18.11 Human System Interface Design Test Program

[*This section describes the AP600 human system interface design test program. This test program consists of two distinct parts:*

- *Concept tests to be performed as part of the human system interface design process*]* (as described in subsection 18.8.1).

[• *Verification and validation (V&V) tests to be performed at the completion of the AP600 design process.*

The goal of the human system interface design test program is to systematically evaluate human factors concerns that affect plant performance and incorporate the results into the design of the human system interface.

Plant facilities and plant staff activities are addressed in the AP600 human system interface design test program. Facilities included in the scope of this test program are the main control room, technical support center, the remote shutdown room, and local control stations. Staff activities included are those activities required to operate under normal, abnormal, and emergency conditions.

The AP600 human system interface design test program focuses on the following human system interface resources:

- *Plant information system (including functional and physical displays of plant processes)*
- *Alarm system*
- *Computerized procedure system*
- *Dedicated and soft (computer based) controls*
- *Wall panel information system*
- *Qualified data processing system*]*

As illustrated in Figure 18.11-1, [*a two phase process is used to define the human system interface design test program. Phase 1 is called issue definition. Its purpose is to integrate major operator activities with the human system interface resources in order to establish a set of human performance evaluation issues. Phase 2 addresses test development. The purpose of this phase is to develop testing plans for each of the evaluation issues identified in Phase 1. Reference 1 presents a description of the methodology, analysis, and the results of executing these two phases. The results include the identification of 17 human performance evaluation issues and a description of the testing approach and requirements for addressing each of the evaluation issues. The 17 human performance evaluation issues are listed in Table 18.11-1.*]*

*NRC Staff approval is required prior to implementing a change in this information; see DCD Introduction Section 3.5.

[*The 17 human performance issues are organized under five headings:*

- *Evaluations for detection and monitoring*
- *Evaluations for interpretation and planning*
- *Evaluations for controlling plant state*
- *Evaluations of conformance to human factors engineering design guidelines*
- *Evaluations for validation of the integrated human system interface*

The first 15 issues are grouped into the first three headings above.]*

As described in subsection 18.8.1, [*man-in-the-loop concept tests are performed as part of the human system interface design process. These concept tests are organized around the first 15 human performance issues. Reference 2 provides a description of the AP600 man-in-the-loop test plan which includes the concept tests.*

Evaluation issues 16 and 17 describe evaluations that are performed as part of the AP600 human factors verification and validation and fall under the last two headings above. A programmatic level description of the AP600 verification and validation program is provided by Reference 3. Figure 18.8-2 shows the man-in-the-loop concept testing and the verification and validation activities conducted as part of AP600 human factors engineering program.]* Using the programmatic level description, it is the responsibility of the Combined License applicant to develop an implementation plan for the AP600 human factors engineering verification and validation. The Combined License applicant is responsible for the execution and documentation of the plan.

18.11.1 Combined License Information

Combined License applicants referencing the AP600 certified design will address the development, execution and documentation of an implementation plan for the verification and validation of the AP600 human factors engineering program. The programmatic level description of the AP600 verification and validation program, presented and referenced by Section 18.11, will be used by the Combined License applicant to develop the implementation plan.

18.11.2 References

[*1. WCAP-14701, "Methodology and Results Of Defining Evaluation Issues For the AP600 Human System Interface Design Test Program," Revision 1, May 1997.*]*

[*2. WCAP-14396, "Man-In-The-Loop Test Plan Description," Revision 2, January 1997.*]*

[*3. WCAP-14401, "Programmatic Level Description of the AP600 Human Factors Verification and Validation Plan," Revision 3, April 1997.*]*

*NRC Staff approval is required prior to implementing a change in this information; see DCD Introduction Section 3.5.

Table 18.11-1 (Sheet 1 of 2)

[*HUMAN PERFORMANCE EVALUATION ISSUES*]*

Operator Activity: Detection and Monitoring

Issue 1: Do the wall panel information system and the workstation summary and overview displays support the operator in maintaining an awareness of plant status and system availability without needing to search actively through the workstation displays?

Issue 2: Does the wall panel information system support the operator in getting more detail about plant status and system availability by directed search of the workstation functional and physical displays?

Issue 3: Do the HSI features support efficient navigation to locate specific information?

Issue 4: Do the HSI features effectively support crew awareness of plant condition?

Operator Activity: Interpretation and Planning

Issue 5: Does the alarm system convey information in a way that enhances operator awareness and understanding of plant condition?

Issue 6: Does the physical and functional organization of plant information on the workstation displays enhance diagnosis of plant condition and the planning/selection of recovery paths?

Issue 7: Does the integration of alarms, wall panel information system, workstation, and procedures support the operator in responding to single-fault events?

Issue 8: Does the integration of alarms, wall panel information system, workstation and procedures support the operator in interpretation and planning during multiple-fault events?

Issue 9: Does the integration of alarms, wall panel information system, workstation and procedures support the crew in interpretation and planning during multiple-fault events?

Issue 10: Does the integration of alarms, wall panel information system, workstation, and procedures support the crew in interpretation and planning during severe accidents?

*NRC Staff approval is required prior to implementing a change in this information; see DCD Introduction Section 3.5.

Table 18.11-1 (Sheet 2 of 2)

[*HUMAN PERFORMANCE EVALUATION ISSUES*]*

Operator Activity: Controlling Plant State

Issue 11: Do the HSI features support the operator in performing simple, operator-paced control tasks?

Issue 12: Do the HSI features support the operator in performing control tasks that require assessment of preconditions, side effects and post-conditions?

Issue 13: Do the HSI features support the operator in performing control tasks that require multiple procedures?

Issue 14: Do the HSI features support the operator in performing event paced control tasks?

Issue 15: Do the HSI features support the operator in performing control tasks that require coordination among crew members?

Conformance to Human Factors Engineering Design Guidelines

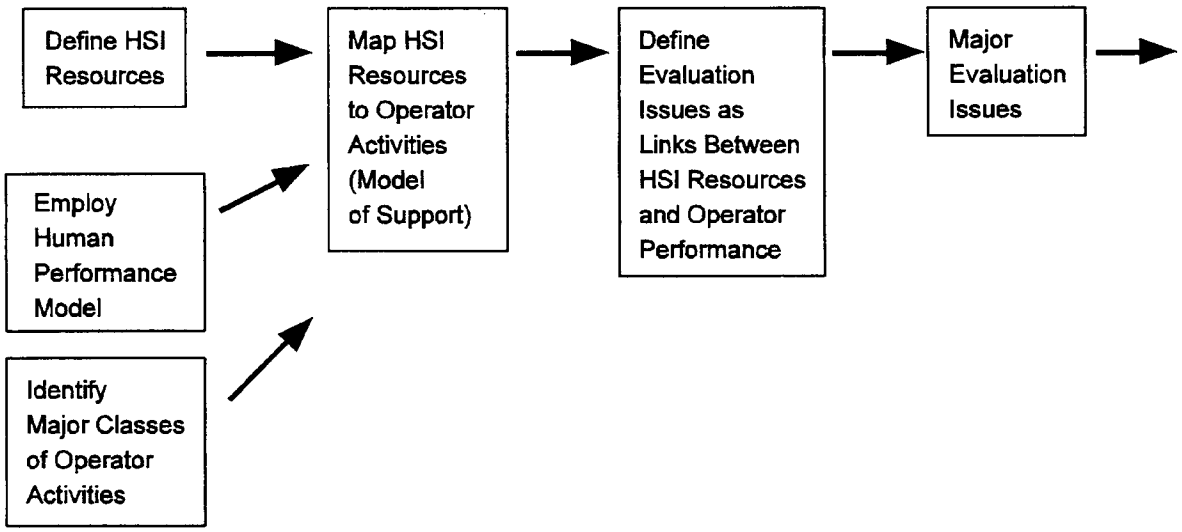
Issue 16: Do the HSI components satisfy relevant human factors engineering design guidelines?

Validation of Integrated HSI

Issue 17: Does the integration of HSI components satisfy requirements for validation of control room functions and integrated performance capabilities?

*NRC Staff approval is required prior to implementing a change in this information; see DCD Introduction Section 3.5.

Phase 1. Issue Definition



Phase 2. Test Development

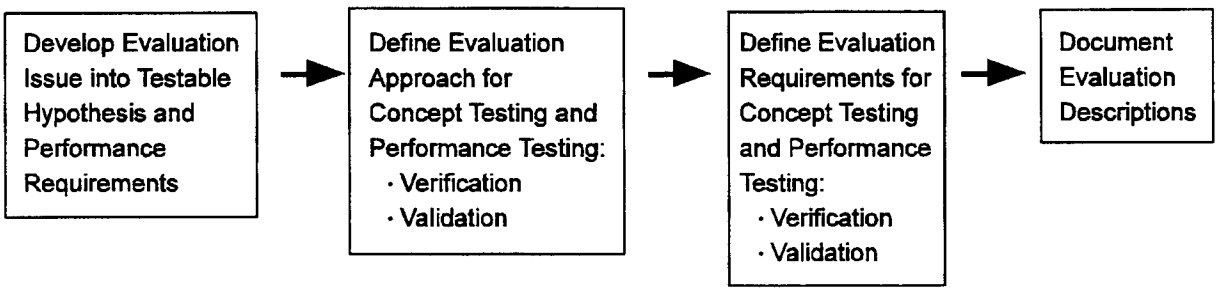


Figure 18.11-1

Two-phase Process Used to Define the Human System Interface Design Test Program