

Updating the NRC's Human Factors Engineering (HFE) Design Review Guidance

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Overview

- Background
- Project Objective
- Approach
- Schedule



Background

- NRC performs HFE reviews to help ensure safe operation of nuclear power plants (NPPs).
- Design process and products are reviewed.



Background (cont'd)

- NPP areas of HFE impact:
 - Reviews of new NPP/control room designs
 - Upgrades to HSIs and procedures
 - Changes impacting credited human actions in SAR
 - Staff investigation of events involving human performance



Background (cont'd)

- Regulatory basis:
 - 10 CFR Part 52 – new NPPs
 - 10 CFR Part 50 – currently operating NPPs
- Key provision - [10 CFR 50.34(f)(2)(iii)]:

“ Provide, for Commission review, a control room design that reflects state-of-the-art human factors principles prior to committing to fabrication or revision of fabricated control room panels and layouts.”

Background (cont'd)

Key HFE Review Guidance Documents

- NUREG-0800 - Standard Review Plan, Chapter 18, Human Factors Engineering (2004)
- NUREG-0711, Rev. 2 - Human Factors Engineering Program Review Model (2004)
- NUREG-0700, Rev. 2 - Human-System Interface Design Review Guidelines (2002)



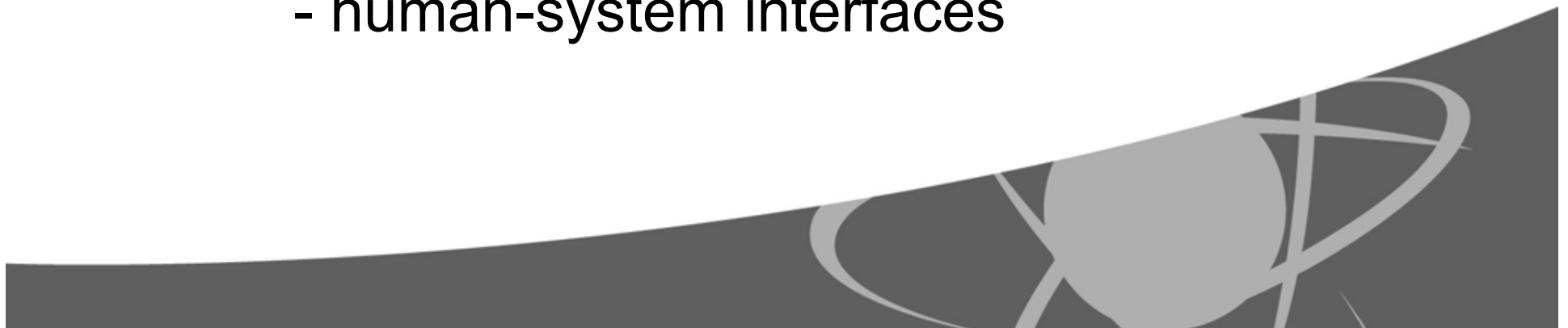
Background (cont'd)

Additional HFE Guidance Documents

- Guidance for the Review of Changes to Human Actions: Final Report (NUREG-1764)
- Guidelines for the Preparation of Emergency Operating Procedures (NUREG-0899)
- Interim Staff Guidance on Highly-Integrated Control Rooms – Human Factors Issues (DI&C-ISG-05)
 - Addresses computer-based procedures, minimum inventory and crediting manual operator actions in D3 analyses

Background (cont'd)

- The key guidance is 6-8 years old
- Research supporting tech basis 15 years old
- Next generation NPPs differ from current fleet
 - passive safety features
 - digital I&C
 - human-system interfaces



Background (cont'd)

- Human performance research issues with emerging technologies in new plant designs
 - 2003, OECD/NEA Workshop
 - 2006, CSNI/Halden Workshop
 - 2008, NUREG/CR -6957 and BNL Technical Report
 - 2009, CSNI Technical Opinion Paper
 - 2010, WGHOFF/NRC Workshop



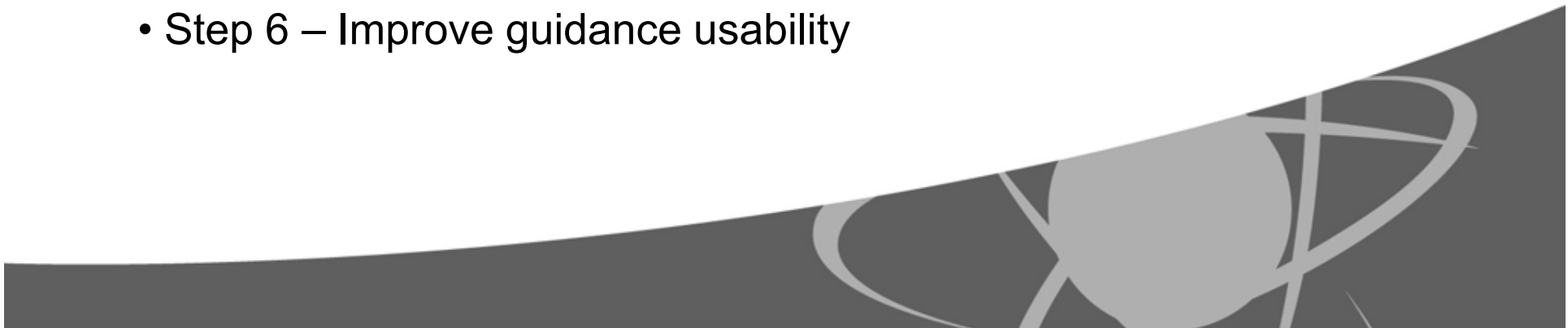
Objective

The objective of this project is to update the detailed HFE review criteria contained in NUREG-0711, NUREG-0700 and NUREG-0800 Chapter 18, and to improve the usability of the guidance.



Approach

- Step 1 – Obtain and analyze feedback from users of HFE guidance
- Step 2 – Conduct literature review pertaining to the use of NRC HFE guidance
- Step 3 - Identify NRC Technical Documents to serve as a basis for guidance updates
- Step 4 – Obtain peer review
- Step 5 – Revise the guidance
- Step 6 – Improve guidance usability



Step 1: Obtain and Analyze Feedback from Users of HFE Guidance

- Obtain feedback on guidance use and usability from:
 - NRC staff
 - Vendors
 - Licensees
 - Other regulatory agencies
 - International users
- Areas of feedback to include:
 - areas needing clarification
 - areas that may be inconsistent with acceptable current industry design & implementation methods
 - areas needing additional guidance development to better address licensee applications
 - areas requiring supplemental information to clarify existing guidance

Step 2: Conduct a Literature Review Pertaining to the Guidance

- Review current literature to identify applications of NRC HFE guidance
- Identify lessons learned and recommendations for guidance modification



Step 3: Identify NRC Technical Documents for Updates

- Existing NRC publications:
 - Human performance model guidance for NPPs
 - Effects of degraded digital I&C guidance on human performance and HSIs
 - Guidance on assessing exemption requests from operator staffing requirements
 - Guidance for reviewing HSIs to automatic systems
- Ongoing research
 - e.g., CONOPs of small modular reactor designs
- Other
 - IEEE standards (e.g., P1786), ISO standards (e.g., 11064)

Step 4: Obtain Peer Review

- Develop an approach for peer review of technical basis documents
 - Ensures updated HFE guidance is valid and technically defensible
- Identify peer reviewers
 - Subject matter experts within HF field and nuclear power industry
 - Organizations external to NRC (e.g., IEEE, ANS)



Step 5: Revise the Guidance

- Based on steps 1-4, implement revisions that have been identified
- Comment resolution, final disposition and tracking
- Based on revisions to NUREG-0711 and NUREG-0700, revise NUREG-0800, Chapter 18



Step 5 (con'td): Revise NUREG-0711

Update categories include:

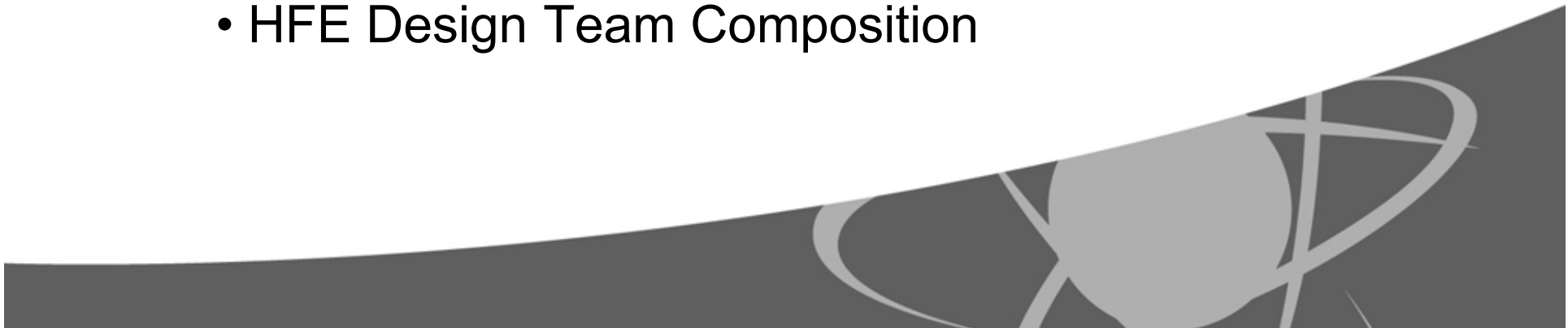
- Clarifications and corrections
- Technical information updates
- Element revisions
- Expansion updates
- Cross-checks with other documents
- Potential new considerations
- Potential supporting information



Step 5 (con'td): Revise NUREG-0711

Examples of changes include:

- Allocation of functions
- Using human performance modeling for design and evaluation
- Analyses to identify HFE significant I&C degradations
- V&V and Integrated System Validation
- HFE Design Team Composition



Step 5 (con'td): Revise NUREG-0700

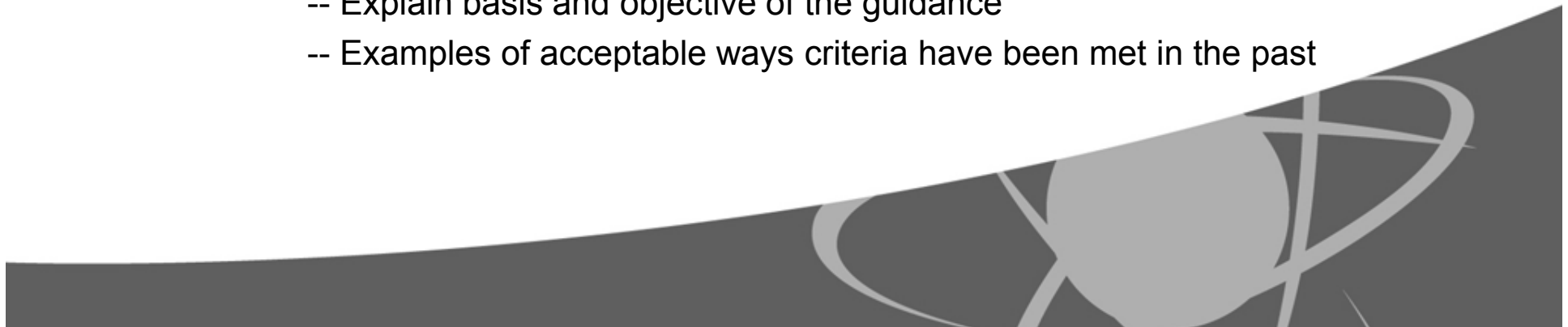
Examples of changes include:

- HSIs for systems at various levels of automation
- HSI indications for degraded I&C conditions
- Computer-based procedures



Step 6: Improve Guidance Usability

- Improve guidance usability for NRC staff reviewers
 - Employ electronic information technology to improve staff access to, and use of, the HFE guidance
 - Faster and more thorough access
 - Custom checklists
 - Links to technical bases documents
 - Comment support and knowledge management
 - Companion document or primer to increase efficiency and consistency of staff safety evaluations
 - Explain basis and objective of the guidance
 - Examples of acceptable ways criteria have been met in the past



Schedule



Project Start: September 2009

- Update NUREG-0711 July 2011
- Update NUREG-0700 September 2012
- Update NUREG-0800 (Ch. 18) December 2012
- Improve Guidance Usability
 - NUREG-0711 companion document September 2013
 - Electronic media November 2013



Questions?

