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Enclosure 2

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ESBWR Human Factors Engineering Task Analysis Implementation Plan
Revision 3

Non-Proprietary Version

HITACHI

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Licensing Topical Report

ESBWR HUMAN FACTORS ENGINEERING TASK ANALYSIS IMPLEMENTATION PLAN

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SUMMARY OF CHANGES (NEDE-33221P, REV 3 VS. REV 2)

Item	Location	Change	Comment
(1)	All	Content change for this revision resulted in base document changing from Class I to Class III.	N/A
(2)	All	Added pointers to reference section throughout document.	N/A
(3)	1.1	Revised last bullet indicating Reg. Guide 1.97 versus Minimum Inventory.	RAI 18.5-27 S03
(4)	1.2	Revised last bullet indicating Reg. Guide 1.97 versus Minimum Inventory.	RAI 18.5-27 S03
(5)	1.3.1	Deleted Minimum Inventory HSIs definition and added Reg. Guide 1.97 Instrumentation definition.	RAI 18.5-27 S03
(6)	2.1.1 and 2.1.2	Removed or updated references revision levels as appropriate.	N/A
(7)	2.1.2	Added reference to DCD Chapter 7 due to use in section 1.3.1 definition of HSI.	N/A
(8)	2.5 (3) and (4)	Added references used in Appendices B and C.	Related to RAI 18.5-5 S05
(9)	3	Added bullet related to Reg. Guide 1.97.	RAI 18.5-27 S03
(10)	3.3	Deleted entire section related to minimum inventory.	RAI 18.5-27 S03
(11)	4.1	Added pointer to Appendix B.	RAI 18.5-5 S05
(12)	4.1.2	Added bullet for OER/BRR.	RAI 18.5-5 S05
(13)	4.1.3.3	Revised first bullet to include Reg. Guide 1.97 parameters.	RAI 18.5-27 S03
(14)	4.1.3.5(2)	Added note.	RAI 18.5-5 S05
(15)	4.1.3.6	Added pointer to Appendix A.	RAI 18.5-26 S03
(16)	4.1.4	Added bullet related to Reg. Guide 1.97.	RAI 18.5-27 S03
(17)	4.2	Added pointer to Appendix C.	RAI 18.5-5 S05
(18)	4.2.3.5(2)	Added note.	RAI 18.5-5 S05

Item	Location	Change	Comment
(19)	4.2.3.6	Added pointer to Appendix A.	RAI 18.5-26 S03
(20)	4.3	Deleted entire section related to minimum inventory.	RAI 18.5-27 S03
(21)	5.1	Deleted bullet related to minimum inventory.	RAI 18.5-27 S03
(22)	Appendix A	Added Appendix.	RAI 18.5-26 S03
(23)	Appendix B	Added Appendix.	RAI 18.5-5 S05
(24)	Appendix C	Added Appendix.	RAI 18.5-5 S05

1. OVERVIEW

The ESBWR Man-Machine Interface System And Human Factors Engineering Implementation Plan [Reference 2.1.1 (2)], illustrated in Figure 1, establishes three specific activities that support operational analysis:

- Functional Requirements Analysis (FRA)
- Allocation of Functions (AOF)
- Task Analysis (TA)

These steps determine:

- Functions required to achieve plant goals and system functions
- Distribution of functions among human, machine, and shared control
- Integrated human actions (HAs) and machine actions required at the task level

The overall operations analysis is an iterative integration of the three elements of functional requirements, function allocation, and task analysis to establish requirements for the Human-System Interface (HSI) design. Plant equipment, software, personnel, and procedural requirements are systematically defined. As a result, functional objectives are met.

This plan document covers the third of these steps, task analysis. Task analysis scrutinizes tasks that support functional requirements for plant operation to support:

- Start-up, power operation, shutdown, and refueling activities
- Normal, abnormal, and emergency operation
- Performance of maintenance, calibration, and surveillances

Subsequent HFE tasks refine this initial assignment by strategically employing human and machine capabilities. Factors considered during TA include:

- Existing Baseline Record Review (BRR) operating experience review (OER)
- Regulatory requirements (e.g., Reg. Guides/NUREG/DCD)
- ESBWR mission and supporting goals
- Reliability of the human, machine, and shared control schemes (e.g., D3-Defense-in-Depth and Diversity)
- Operator workload and situational awareness (e.g., HRA/PRA)
- Capital cost, operating costs, and technical feasibility

1.1 PURPOSE

The purpose of this implementation plan is to prescribe and guide task analysis for the ESBWR plant design in accordance with the requirements of the ESBWR MMIS HFE Implementation Plan [Reference 2.1.1 (2)].

The TA Plan establishes methods to:

- Conduct the TA consistent with accepted HFE methods
- Promote the ESBWR mission, goals, and philosophy
- Identify prerequisites to performing a task or task sequence
- Identify the parameters required to coordinate tasks and task sequences
- Identify the termination criteria to abort a task or task sequence
- Identify the parameters that confirm successful completion of tasks or task sequences
- Sequence tasks to support normal operation
- Sequence tasks to support abnormal operation
- Sequence tasks to support surveillance functions
- Sequence tasks to support maintenance functions
- Assess the impact of design, staffing, training, procedure, and HSI changes on the sequence and coordination of tasks
- Identify Reg. Guide 1.97 [Reference 2.3 (6)] instrumentation including the respective variable type

1.2 SCOPE

This plan establishes the following scope elements for the analysis:

- Objectives, performance requirements, and constraints
- Methods and criteria for conducting the TA in accordance with accepted human factors principles and practices
- System and function requirements that define task sequencing and coordination restraints
- Resultant systems HSI requirements
- TA responsiveness to HRA/PRA and deterministic evaluations
- Task sequencing for each identified function
- Overall system configuration design
- Methods for identifying Reg. Guide 1.97 [Reference 2.3 (6)] instrumentation including the respective variable type

To accomplish these objectives, system-level and plant-level functions are systematically analyzed. The relationships and interaction between human and machine tasks are examined through several iterations of analysis. TA considers all functions identified by the FRA and allocated to human, machine, or shared ownership.

Task analysis applies to the full range of plant conditions including:

- Startup
- Normal operations
- Abnormal and emergency operations
- Transient conditions
- Low power operation
- Shutdown conditions

TA also does the following:

- Identifies needed information, controls, and alarms
- Supports operations during periods of maintenance and tests of plant systems and equipment, including HSI equipment
- Evaluates tasks that the HRA/PRA has determined to be risk important using the process described in ESBWR HFE Human Reliability Implementation Plan [Reference 2.1.2 (9)].
- Produces procedure outlines
- Produces automation logic

1.3 DEFINITIONS AND ACRONYMS

1.3.1 Definitions

Several terms are defined to provide a common basis for developing TA recommendations referred to in this plan.

Component: An individual piece of equipment such as a pump, valve, or vessel; usually part of a plant system.

Consequences: The results of (i.e., events that follow and depend upon) a specified event.

Crew: The group of people at the plant that manage and perform activities modeled in the PRA and are necessary to operate the plant and maintain its safety.

Function: An activity or role performed by a human, structure, or automated system to fulfill an objective [ESWBR Functional Requirements Analysis Implementation Plan, Reference 2.1.2 (4)].

HSI requirements: The validated HSIs and their characteristics that satisfy the task analysis information and control needs. This input is obtained from the revised HSI report resulting from the ESBWR HSI Design [Reference 2.1.2 (10)] activity and amended by the ESBWR HFE V&V [Reference 2.1.2 (13)] activity.

Human Action (HA): A manual response to a cue involving one person to achieve one task or objective. Potentially risk important actions affect equipment or physical systems. Single human actions can be represented as an event in a fault tree or branch point in an event tree.

Human error: Can be defined as a mismatch between a performance demand and the human capability to satisfy that demand.

Human factors engineering (HFE): The application of knowledge about human capabilities and limitations to plant, system, and equipment design. HFE ensures that the plant, system, or equipment design, human tasks, and work environment are compatible with the sensory, perceptual, cognitive, and physical attributes of the personnel who operate, maintain, and support the system.

Human Reliability Analysis (HRA): A structured approach used to identify potential human failure events and to systematically estimate the probability of those errors using data, models, or expert judgment. [Reference 2.2 (1)]

Human System Interface (HSI): In general the HSI encompasses all instrumentation and control systems provided as part of the ESBWR for use in performing the monitoring, control, alarming, and protection functions associated with all modes of plant normal operation (i.e., startup, shutdown, standby, at power operation, and refueling) as well as off-normal, emergency, and accident conditions. Specifically, the HSI is the organization of inputs and outputs used by personnel at a location to interact with the plant, including the using of alarms, displays, controls, and job performance aids. Generically, this includes interfaces that support actions for monitoring, controlling, maintaining protection functions, responding to events, and performing maintenance, calibration, inspection and testing activities. The details of the HSI systems are defined in ESBWR DCD, Tier 2, Chapter 7 [Reference 2.2 (1)].

Human Task: The activity of a human required to accomplish a function. For example, the human user conserves, reduces, or adds information, and supplies or controls energy.

Maintenance: Activities carried out to keep systems and equipment available. Specific types of maintenance include preventive, and corrective. Activities associated with preventive maintenance include testing, surveillance, inspection, and calibration. Activities associated with corrective maintenance include repair, replace, and modify.

Operational Analysis: An iterative process that describes plant, system, and component state changes as a series of tasks including supporting information requirements. This is accomplished through performance of system functional requirements analyses, allocation of functions, and task analyses. The analysis process determines what must be done, who does it (man, machine, or shared), and how it is to be done (controls, indications, supporting information, and so forth). Results of the analyses are design requirements for the HSI, procedures, and training.

Operating experience review (OER): A systematic review, analysis and evaluation of operating experience that can apply to the development of the HSI design.

Reg. Guide 1.97 Instrumentation: Instrumentation identified as being required by the operators in accordance with IEEE Std 497-2002 [Reference 2.5 (2)] as modified by Reg. Guide 1.97, Rev. 4 [Reference 2.3 (6)].

Risk-important human actions: Actions that are performed by plant personnel to provide assurance of plant safety. Actions may be made up of one or more tasks. There are both absolute and relative criteria for defining risk-important actions. From an absolute standpoint, a risk-important action is any action whose successful performance is needed to provide reasonable assurance that predefined risk criteria are met. From a relative standpoint, the risk-important actions may be defined as those with the greatest risk in comparison to all human actions. The identification can be done quantitatively from risk analysis and qualitatively from various criteria, such as task performance concerns based on the consideration of performance shaping factors.

Risk Significant Local Control Stations: A local control station(s) at which risk-important human actions are performed or which control safety-related equipment.

Task: A collection of activities with a common purpose, often occurring in temporal proximity, with an identifiable start and end point for which human actions are performed using displays and controls.

Workload: The physical and cognitive demands placed on plant personnel [Reference 2.3 (5)].

1.3.2 Acronyms

The following is a list of acronyms used in this plan:

Acronym	Description
AOF	Allocation of Function
ASME	American Society of Mechanical Engineers
BRR	Baseline Review Record
COL	Combined Operating License
DCD	Design Control Document
D3	Defense-in-Depth and Diversity
EOP	Emergency Operating Procedures
FSS	Full Scope Simulator
FRA	Functional Requirements Analysis
HAs	Human Actions
HRA	Human Reliability Analysis
HFE	Human Factors Engineering
HRA/PRA	Human Reliability Analysis/Probabilistic Risk Assessment
HSI	Human-System Interface

IOP	Integrated Operating Procedures
LCSs	Local Control Stations
MMIS	Man-Machine Interface Systems
NUREG	Nuclear Regulatory Commission technical report designation
OER	Operating Experience Review
PAS	Plant Automation System
PRA	Probabilistic Risk Assessment
RGs	Regulatory Guides(s)
SFRA	System Functional Requirements Analysis
SOP	System operating procedure
TA	Task Analysis
S&Q	Staffing and Qualifications
V&V	Verification and Validation

2. APPLICABLE DOCUMENTS

Applicable documents include supporting documents, and supplemental documents. Codes and standards are also provided in this section. Supporting documents provide the input requirements to this plan. Supplemental documents are used in conjunction with this plan. Codes and standards are applicable to this plan to the extent specified herein.

2.1 SUPPORTING AND SUPPLEMENTAL GEH DOCUMENTS

2.1.1 Supporting Documents

The following supporting documents were used as the controlling documents in the production of this plan. These documents form the design basis traceability for the requirements outlined in this plan.

(1) ESBWR DCD, Chapter 18, (GEH 26A6642BX)

(2) NEDE-33217P and NEDO-33217, Rev 5, ESBWR Man-Machine Interface System And Human Factors Engineering Implementation Plan

2.1.2 Supplemental Documents

The following supplemental documents are used in conjunction with this document plan:

(1) ESBWR DCD, Tier 2, Chapter 7, (GEH 26A6642AW)

(2) ESBWR DCD, Tier 2, Chapter 13, (GEH 26A6642BL)

(3) ESBWR DCD, Tier 2, Chapter 19, (GEH 26A6642BZ)

(4) NEDO-33219, Rev 3, ESBWR HFE Functional Requirements Analysis Implementation Plan

(5) NEDE-33220P and NEDO-33220, Rev 3, ESBWR HFE Allocation of Function Implementation Plan

(6) NEDE-33226P and NEDO-33226, Rev 4, ESBWR I&C Software Management Program Manual

(7) NEDO-33262, Rev 2, ESBWR HFE Operating Experience Review Implementation Plan

(8) NEDO-33266, Rev 2, ESBWR HFE Staffing and Qualifications Implementation Plan

(9) NEDO-33267, Rev 3, ESBWR HFE Human Reliability Analysis Implementation Plan

(10) NEDE-33268P and NEDO-33268, Rev 4, ESBWR HFE Human System Interface Design Implementation Plan

(11) NEDO-33274, Rev 3, ESBWR HFE Procedures Development Implementation Plan

(12) NEDO-33275, Rev 3, ESBWR HFE Training Program Development Implementation Plan

(13) NEDE-33276P and NEDO-33276, Rev 2, ESBWR HFE Verification and Validation Implementation Plan

(14) NEDO-33277, Rev 3, ESBWR HFE Human Performance Monitoring Implementation Plan

(15) NEDO-33278, Rev 3, ESBWR HFE Design Implementation Plan

2.2 CODES AND STANDARDS

The following codes and standards are applicable to the HFE program to the extent specified herein.

(1) ASME RA-S-2002, Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications

2.3 REGULATORY GUIDELINES

(1) NUREG-0700, Rev 2, Human-System Interface Design Review Guidelines, 2002

(2) NUREG-0711, Rev 2, Human Factors Engineering Program Review Model, 2004

(3) NUREG-0737, Clarification of TMI Action Plan Requirements, 1980, and Supplement 1, Requirements for Emergency Response Capability, 1983

(4) NUREG-0800, Rev 1, Standard Review Plan, Chapter 18, 2004

(5) NUREG-1764, Rev 0, Guidance for Review of Changes to Human Actions, 2004

(6) Regulatory Guide 1.97, Rev 4, Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants, June 2006

(7) NUREG/CR-6634, Computer-Based Procedure Systems: Technical Basis and Human Factors, 2000

2.4 DOD AND DOE DOCUMENTS

None.

2.5 INDUSTRY AND OTHER DOCUMENTS

(1) DI&C-ISG-05, Digital Instrumentation and Controls: Highly Integrated Control Rooms-Human Factors Issues, September 2007

(2) IEEE Std 497-2002, Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations, September, 2002

(3) IEEE 1023-2004 IEEE Recommended Practice for the Application of Human Factors Engineering to Systems, Equipment, and Facilities of Nuclear Power Generating Stations and Other Nuclear Facilities, June 2005

(4) INPO 06-002 (Good Practice) Change Management Plan, Human Performance Tools for Workers, General Practices for Anticipating, Preventing, and Catching Human Error During the Performance of Work

3. METHODS

The task analysis processes shown in Figures 2 & 3 are applied to human only, shared, and machine only (if any) actions. The design task analysis shown in Figure 2 processes tasks at the plant and system levels that support all aspects of all normal operating modes. The detailed task analysis processes tasks that support all aspects of abnormal and emergency operations. The economic task analysis processes tasks that support all aspects of plant maintenance, calibration, inspection, and testing.

The Task Analysis:

- Coordinates and implements plans in accordance with NRC guidelines
- Performs system (including components) and plant-level analyses of functions
- Performs analysis of normal and abnormal functions
- Executes the HFE plans iteratively from the early design phase through turnover to the fleet-wide owners' group and COL Applicants
- Follows accepted HFE and I&C practices and processes
- Follows the activities for HSI design and system hardware/software design
- Meets the commitments of ESBWR DCD, Tier 2, Chapter 18 [Reference 2.1.1 (1)]
- Develops the list of Reg. Guide 1.97 [Reference 2.3 (6)] instruments including the respective variable type.

The objective of task analysis is to determine how monitoring, control, and communication is best performed. Functions identified during the Design-phase FRA, which are determined to be human or shared functions during AOF are restated as tasks. Any subtasks that support these tasks are identified during the TA.

Task analysis is applied during many phases of the design as illustrated in Figure 2. The ESBWR HFE designs pass through several phases: from the initial, detailed and economic design phases, through implementation, start-up testing, and operating, and decommissioning phases. This plan discusses the first three design phases: design, detailed, and economic, as shown in Figure 2.

Outputs from each of these three design phases provides or refines:

- Requirements to the HSI Implementation Plan
- Detailed procedure outlines to the Procedure Development Plan
- Task sequence and interlock logic for plant automation and auto control of functions

Task analysis identifies the individual tasks, mental and physical, necessary to support the functions allocated to, or shared by, the plant operator. Human, machine, and shared tasks are subject to interactive analysis.

3.1 SYSTEM-LEVEL TASK ANALYSIS

3.1.1 Background

This plan provides the methodology for performing TA during the design phase associated with the MCR, RSS, and other risk significant Local Control Stations (LCSs). This TA methodology is employed at all stages in the life cycle of a system to ensure that both the initial design and subsequent design changes meet the goals of the MMIS and HFE Implementation Plan.

3.1.2 Goals

System Task Analysis goals include:

- Eliminating latent and active human errors
- Creating task sequences and priorities that are utilized by both automatic system controls and operating procedures
- Making seamless transitions between manual and automatic control
- Providing function allocation feedback to the AOF plan through workload assessment
- Developing design inputs early in the design process to maximize HSI usability
- Minimal impact on design schedule and project budget

3.1.3 Basis and Requirements

The methods and criteria recommended for conducting task analyses are in accordance with accepted human factors practices and principles.

3.1.4 General Approach

Operational analysis is designed as a multi-step process, as illustrated in Figure 2. Subsequent iterations contain more detailed information about the system and further establish the roles of various personnel. The functional requirements analysis generates the following system level outputs:

- System Operating Modes
- System Change Modes
- Component Lineups
- Component Operational Requirements (i.e. components required to be remotely operated)
- Component control requirements (i.e. automatic, manual, etc.)
- Component manipulations required to change modes (as defined for normal and abnormal system operating procedure development), and
- Functional logic diagrams

Each of these sets of functions are processed and presented by FRA as sequenced data structures. These data structures provide inventories of required parameters, indication and controls, and outline sequences to be processed by AOF. The function outline sequences are evaluated using the AOF process. Each function or sub-function in the sequence is evaluated and allocated to one of the following resources for execution:

- **Human Only** – the function is executed entirely by plant personnel. The HSI is used to carry out the actions and monitoring performed by humans. The machine has no direct control, backup, or limiting actions associated with the function(s) being allocated.
- **Machine Only** - the function is executed entirely by plant automation. Humans have no direct control, backup, or limiting actions associated with the function(s) being allocated.
- **Shared** – the function is executed using a combination of both human and machine resources.

Task analysis processes the allocated functions and generated detailed task sequences and associated logic to meet the goals and requirements determined by FRA when implemented by the resource to which the function was allocated in AOF.

The resulting task sequences provide procedure outlines and input to PAS and system automation control logic. Procedures and machine logic generated by a common data structure minimizes potential errors when transferring control from manual to automatic as well as when human action is required.

Latent errors are detected during TA through the use of simulation. Thus, future consequences and costs of corrective actions are avoided. Active errors are reduced during workload assessment by:

- Providing feedback to AOF from workload assessment to reallocate functions
- Setting function hierarchy and priorities to allow the humans and automation to concentrate on the most risk-important tasks

3.1.5 Application

Identifies and documents the requirements for task performance, including the following:

- Specific human and machine actions
- Tasks and subtasks
- Conditions, priorities, sequences, initiators, and interlocks
- Controls and displays (indications)
- Criteria to determine success or failure
- Task-abort criteria

3.2 PLANT-LEVEL TASK ANALYSIS

3.2.1 Background

This plan provides the methodology for performing TA during the design phase associated with the MCR, RSS, and risk significant Local Control Stations (LCSs). This TA methodology is employed at all stages in the life cycle of a system to ensure that both the initial design and subsequent design changes meet the goals of the MMIS and HFE Implementation Plan [Reference 2.1.1 (2)].

3.2.2 Goals

Plant-level task analysis goals include:

- Eliminating latent and active human errors
- Creating task sequences and priorities that are utilized by both automatic controls and operating procedures
- Making seamless transitions between manual and automatic control
- Providing function allocation feedback to the AOF plan through workload assessment
- Developing design inputs early in the design process to maximize HSI usability
- Having minimal impact on design schedule and project budget

3.2.3 Basis and Requirements

The methods and criteria recommended for conducting task analyses are in accordance with accepted human factors practices and principles.

3.2.4 General Approach

The plant level task analysis orchestrates the tasks identified at the system level. Operational analysis is designed to be a multi-step process, as illustrated in Figure 2. Subsequent iterations contain more detailed information about the systems and further establish the roles of various personnel. The functional requirements analysis generates the following plant level outputs:

- Plant goals
- Plant states
- Plant processes
- Procedure process (EPG, IOP, and EAL) outlines
- Plant process and function redundancies
- Critical safety functions
- Plant functions and sub-functions
- Inventory of critical safety parameters

- Requirement for HSI design
- Outlines for simulator scenarios

Each of these sets of functions are processed and presented by FRA as sequenced data structures. These data structures provide inventories of required parameters, indication and controls, and outline sequences to be processed by AOF. The function outline sequences are evaluated using the AOF process. Each function or sub-function in the sequence is evaluated and allocated to one of the following resources for execution:

- **Human Only** – the function is executed entirely by plant personnel. The HSI is used to carry out the actions and monitoring performed by humans. The machine has no direct control, backup, or limiting actions associated with the function(s) being allocated.
- **Machine Only** - the function is executed entirely by plant automation. Humans have no direct control, backup, or limiting actions associated with the function(s) being allocated.
- **Shared** – the function is executed using a combination of both human and machine resources.

Task analysis processes the allocated functions and generated detailed task sequences and associated logic to meet the goals and requirements determined by FRA when implemented by the resource to which the function was allocated in AOF.

The resulting task sequences provide IOP outlines and input to PAS logic. Procedures and machine logic generated by a common data structure minimize potential errors when transferring control from manual to automatic, as well as when human action is required.

Latent errors are detected during TA through the use of simulation. Thus, future consequences and costs of corrective actions are avoided. Active errors are reduced during workload assessment by:

- Providing feedback to AOF from workload assessment to reallocate functions
- Setting function hierarchy and priorities to allow the humans to concentrate on the most risk-important tasks

3.2.5 Application

Identify, prioritize, and organize plant and system tasks include:

- Set priorities among system functions
- Direct user focus
- Sequence plant and system tasks
- Coordinate task conditions, priorities, sequences, initiation, and interlocks
- Verify successful task completion
- Respond to aborted tasks

3.3 (DELETED)

4. IMPLEMENTATION

4.1 SYSTEM-LEVEL TASK ANALYSIS

The TA process is illustrated in Figure 3 while Appendix B provides the detailed system level TA process.

4.1.1 Assumptions

System level assumptions include:

- Tasks required to start-up and shutdown the ESBWR automation
- Common sequence, priority, and logic are employed by the SOPs and each system's automatic control

4.1.2 Inputs

Task analysis inputs include:

- System configurations from SFRA
- Configuration changes from SFRA
- SFRA function flow data structure
- OER/BRR
- Functions allocated during AOF
- HRA/PRA

4.1.3 Process

4.1.3.1 *Task Identification*

Convert functions and configuration changes identified in the SFRA into tasks.

4.1.3.2 *Sequence Tasks*

Order tasks logically considering:

- System requirements
- System limitations
- Industrial safety
- Nuclear safety
- Resource allocation (time, staff, and urgency)

4.1.3.3 *Parameters*

Identify Parameters through:

- Assessing what information is necessary for task completion, including which parameters meet Reg. Guide 1.97 [Reference 2.3 (6)] criteria

- Determining how information is provided

4.1.3.4 *Interdependency*

Identify Interdependency:

- Identify requirements not identified by the system
- Identify criteria for successful task completion
- Identify criteria for task termination

4.1.3.5 *Operating Guidelines*

(1) Develop System Operating Guidelines

Generate system operations guidelines such as:

- Identify prerequisites and limitations
- List subtask steps
- Identify cues used by operators or automation to start, stop, or control plant equipment
- Incorporate completion and termination criteria

(2) Evaluate Operating Guidelines

Note: The elements in this subsection rely on simulations that are initially performed during HSI development per Reference 2.1.2 (10), and later fully validated during validation and verification (V&V) testing per Reference 2.1.2 (13).

Using system level simulation validate:

- Prerequisites and limitations
- Task sequence
- Task timing
- Initiation, completion, and termination criteria

4.1.3.6 *Operator Workload*

Assess operator workload by addressing issues such as:

- Operator vigilance
- Physical and cognitive workload
- Crew-member skills, knowledge, and ability
- Situational awareness during transients and abnormal operation
- Meaningful work allocation

See Appendix A for more detailed work process.

4.1.4 Outputs

System-level task analysis outputs include:

- Communications requirements
- HSI descriptors
- Availability and arrangement of indicators
- Display requirements
- Control requirements
- Alarm requirements
- List of instruments meeting Reg. Guide 1.97 [Reference 2.3 (6)] criteria along with the respective variable type
- Data processing requirements
- Access requirements
- Workplace and workstation design considerations
- Environmental considerations
- Equipment requirements
- Activities required for successful completion of tasks
- Sequences that serve as both procedure outlines and automation logic
- Task input to the training development
- Task input to the staffing and qualification process

4.2 PLANT-LEVEL TASK ANALYSIS

Appendix C provides the detailed plant level task analysis process.

4.2.1 Assumptions

Plant level assumptions include:

- Tasks required to start-up and shutdown the ESBWR automation
- Common sequence, priority and logic are employed by the IOPs and plant automation

4.2.2 Inputs

Task analysis inputs include:

- Plant configurations from PFRA
- Configuration changes from PFRA
- PFRA function flow data structure

- Functions allocated during AOF
- HRA/PRA
- System level TA

4.2.3 Process

4.2.3.1 *Task Identification*

Convert plant functions and configuration changes identified in the PFRA into tasks.

4.2.3.2 *Sequence Tasks*

Order tasks logically considering:

- Plant and system level requirements
- Plant and system limitations
- Industrial safety
- Nuclear safety
- Resource allocation (time, staff, and urgency)

4.2.3.3 *Parameters*

Identify parameters through:

- Assessing task requirements
- Determining how this is provided

4.2.3.4 *Interdependency*

Identify interdependency:

- Identify requirements not identified by the system level task analyses
- Identify criteria for successful task completion
- Identify criteria for task termination
- Identify and coordinate system and plant level requirements and limitations

4.2.3.5 *Operating Guidelines*

(1) Develop Integrated Operating Guidelines

Generate system-operating guidelines such as:

- Identify prerequisites and limitations
- List subtask steps
- Identify cues used by operators or automation to start, stop, or control plant equipment

- Incorporate completion and termination criteria

(2) Operating Guidelines

Note: The elements in this subsection rely on simulations that are initially performed during HSI development per Reference 2.1.2 (10), and later fully validated during V&V testing per Reference 2.1.2 (13).

Using plant level simulation validate:

- Prerequisites and limitations
- Task sequence
- Task timing
- Initiation, completion, and termination criteria

4.2.3.6 *Operator Workload*

Assess operator workload by addressing issues such as:

- Operator vigilance
- Crew members' physical and cognitive workload
- Crew members' skills
- Tasks and control room activities
- Situational awareness during transients and abnormal operation
- Monitoring and control tasks
- Meaningful work allocation

See Appendix A for more detailed work process.

4.2.4 Outputs

- Communications requirements
- HSI descriptors
- Availability and arrangement of indicators
- Display requirements
- Control requirements
- Alarm requirements
- Data processing requirements
- Access requirements
- Workplace and workstation design considerations
- Environmental considerations

- Equipment requirements
- Activities required for successful completion of tasks
- Sequences that serve as both procedure outlines and PAS logic
- Task input to the training development
- Task input to the staffing and qualification process

4.3 (DELETED)

5. RESULTS

5.1 RESULTS SUMMARY REPORTS

The results of the Task Analysis are summarized in a Results Summary Report (RSR). This report is the main source of information used to demonstrate that efforts conducted in accordance with the implementation plan satisfy the applicable review criteria of NUREG-0800 [Reference 2.3 (4)]. The report contains the following:

- General approach including the purpose and scope of Task Analysis
- A list of task descriptions
- A description of the process for documenting and retaining detailed task analysis results
- Examples of detailed task analysis results

TA Results Summary Reports (RSR) may be combined with the FRA and/or AOF RSRs.

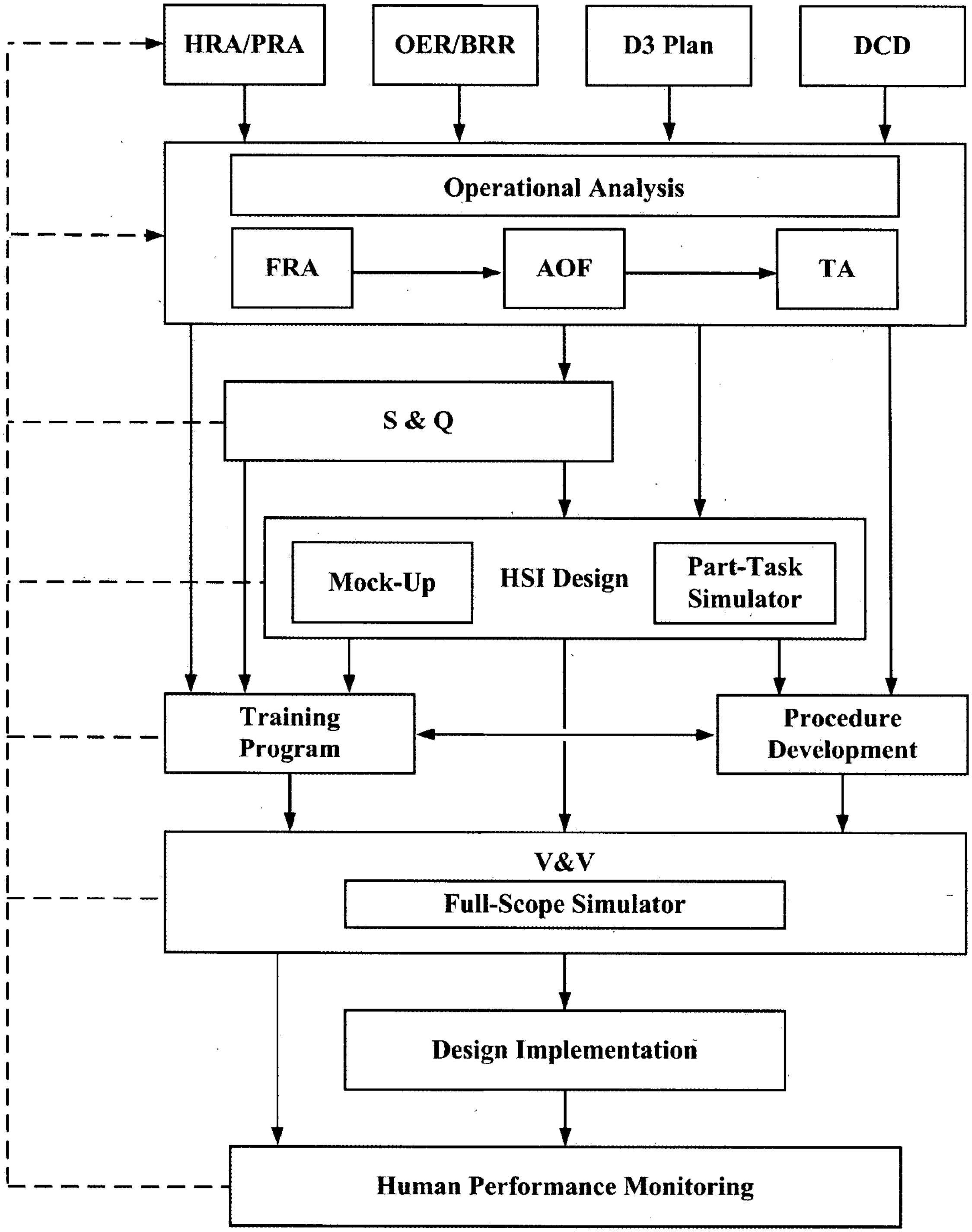

Figure 1. HFE Implementation Process

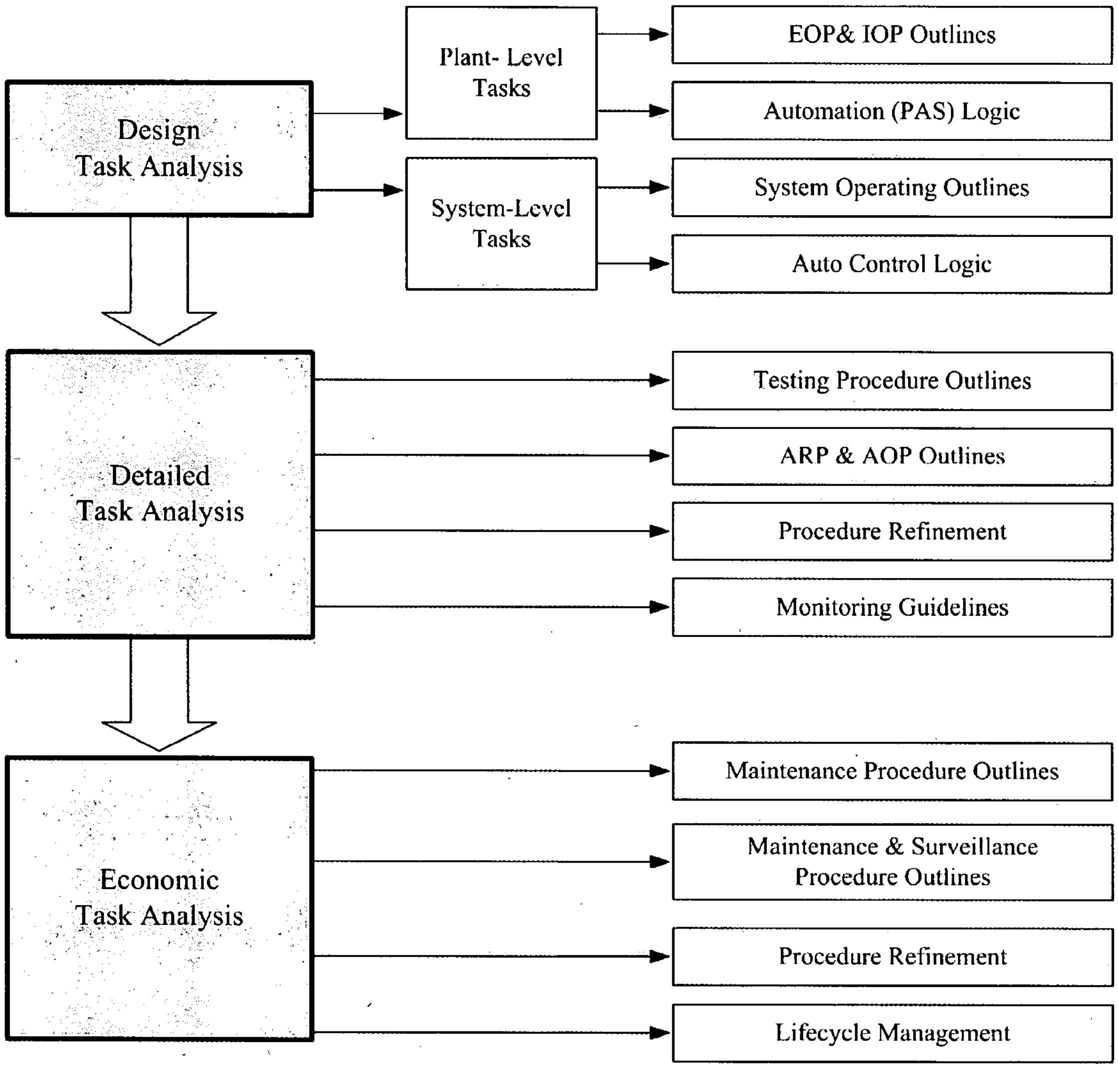

Figure 2. Task Analysis Phases

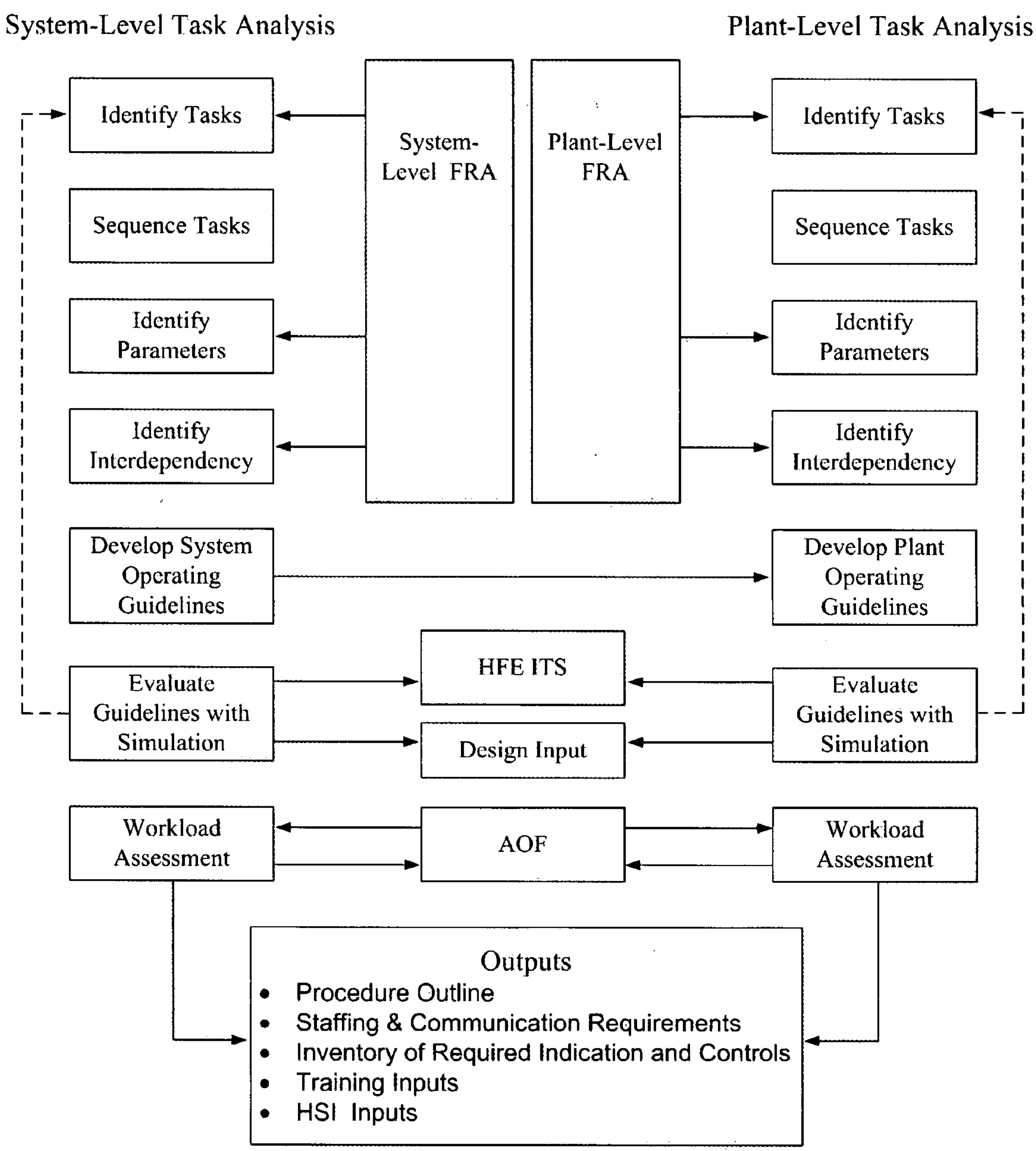

Figure 3. Task Analysis

APPENDIX A WORKLOAD ANALYSIS PROCESS

A.1 PROCESS OVERVIEW

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A.2 STAGE 1 - INITIAL SCREENING

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Table A-1
Workload Measurement Tools

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1. [[

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Figure A-1. Stress/Workload Screening Questionnaire

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Figure A-2. Workload Analysis

APPENDIX B SYSTEM TA DEVELOPMENT WORK PROCESS

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B.1 TA INPUTS

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B.2 TA DEVELOPMENT

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APPENDIX C PLANT LEVEL TA DEVELOPMENT WORK PROCESS

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C.1 PLTA INPUTS

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C.2 TA DEVELOPMENT

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Enclosure 3

MFN 09-402

Licensing Topical Report NEDE-33221P

ESBWR Human Factors Engineering Task Analysis Implementation Plan

Revision 3

Affidavit

GE-Hitachi Nuclear Energy Americas LLC

AFFIDAVIT

I, David H. Hinds, state as follows:

(1) I am Manager, New Units Engineering, GE Hitachi Nuclear Energy ("GEH"), and 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 1 of GEH's letter, MFN 09-402 Mr. Richard E. Kingston to U.S. Nuclear Energy Commission, entitled "Submittal of Licensing Topical Report NEDE-33221P, ESBWR Human Factors Engineering Task Analysis Implementation Plan, Revision 3 – GEH Proprietary Information" dated June 16, 2009. The proprietary information in enclosure 1, which is entitled "*MFN 09-402 - Licensing Topical Report NEDE-33221P, ESBWR Human Factors Engineering Task Analysis Implementation Plan, Revision 3 – GEH Proprietary Information*" is delineated by a [[dotted underline inside double square brackets{3}]]. Figures and large equation objects 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) is classified as proprietary because it contains details of GEH's design and licensing methodology. The development of the methods used in these analyses, along with the testing, development and approval of the supporting methodology was achieved at a significant cost to GEH.

(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 16th day of June 2009.

David H. Hinds
GE-Hitachi Nuclear Energy Americas LLC