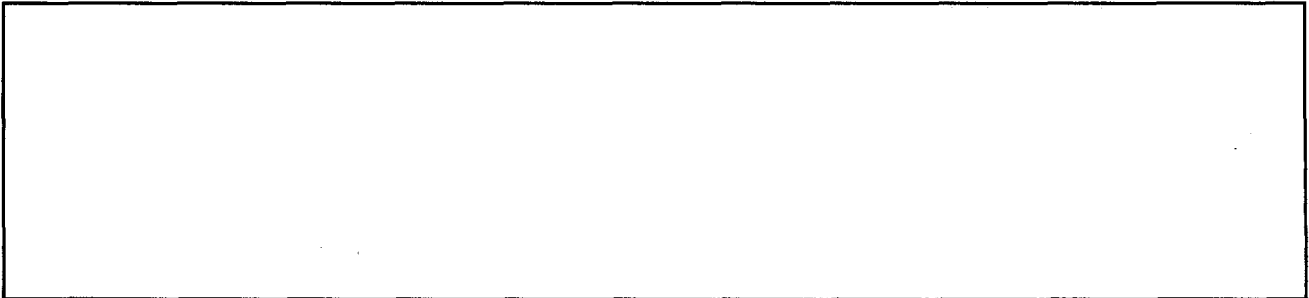
Figure 2. Human-System Interface Design Implementation Process

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A.2 OBTAIN DESIGN INPUTS

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APPENDIX A: HSI DEVELOPMENT WORK PROCESS

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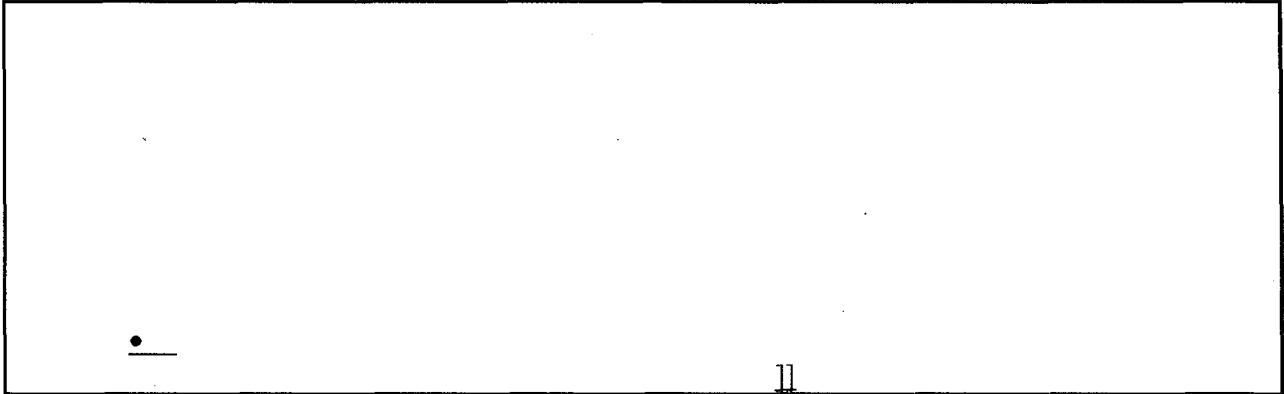
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A.1 DEVELOP A CONCEPT OF OPERATIONS

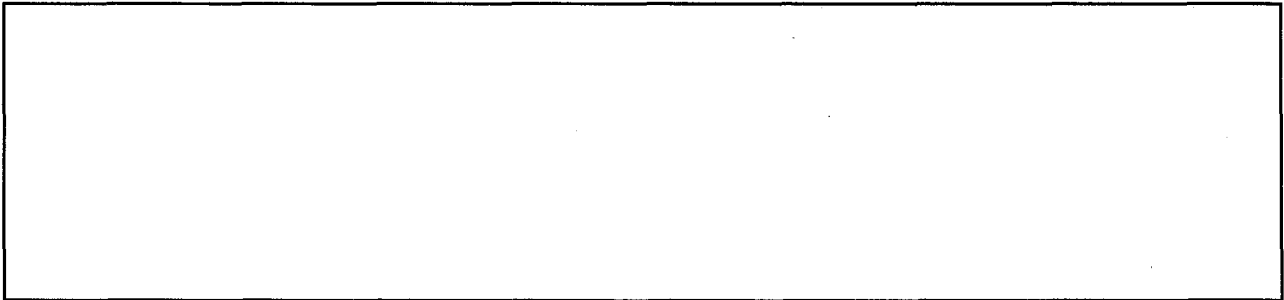
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A.2 OBTAIN DESIGN INPUTS

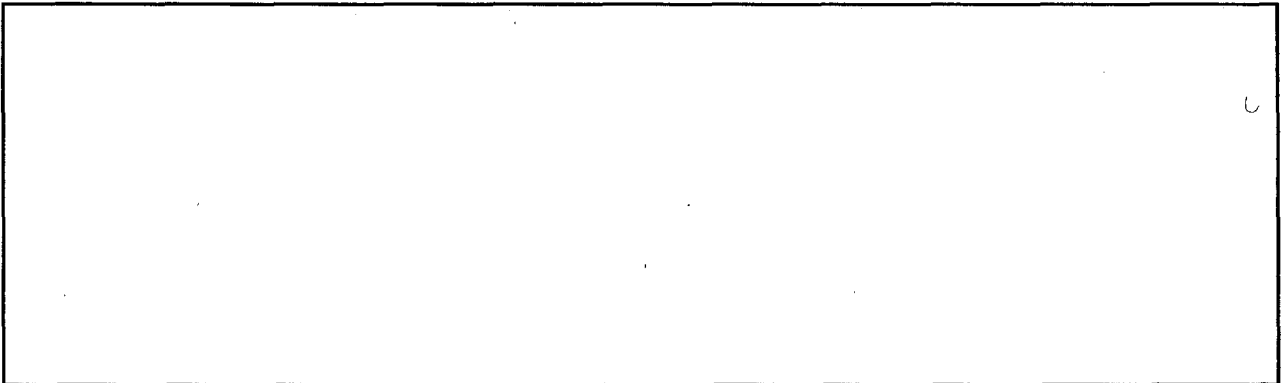
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A.3 HSI CONTROL ROOM CONCEPT DESIGN

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A.4 HSI CONTROL ROOM CONCEPT PANEL PLACEMENT

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A.5 HSI DETAILED DESIGN AND HARDWARE INTEGRATION

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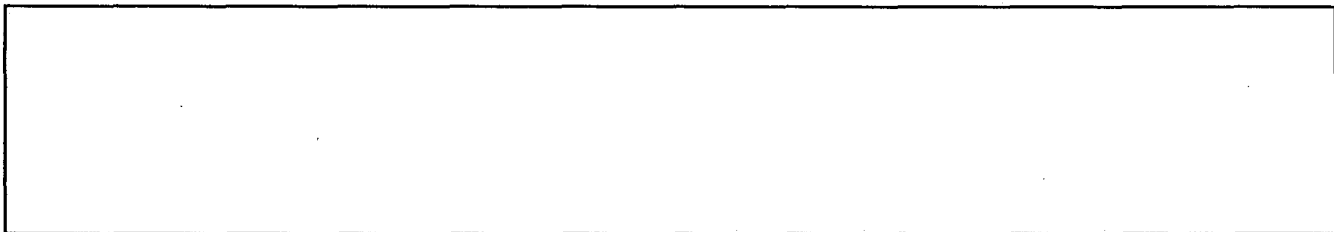
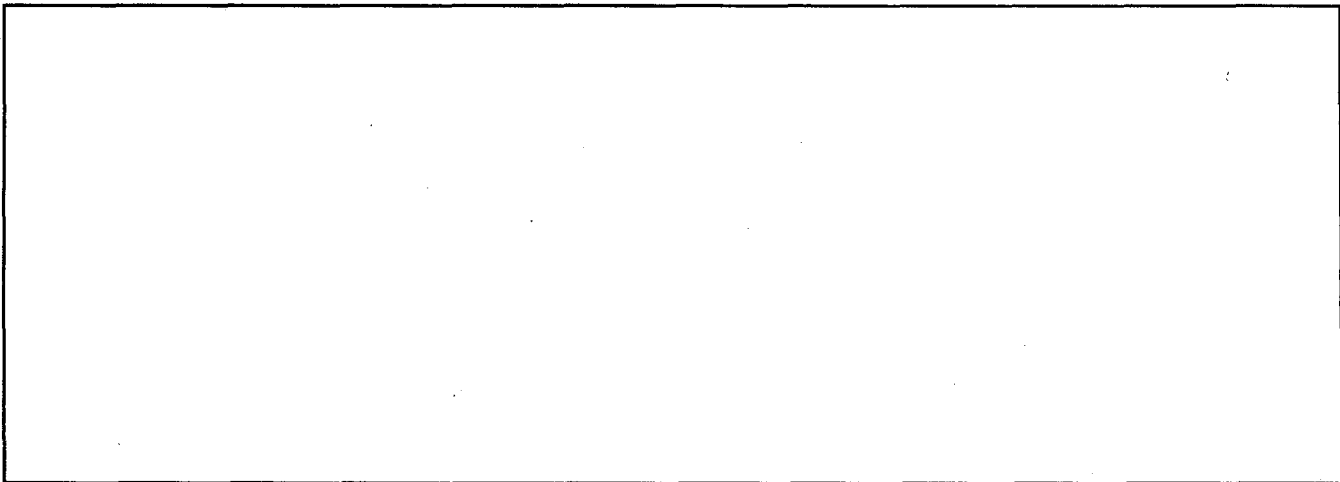
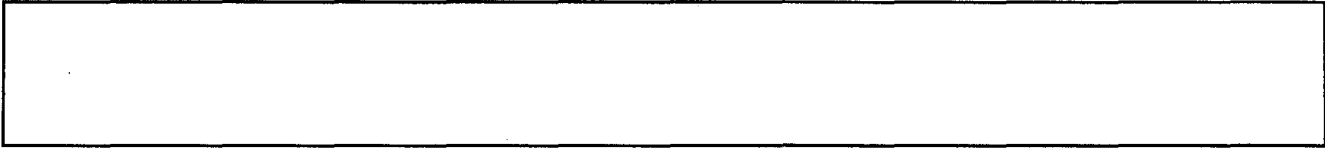
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A.6 HSI DETAILED DESIGN AND HARDWARE INTEGRATION

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APPENDIX A: HSI DEVELOPMENT WORK PROCESS

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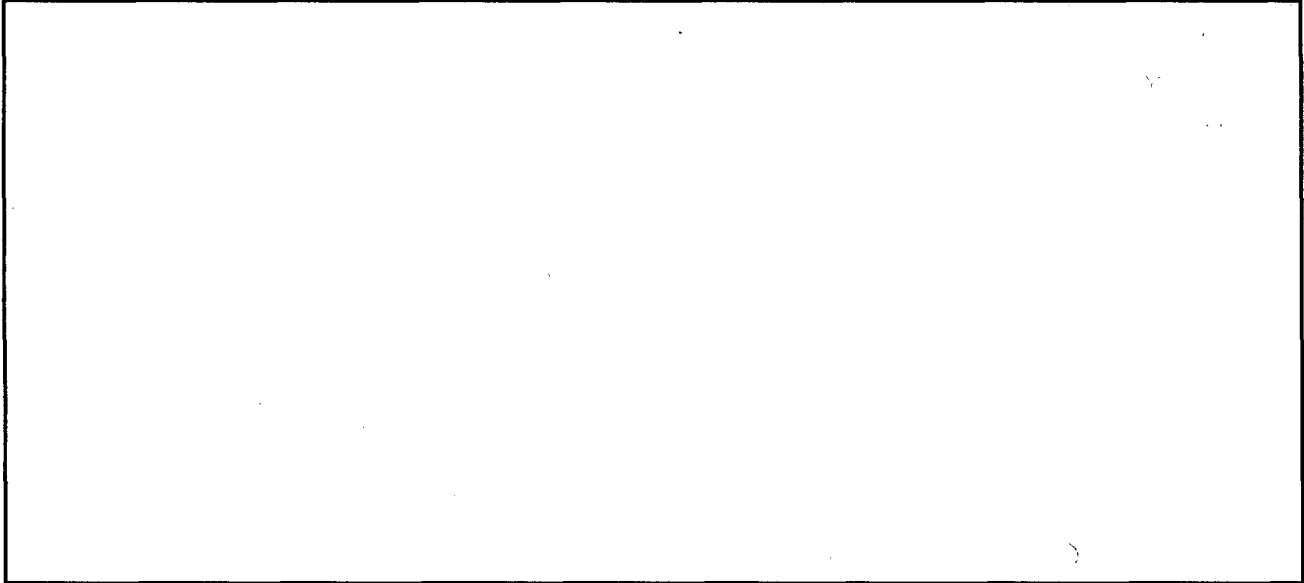
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A.1 DEVELOP A CONCEPT OF OPERATIONS

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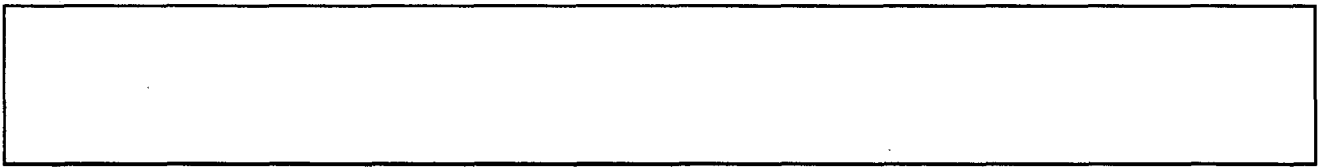
A.5 HSI DETAILED DESIGN AND HARDWARE INTEGRATION

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A.6 HSI DETAILED DESIGN AND HARDWARE INTEGRATION

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A.5 HSI DETAILED DESIGN AND HARDWARE INTEGRATION

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A.6 HSI DETAILED DESIGN AND HARDWARE INTEGRATION

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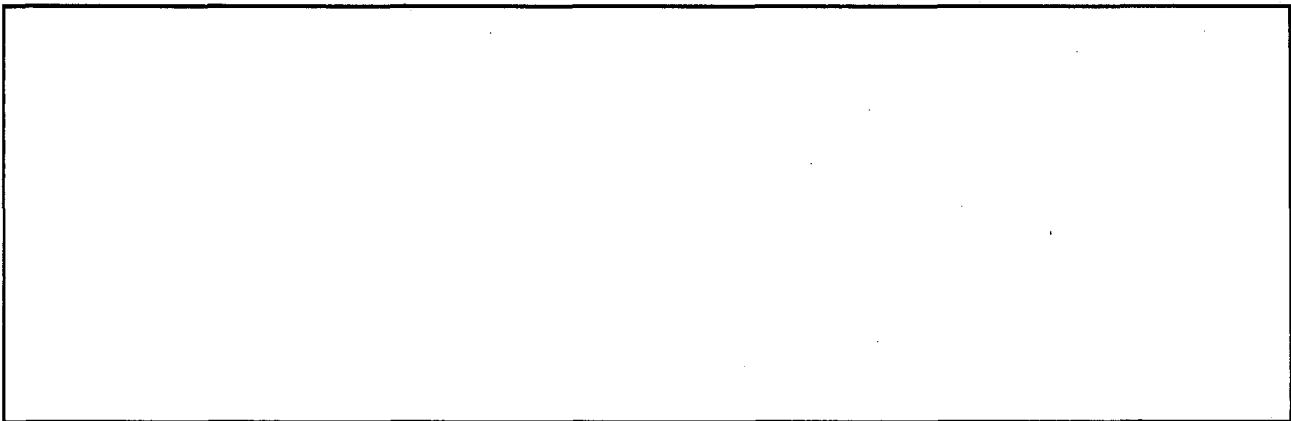
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A.3 HSI CONTROL ROOM CONCEPT DESIGN

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A.4 HSI CONTROL ROOM CONCEPT PANEL PLACEMENT

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A.5 HSI DETAILED DESIGN AND HARDWARE INTEGRATION

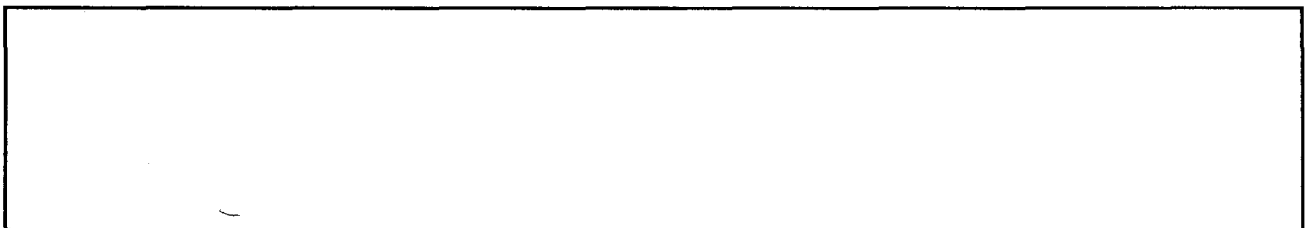
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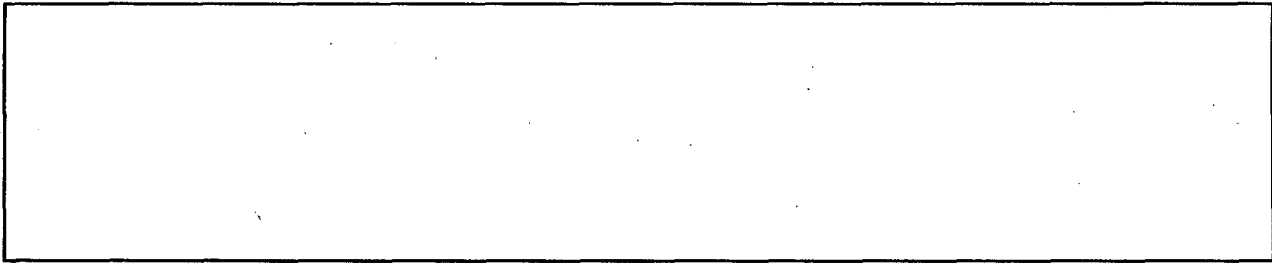
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A.6 HSI DETAILED DESIGN AND HARDWARE INTEGRATION

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APPENDIX B: HSI TEST AND EVALUATION WORK PROCESS

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B.1 EVALUATION GOAL ESTABLISHMENT

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B.2 TRADE OFF EVALUATION OPTION

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B.3 PERFORMANCE BASED EVALUATION OPTION

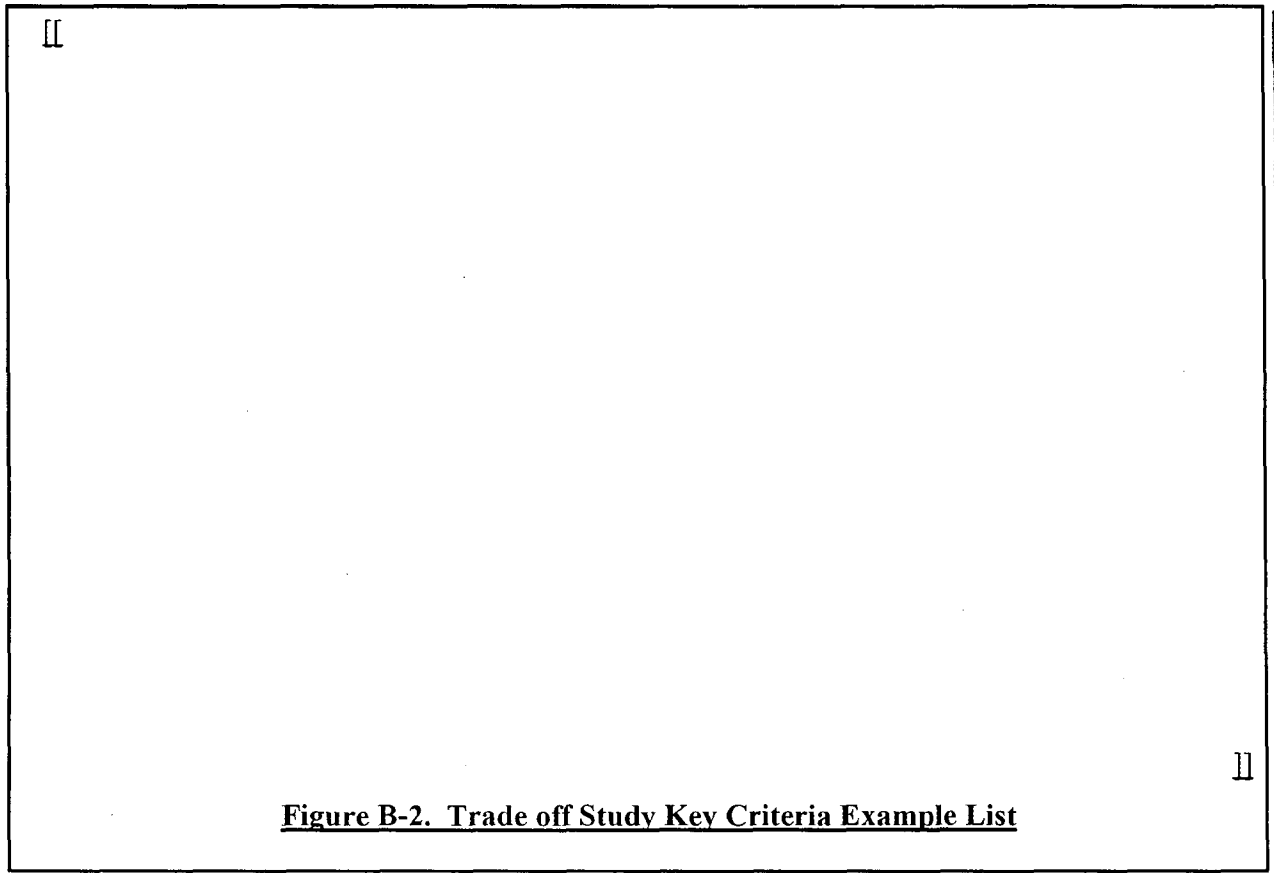
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Figure B-1. HFE Evaluation Request Form
Sheet 1 of 2

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<p><u>Figure B-1. HFE Evaluation Request Form</u></p> <p><u>Sheet 2 of 2</u></p>	



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Figure B-3. Pugh Matrix

MFN 09-263

Enclosure 4

Affidavit

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, **Larry J. Tucker**, state as follows:

- (1) I am Manager, ESBWR Engineering, GE-Hitachi Nuclear Energy Americas LLC (“GEH”). I have been delegated the function of reviewing the information described in paragraph (2) which is sought to be withheld, and have been authorized to apply for its withholding.
- (2) The information sought to be withheld is contained in Enclosure 2 of GEH’s letter, MFN 09-263, Richard E Kingston to Nuclear Regulatory Commission, entitled *Submittal of Response to Portion of NRC Request for Additional Information Letter No. 310 Related to ESBWR Design Certification Application Chapter 18 - Human Factors Engineering - RAI Numbers 18.8-2 S03, 18.8-35 S04, 18.8-50 S02, 18.8-51 S02, 18.8-52 S02, 18.8-53 S01, 18.8-54 S01, 18.8-55 S01, 18.8-56 S01, 18.8-57 S01, 18.8-58 S01, 18.8-59 S02*, May 7, 2009. GEH text proprietary information in Enclosure 2, which is entitled “Markups for Response to Portion of NRC Request for Additional Information Letter No. 310 Related to ESBWR Design Certification Application - Human Factors Engineering - RAI Numbers 18.8-2 S03, 18.8-35 S04, 18.8-50 S02, 18.8-51 S02, 18.8-52 S02, 18.8-53 S01, 18.8-54 S01, 18.8-55 S01, 18.8-56 S01, 18.8-57 S01, 18.8-58 S01, 18.8-59 S02”, is identified by a underline inside double square brackets [[This sentence is an example.⁽³⁾]]. Figures and large equation objects containing GEH proprietary information are identified with double square brackets before and after the object. In each case, the superscript notation ⁽³⁾ refers to Paragraph (3) of this affidavit, which provides the basis for the proprietary determination.
- (3) In making this application for withholding of proprietary information of which it is the owner or licensee, GEH relies upon the exemption from disclosure set forth in the Freedom of Information Act (“FOIA”), 5 USC Sec. 552(b)(4), and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR 9.17(a)(4), and 2.390(a)(4) for “trade secrets” (Exemption 4). The material for which exemption from disclosure is here sought also qualify under the narrower definition of “trade secret”, within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).
- (4) Some examples of categories of information which fit into the definition of proprietary information are:
 - a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by GEH's competitors without license from GEH constitutes a competitive economic advantage over other companies;
 - b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product;

- c. Information which reveals aspects of past, present, or future GEH customer-funded development plans and programs, resulting in potential products to GEH;
- d. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs (4)a. and (4)b. above.

- (5) To address 10 CFR 2.390(b)(4), the information sought to be withheld is being submitted to NRC in confidence. The information is of a sort customarily held in confidence by GEH, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by GEH, no public disclosure has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.
- (6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge, or subject to the terms under which it was licensed to GEH. Access to such documents within GEH is limited on a "need to know" basis.
- (7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist, or other equivalent authority for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside GEH are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.
- (8) The information identified in paragraph (2) above is classified as proprietary because it identifies details of GEH ESBWR methods, techniques, information, procedures, and assumptions related to the application of human factors engineering to the GEH ESBWR.

The development of the evaluation process along with the interpretation and application of the analytical results is derived from the extensive experience database that constitutes a major GEH asset.

- (9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to GEH's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of GEH's comprehensive BWR safety and technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and

analytical methodology and includes development of the expertise to determine and apply the appropriate evaluation process. In addition, the technology base includes the value derived from providing analyses done with NRC-approved methods.

The research, development, engineering, analytical and NRC review costs comprise a substantial investment of time and money by GEH.

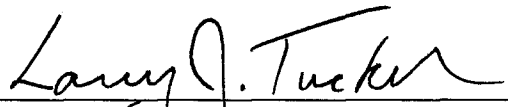
The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

GEH's competitive advantage will be lost if its competitors are able to use the results of the GEH experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to GEH would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake a similar expenditure of resources would unfairly provide competitors with a windfall, and deprive GEH of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing and obtaining these very valuable analytical tools.

I declare under penalty of perjury that the foregoing affidavit and the matters stated therein are true and correct to the best of my knowledge, information, and belief.

Executed on this 7th day of May, 2009.



Larry J. Tucker
GE-Hitachi Nuclear Energy Americas LLC