

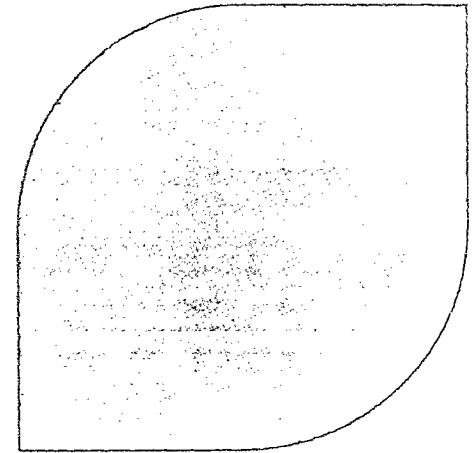
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AREVA

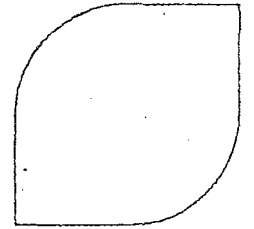
NRC Meeting Chapter 18 Human Factors Engineering

Rockville, MD

December 8, 2009

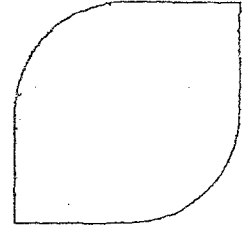


Objective



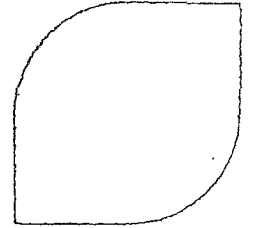
- ▶ **Discuss status of Chapter 18 review and the path forward**

Outline



- ▶ **Discuss draft responses for RAI sets 319, 322, & 328**
- ▶ **Discuss additional RAIs**
- ▶ **Status of review**
- ▶ **RAI closure schedule**
- ▶ **Path forward**

RAI 18-37



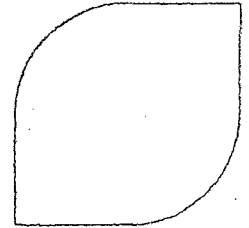
▷ **NRC RAI: Information used as a basis a safety determination and for verifying implementation of NUREG-0711 criteria for the Human Factors Engineering Program must be docketed. As discussed in the 09/29/09 audit with AREVA, provide the latest revisions of the following documents for docketing:**

- ◇ AREVA NP Technical Document 117-9097806-000, "U.S. EPR Local Control Station Style Guide"
- ◇ AREVA NP Technical Document 117-9041149-000, "U.S. EPR Human System Interface Design Guide"

▷ **Draft response**

- ◇ HSI IP covers requirements for the style guides
- ◇ Style Guides are available for audit
- ◇ Customer requirement will impact the guides and they will be revised

RAI 18-40 NRC Question

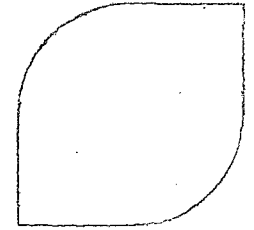


- ▷ **Section 3.4.1 of NUREG-0711 (criterion 3) states: The OER should address related HFE technology. For example, if touch screen interfaces or computerized procedures are planned, HFE issues associated with their use should be reviewed.**

Section 3.2.3 of the EPR OER implementation plan provides lists of non-nuclear industries to solicit for OER, as well as a listing of types of related HFE technology. This section also contains a listing of website databases from which OE in advanced HFE technology may be found.

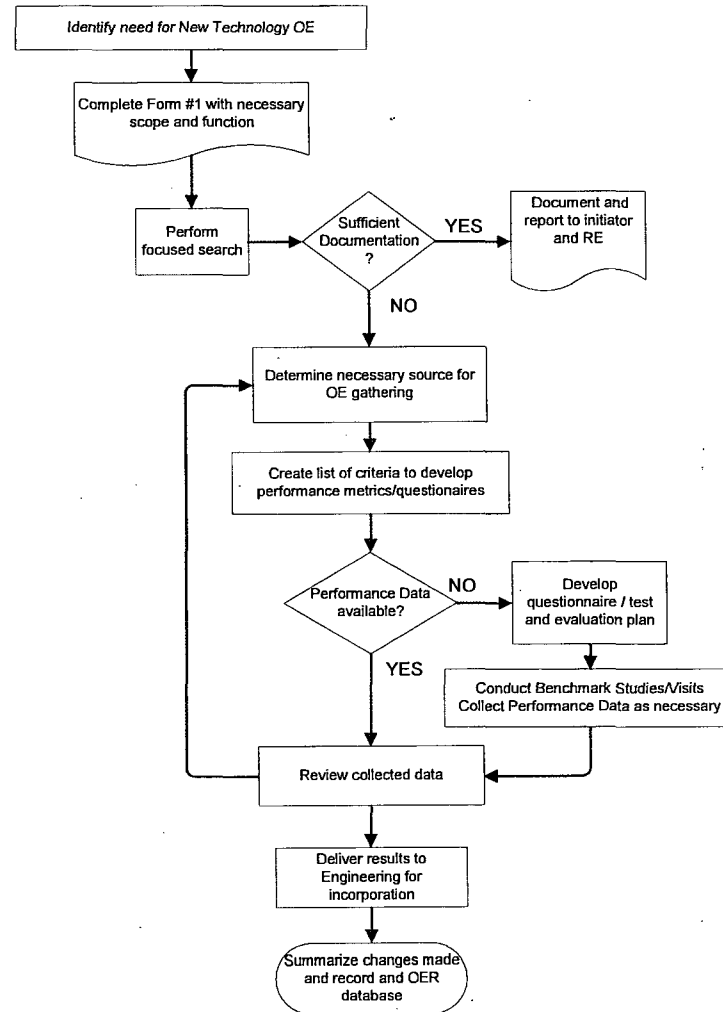
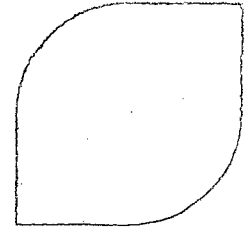
More information is needed for this section of the implementation plan. Provide to the Staff a detailed methodology for collecting this information, including how the data collection will take place and the sequence of events for the review and evaluation.

RAI 18-40 Draft Response

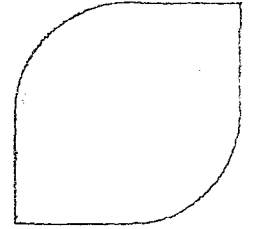


- ▶ **NUREG-0700 and NUREG-0800 are satisfied with the OER implementation plan description of section 3.2.3 “HFE-related technology”. The detailed method for collection of New Technology HFE data is described in detailed OER work plan. Figure 5-2 of this section shows a flow chart of the process to determine to what extent this collection should be. This also describes the sequence of events step-by-step for collection, review, and evaluation of this information.**
- ▶ **Detailed methodology is provided in site specific OER work plan (procedure).**

Detailed OER Methodology



Detailed Methodology – cont.



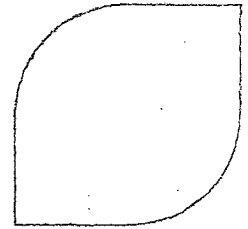
Initiator:

- ▷ Recognize need for new technology OE review. Fill out needed information on App. C form
- ▷ Deliver to HFE Team

HFE OER Personnel:

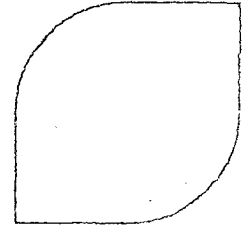
1. Complete form for Necessary OE review for new technology in App. C along with initiator
2. Perform focused search for required new technology information. It may be necessary to look in alternative databases in addition to those for the nuclear industry. The following are possibilities for the inclusion in new technology searches. This is not meant to be an exhaustive list. These databases contain various HFE-related topics including HSI issues, training, communications, procedures, and crisis handling.
 1. For a review of chemical industry events: U.S. Chemical Safety and Hazard Investigation Board website: <http://www.chemsafety.gov/>
 2. For a review of various transportation events: National Transportation Safety Board website: <http://www.nts.gov/>
 3. For a review of aircraft events: Aviation Safety Reporting System website: <http://www.nts.gov/NTSB/Query.asp>
 4. For a review of Space Industry HFE-related data: NASA websites: <http://asrs.arc.nasa.gov/search/reportsets.html>
http://akama.arc.nasa.gov/ASRSDBOnline/QueryWizard_Filter.aspx
http://www.nasa.gov/columbia/home/CAIB_Vol1.html
3. Decide if there is enough material to sufficiently cover all facets of information needed. See App. D for topics that should be covered and possible examples. If there is enough material, then complete report and deliver data to appropriate personnel. If there is not enough information then continue with step four
4. Determine necessary places for possible benchmarking or data collection
5. Create a list of all performance criteria needed to define the specific uses for which we will employ the new technology
6. Create a set of questionnaires in accordance with section 3.2.2
7. Contact facility to obtain needed information
8. Determine if necessary information is available
9. Create benchmarking plan including all testing that would be required to obtain necessary data
10. Conduct benchmarking trip for data collection
11. Create trip report with all data Included in summary form.
12. Complete Search report including recommendations in accordance with App. C
13. Continue with Section 3.3

RAI 18-42 NRC Question



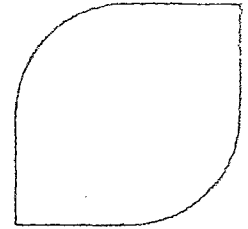
- ▷ **Section 3.4.1 of NUREG-0711, Criterion 4 states “Personnel interviews should be conducted to determine operating experience related to predecessor plants or systems.”**
- ▷ **Section 3.2.4 of the EPR Operating Experience Review (OER) implementation plan describes the methodology for conducting the interviews for the operating experience review. Staff is aware that documents referenced and identified in the OER implementation plan, such as “Human Performance Characterization in Nuclear Events,” dated January 2007, may address some of this information. However, the staff inquires how guidance from this and similar OER reference documents will be used to obtain the operating experience information.**
- ▷ **In addition, according to Section 3.2.4 of the OER implementation plan, the applicant intends to obtain operator information on plant performance through interviews of plant operators. However, the processes for identification and sampling of operators, and the methods to obtain unbiased interview information, are unclear to the staff, based on the information presented in the implementation plan.**
- ▷ **Provide the methods to be used for operator identification and sampling, and the manner in which interview questions will be developed, and interviews conducted**

RAI 18-42 Draft Response



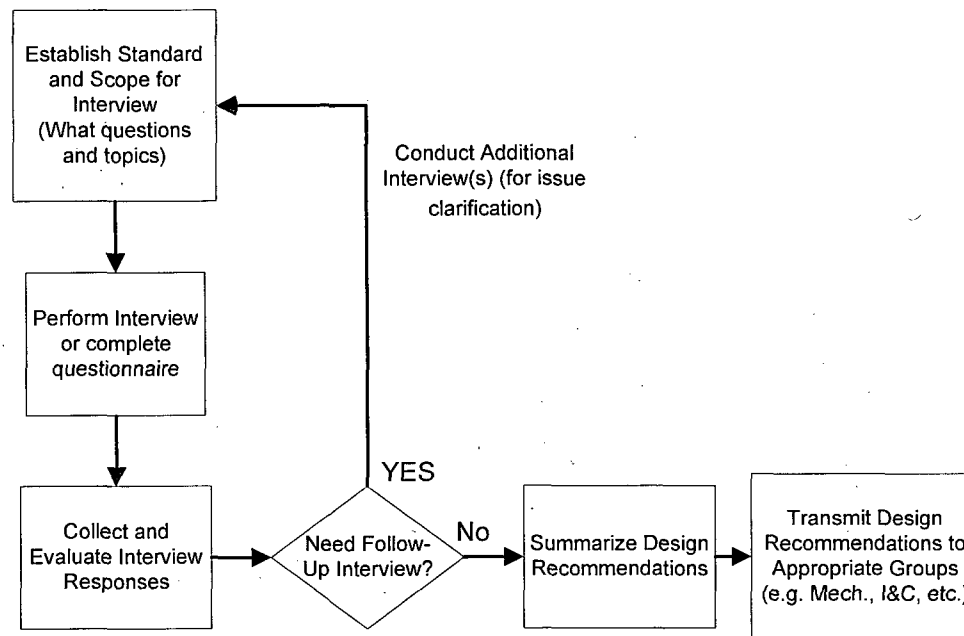
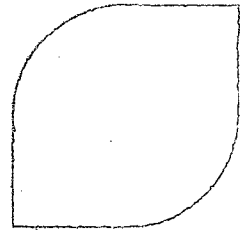
- ▷ **NUREG-0700 and NUREG-0800 are satisfied with the OER implementation plan description of section 3.2.4 “Operator Interviews.” The detailed method for collection of operator interviews is described in OER detail work plan (procedure). Figure 5-1 of this section shows a flow chart of the process to perform the interview process. This also describes the sequence of events step-by-step for collection, review, and evaluation of this information. OER IP changed to simply state:**
 - ◇ **“Operators are the best source to identify design inefficiencies that caused unexpected, inappropriate, or risky actions to be taken during operation. The operator interviews aim to collect information from the operators about any design inefficiencies and workarounds. Interviews will be conducted in accordance with Human Factors Characterization in Nuclear events (reference [7]). Questions developed are intended to form objective descriptions of the event and as much as possible, remove operator bias. Interviews on specific events will be performed during the abnormal and emergency sections of Task Analysis where these conditions are analyzed in higher detail using simulated scenarios.”**

OER Detailed Work Plan Section on Interviews

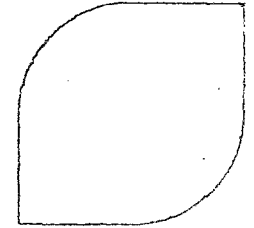


- ▷ **The category of interviews contains both physical interviews and surveys in the form of standardized questionnaires. This allows for the capture of data that would otherwise not have met the threshold for operating experience reports. The overall process for administering the operator interviews is shown in Figure 3-1. This process can also be utilized in conjunction with section 3.2.3 for collecting new technology data.**
- ▷ **Individual interviews will be run upon a sample of nuclear plant personnel involved in operations. Additional surveys will be used to clarify unsolved issues (See Figure).**

Detailed Methodology – Interviews



Detailed Methodology – Interviews cont.



HFE Group:

1. Determine the system(s) to be the subject of the interview. This may include several systems if the topic for example is ventilation or breakers.
2. Develop standard questions for the subject of the interview. This should include HFE topics relevant to the system.

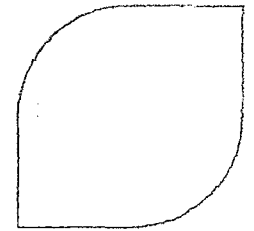
Specific questions are developed that cover these topics:

- Normal plant evolutions (e.g., startup, full power, and shutdown)
- Instrument failures (e.g., safety-related system logic and control unit, fault tolerant controller (nuclear steam supply system), local "field unit" for multiplexer (MUX) system, MUX controller (balance of plant), break in MUX line)
- HSI equipment and processing failure (e.g., loss of video display units, loss of data processing, loss of large overview display)
- Transients (e.g., turbine trip, loss of offsite power, station blackout, loss of all feed water, loss of service water, loss of power to selected buses or control room power supplies, and safety/relief valve transients)
- Accidents (e.g., main steam line break, positive reactivity addition, control rod insertion at power, control rod ejection, ATWS, and various-sized LOCA)
- Reactor shutdown and cool down using remote shutdown system
- Alarm and annunciation
- Operating Displays
- Control and automation
- Information processing and job aids
- Real-time communications with plant personnel and other organizations
- Procedures, training, staffing/qualifications, and job design
- Plant Operations: For the station specific events such as transients and accidents, the questions cover items such as what personnel saw or believe they saw, what they understood at the time, the actions they took, why the actions were taken, what they missed to complete their action and why they needed it. From this, insight can be gained in how to better handle events. Any past difficulties are described along with any suggestions for improvements
- HSI Use: Questions regarding the use of specific HSIs cover the personnel's experience with that HSI. Additionally, positive and negative aspects of the HSI are discussed. The interviewer focuses on the real needs of the operators by listening to the solutions that the operators propose as well as taking into account the operators' skills and experience and any related bias (i.e., the habit to handle a specific HSI). As with the plant operations oriented questions, any suggestions for improvement of negative features are noted for further analysis. The relevant suggestions (i.e. applicable to the U.S. EPR™ design) are considered as additional outcomes of operators' interviews

3. Select a relative sample of the population of personnel familiar with the operation of the system/function to perform the interviews
4. Perform the interviews
5. Collect and evaluate the results
6. Determine the need for any follow-up:
 - Does the information collected completely answer the questions?
 - Does the information collected identify new items for consideration?
 - Is clarification needed for any items?
 - Is an item uncovered that requires a broader or different sample collection?

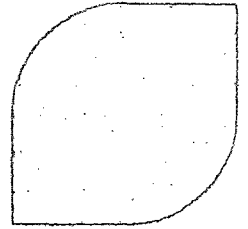
****If the answer to all the above questions is "NO", then continue at step #9.****

7. Develop a follow-up survey or additions to the initial questions that allows for a more complete understanding of existing issues
8. Submit survey to necessary population (expanded if necessary) and follow step #5
9. Group summarized answers into related categories. Analysis is in accordance with Appendix D
10. Write recommendations according to the data found when possible
11. Continue with Section 3.3



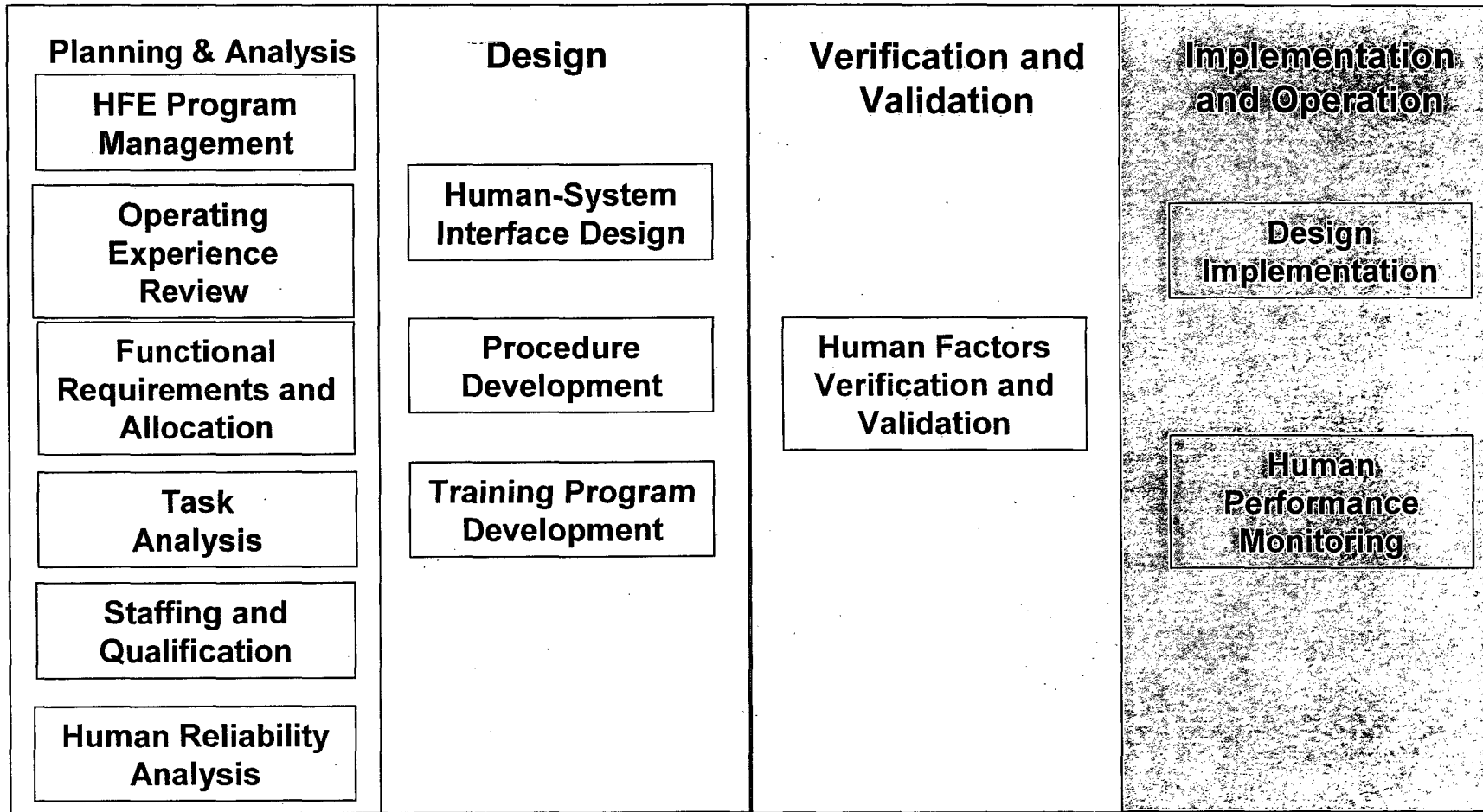
- ▷ This Question indicates insufficient information in the V&V Implementation Plan for the general principal derived from NUREG-0711. This is followed by specific examples that arose because the information provided was insufficient for the review. The examples provided do not comprise a complete set of issues for each category. Rather, they are used to illustrate the general issue caused by the missing information. It is the responsibility of the Applicant to apply the general principals illustrated by staff in the examples to determine the full-scope of issues affected by the missing information.
- ▷ 3. Section 3.6.7 states that a procedure will be developed as part of the validation procedure, and that test procedures should minimize the opportunity for participant or administrator bias. The discussion in this section is primarily a restatement of some of the guidance provided in NUREG-0711. More detail is needed regarding the procedures to be followed during validation testing. What considerations should affect interaction between participants and administrators? What considerations will guide how and when will data be collected and stored? What procedures will be followed for documentation of the testing scenarios? Procedures for the documentation of testing irregularities and training on the importance of documenting training irregularities should be presented
- ▷ ...(additional sub-parts)

RAI 18-67 Draft Response



- ▶ **The V&V IP will be revised to include structure changes to meet review criteria.**
- ▶ **Level of detail in the V&V plan meets NUREG-0711 review criteria.**
- ▶ **V&V detailed work plans will be developed later in the design process according to the design timeline.**

NUREG-0711 rev. 2

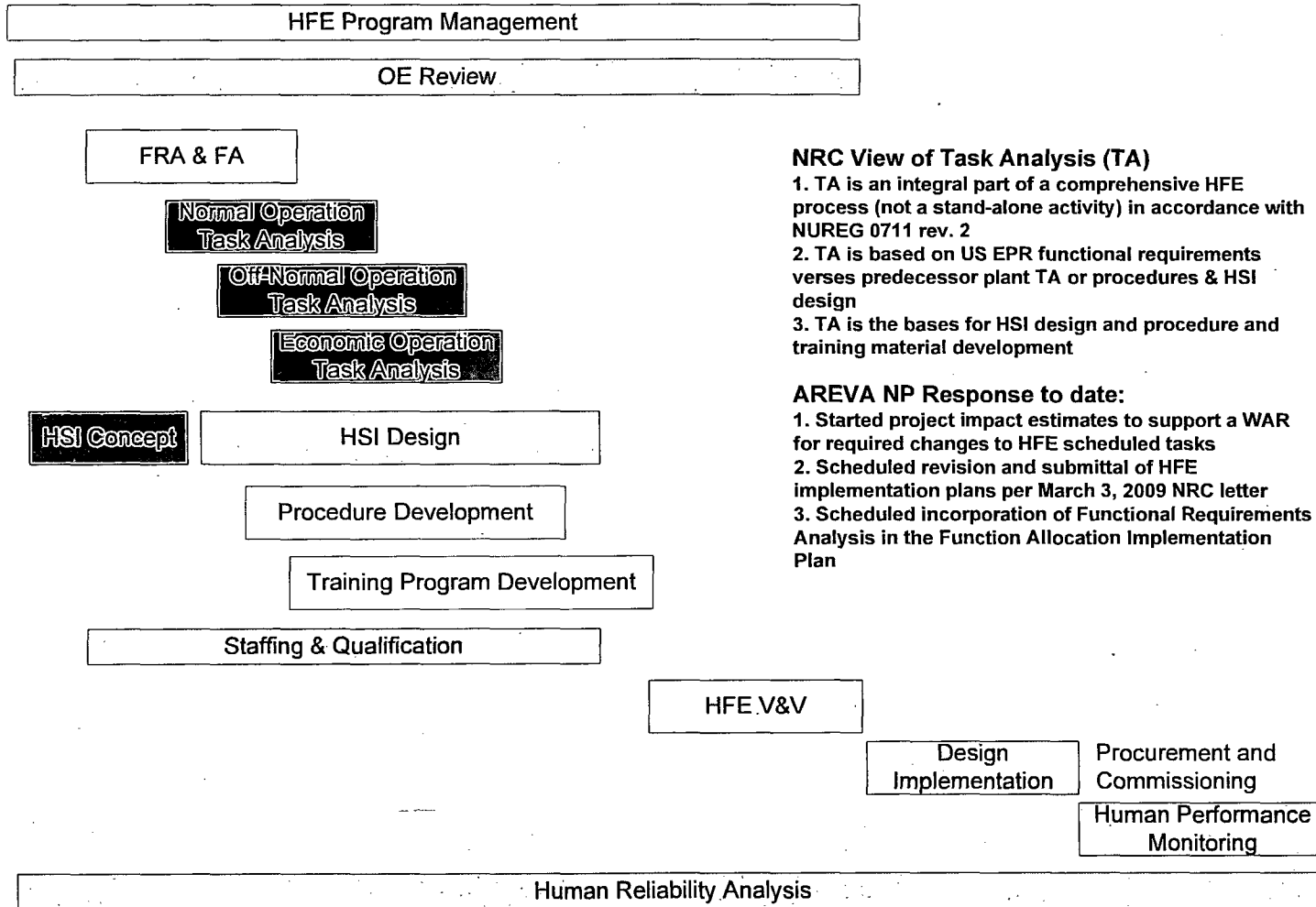
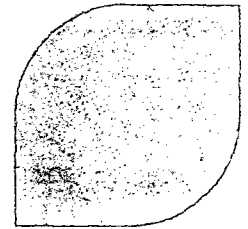


Design Certification – High level Plans

Detail Engineering – Detailed level Plans



HFE Relative Schedule



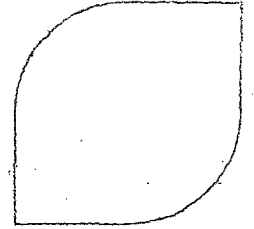
NRC View of Task Analysis (TA)

1. TA is an integral part of a comprehensive HFE process (not a stand-alone activity) in accordance with NUREG 0711 rev. 2
2. TA is based on US EPR functional requirements versus predecessor plant TA or procedures & HSI design
3. TA is the bases for HSI design and procedure and training material development

AREVA NP Response to date:

1. Started project impact estimates to support a WAR for required changes to HFE scheduled tasks
2. Scheduled revision and submittal of HFE implementation plans per March 3, 2009 NRC letter
3. Scheduled incorporation of Functional Requirements Analysis in the Function Allocation Implementation Plan

Path Forward



- ▶ **AREVA NP is not taking exception to NUREG-0711 R2 for U.S. EPR**
- ▶ **RAI responses will describe how the implementation plans will be revised (December 2009 – January 2010)**
 - ◆ RAI response will have level of detail required for full understanding
 - ◆ IP will contain level of detail to meet review criteria
- ▶ **Updated IPs will be submitted 1QCY2010**