

18.4 Task Analysis

The functions allocated to plant personnel define their roles and responsibilities; human actions (HAs) accomplish these functions. HAs can be further divided into tasks or groups of related activities which have common objectives or goals. Task analysis (TA) identifies requirements for accomplishing these tasks; specifically, for the displays, data processing, controls, and job support aids needed to accomplish tasks. The results of the TA are identified as inputs in many HFE activities in accordance with NUREG-0711 (Reference 1), such as:

- Staffing, qualifications, job design, and training.
- Human system interface (HSI), procedure, and training program design.
- Defining task support verification and validation criteria.

The scope and methodology for TA for the U.S. EPR are summarized in the Human Factors Topical Report (Reference 2).

18.4.1 Task Analysis Objectives and Scope

The objective of the U.S. EPR TA is to identify the specific tasks needed to accomplish the safety significant functions that are allocated to personnel. The TA also identifies the information, control, and support requirements for those tasks. TA is used to develop the inventory of alarms, displays, and controls necessary for operators to perform tasks.

The TA considers a full range of plant operating modes (i.e., startup, normal power, abnormal and emergency operations, as well as transient, low-power, and shutdown conditions) including selected representative and important tasks from the areas of operations, maintenance, test, inspection, and surveillance. The TA also considers HAs that involve monitoring and backup of automatic functions. Risk important HAs are identified via the probabilistic risk assessment (PRA) Level I and II analyses (see Sections 18.6 and 19). Also included in the scope of the TA are the analyses of tasks with automated critical functions, including monitoring the automated system and executing backup actions if the system fails.

18.4.2 Task Analysis Methodology

The U.S. EPR evolved from predecessor plants and utilizes similar control of system functions and instrumentation and control (I&C) concepts. Similarly, U.S. EPR operating procedures evolved from previously developed procedures. Since all safety significant tasks in scope for TA are driven by procedural requirements, developing the operating procedures drives derivation of (i.e., analyzes) the tasks which operators perform to safely operate the plant. Procedure development (see Section 18.8) constitutes an analysis of HAs. U.S. EPR operating procedure guidelines are used to identify the set of information and controls necessary for those tasks to be performed by operating personnel. This TA provides initial input to HSI design and is an iterative

process as details of procedure requirements and HSI elements evolve. Plant procedures are verified by a qualified team of operators.

Section 13.5 describes a basic process for developing emergency operating procedures (EOP) for the U.S. EPR. This process involves the following:

- Use of a well refined symptom-based approach and guideline structure.
- Use of a generic technical basis document to determine gaps between predecessor designs and the U.S. EPR design with respect to addressing how transients are mitigated.
- Incorporation of U.S. EPR specific event analyses.
- Development of guidance to account for design differences between the U.S. EPR and predecessor designs.

Normal and abnormal operating, test, inspection, maintenance, surveillance, and alarm response procedures are similarly developed based on those for predecessor designs. Procedure developers determine gaps between predecessor designs and the U.S. EPR design and determine task requirements for specific procedure requirements. This process is conducted in an iterative manner as the level of detail in the design increases.

Section 18.5 describes the minimum staffing requirement for operators in the U.S. EPR main control room (MCR). Section 18.7 describes the roles and responsibilities of key operating personnel. The collective set of operator roles and responsibilities is input essential to the development of operating procedures. Validation of operating procedures includes a comparison of tasks with the roles and responsibilities of the operator(s) who may perform the task. Discrepancies discovered during validation activities may result in task reassignment or re-design of the HSI (see Section 18.10). As described in Section 18.7, the design of the HSI may be iterated as necessary to support:

- Validation of applicable procedures.
- Changes to operator roles and workloads.
- Reducing the risk significance of certain HAs.

18.4.3 Results Summary

The TA is documented in conjunction with the verification and validation (V&V) results summary by validation of operating procedures containing HAs that the PRA found to be risk significant. The results summary also describes how successive iterations of TA for procedure development, the procedures themselves, and training programs result in an HSI design that supports in-scope information, control, and support requirements.

18.4.4**References**

1. NUREG-0711, "Human Factors Engineering Program Review Model," Revision 2, February 2004.
2. ANP-10279P, "U.S. EPR Human Factors Engineering Program Topical Report," January 2007.