EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Minimum Inventory

Discussion with NRC TWG #5

April 16, 2008
Washington, DC

Objectives of the Discussion

- Review the example (sent to NRC last week) of information to be provided in Tier 2* regarding minimum inventory for new plants
  - Obtain feedback from NRC staff
  - If possible, reach a consensus as to what information should be provided when
- Discuss revisions planned for the minimum inventory EPRI report

Tier 1 / Tier 2* Discussion

Information to be Provided for New Plants on Minimum Inventory

- Tier 1
  - Summary level description or overview of the process that will be used to identify the minimum inventory HSIs
  - EPRI report describes a process in some detail
  - Intent is that NRC will endorse the process described in the EPRI report
    - Applicants can commit in Tier 1 to following that process, relying on NRC's previous endorsement
    - Or an applicant may choose to use a different or modified process and justify it in their submittal

Information to be Provided for New Plants on Minimum Inventory (cont'd)

- Tier 2*
  - A list of the categories of HSIs that will be part of the minimum inventory
  - Example list was provided to NRC last week
- Tier 2
  - Detailed description of the process for defining the minimum inventory
- The detailed list of minimum inventory HSIs will be developed by following the process as part of design
  - Verified through DAC/ITAAC

Information to be Provided for New Plants on Minimum Inventory (cont'd)

- Industry considers that this approach will provide adequate assurance to NRC at the design certification stage, and allow the design process to proceed in a logical and practical sequence such that an adequate minimum inventory is defined as part of the overall control room design
- Note regarding list of categories provided in Tier 2*
  - Designers may decide to implement additional HSIs as safety-related, or SDCV
  - Such additions made as part of the design process would not require NRC review/approval

Planned Revisions to the EPRI Report

Planned Revisions to Minimum Inventory EPRI Report

- NRC provided comments on the December 2007 draft at the February 2008 TWG meeting
- Additional review by industry has also generated additional comments and suggestions for improvements
- Summary of the planned changes is presented on the slides that follow

Providing Better Clarity on Definition and Purpose of Minimum Inventory

- Glossary of terms will be provided
- Section 1 of the report will be modified to:
  - Further clarify definition of minimum inventory
  - Make clear what design criteria we are addressing
  - Make clearer that the report addresses both I&C and HFE issues and criteria related to minimum inventory

Concept of Operations for Degraded HSI Conditions

- Staff commented on an example cited as a possible concept of operations for degraded HSI conditions
  - Concern was expressed about operating “indefinitely”
- We agree that operation should not continue without limit when normal HSIs are degraded
- Main points of this section:
  - Choice of concept of operations is discretionary – there is a range of possibilities
  - The amount of minimum inventory HSI required depends on your choice of concept of operations
  - Shutting down quickly may not be the safest choice

Revised Examples for Concept of Operations under Degraded HSI Conditions

- Immediately trip the plant
  - Use SR controls and displays to reach safe shutdown
- Immediately shut down using preferred means
  - Some independent nonsafety HSIs required
- Continue operating at power for a pre-determined time
  - Maintain stable plant operation
    - Operating restrictions would apply during this time – if cannot operate within prescribed bounds, must shut down
  - Time limit and operating restrictions would be administrative limits – e.g., LCO in Technical Requirements Manual (TRM)
  - Operation beyond administrative limits requires formal internal plant review and approval (plant operations review or safety committee)
  - Additional independent HSIs required will depend on length of time and operational capability desired

Responses to Additional Comments

- Changes will be made to respond to the remaining (more detailed) NRC comments
- Changes also being made to incorporate industry comments received since the last draft
- Next slides give overview of the more substantive changes planned in three areas:
  - Procedures
  - Remote shutdown
  - Safety classifications

Procedures

- Moving discussion of procedures
  - Taking out of “minimum inventory” – report will state that procedures need to be provided for carrying out the intended functions and tasks
  - Address in the Computerized Procedures report the need for a minimum set of backup procedures to handle failure of CPs and process to define them
  - Rationale:
    - Procedures not historically included in “minimum inventory”
    - Consolidates procedure related discussions into CP report

Remote Shutdown

- Remote shutdown is being added to the EPRI report
  - Consistent with ISG
- Shutdown from outside control room will be one of the events evaluated when identifying minimum inventory
- Minimum set of remote shutdown station HSIs will be included in the minimum inventory
- Will specify design criteria for RSS HSIs regarding:
  - Safety classification
  - Accessibility (e.g., SDCV, selectable)

RSS HSIs – Safety Classification

- No requirement that RSS HSIs be safety-related
- However, SRP states that for non-fire events, remote shutdown station must accommodate a single failure
    - Footnote in SRP Section 7.4-7, March 2007 edition
- Proposed criteria for single failure protection:
  - Protect against credible electrical failures (e.g., short circuits, open circuits) and component failures
  - Catastrophic failures such as flooding and external electrical faults would be excluded
  - Result: a robust nonsafety-related system, but without separation and independence

RSS HSIs – Accessibility Requirements

- Not necessary that RSS HSIs be SDCV
- Rationale:
  - Accidents and unanticipated events are not postulated
  - Operations at RSS are driven by procedure
  - Operations are focused, limited to achieving safe shutdown
  - Operations are not time-critical

Safety Classification Categories

- Report will be revised to specify four categories:

  SR Safety-related

  SR* SR but with graded approach to software QA

  NSR* Equivalent to NSR with “augmented quality”

  NSR Nonsafety-related

- The SR, SR*, NSR categories were in the Dec 2007 draft
  - NSR* category is being added
- Rationale:
  - Consistent with regulatory guidance for items such as SPDS and HSIs provided to meet BTP 7-19
  - Consistent with past practice

Mapping to ANSI/ANS-58.14 Classifications

- ANSI/ANS-58.14 Standard
  - Safety and Pressure Integrity Classification Criteria for Light Water Reactors
- Currently undergoing revision
- Mapping of proposed categories to ANS-58.14:

Proposed MI Categories	ANS-58.14 Classifications
SR and SR*	Safety-related
NSR*	“Supplemented grade”
NSR	Nonsafety-related

Examples of Minimum Inventory HSIs in the NSR* Category

- SPDS indications
- BTP 7-19 HSIs
- Prompting alarms for credited manual actions (new plants only)

Going Forward

- Changes to the report are underway
- Expect to provide the next revision to NRC by June 11 (one week prior to June TWG meeting)
- Any additional comments from NRC are welcome – preferably before the May TWG meeting
  - Many of the detailed criteria (e.g., Tables 4-1 and 4-2) will not change (some minor changes are expected)
  - Feedback from NRC on these criteria is especially important
  - Next slides walk through the tables

Section 4 of the EPRI Report – HSI Design Requirements

- This section contains the meat of the technical criteria for minimum inventory
- Sub-sections provide guidance on design requirements for HSIs supporting each category of functions and tasks identified in the report:

1. Credited manual actions
2. Monitor safety functions and backup automatic success paths
3. Preferred manual safety success paths
4. Preferred manual non-safety success paths
5. Additional post-accident monitoring
6. Monitor safety system availability
7. Monitor plant safety parameters
8. Operation under conditions of failed/degraded HSIs
9. Other important tasks during normal operation with all HSIs functioning

Table 4-1
HSI Design Requirements Matrix

- Summarizes the guidance given in the sub-sections of Section 4
- Broken into numbered sections addressing each of the 9 categories of functions/tasks
- In each category, rows address different types of supporting HSIs separately, for example:
  - Prompting alarms
  - Confirming indications
  - Controls and immediate feedback indications
  - Performance indications
  - Performance alarms

Table 4-1 (cont'd)

- Columns address HSI design requirements:
  - Safety classification
    - **SR** Safety-related
    - **SR*** Safety-related – candidate for application of a graded approach (particularly for software QA/V&V)
    - **NSR*** Nonsafety-related – augmented quality (in progress)
    - **NSR** Nonsafety-related
  - Accessibility
    - **SDCV** Spatially dedicated, continuously visible
    - One-step accessible
    - Selectable
- Last column references applicable regulatory and industry requirements and guidance (where they exist)

Table 4-1 (cont'd)

- Some HSIs may support multiple functions/tasks
  - Most stringent requirements apply
- In general, when safety classification and accessibility requirements are specified, a single device should meet both sets of criteria (e.g., SR and SDCV)
  - Some exceptions are noted in the table

Table 4-2
Summary List of SR and SDCV HSIs

- Summarizes Table 4-1
- Lists those categories of HSIs that are identified as SR, SR* and NSR*
- Lists the categories of HSIs that should be implemented as SDCV or one-step accessible

Walk-through of Table 4-1

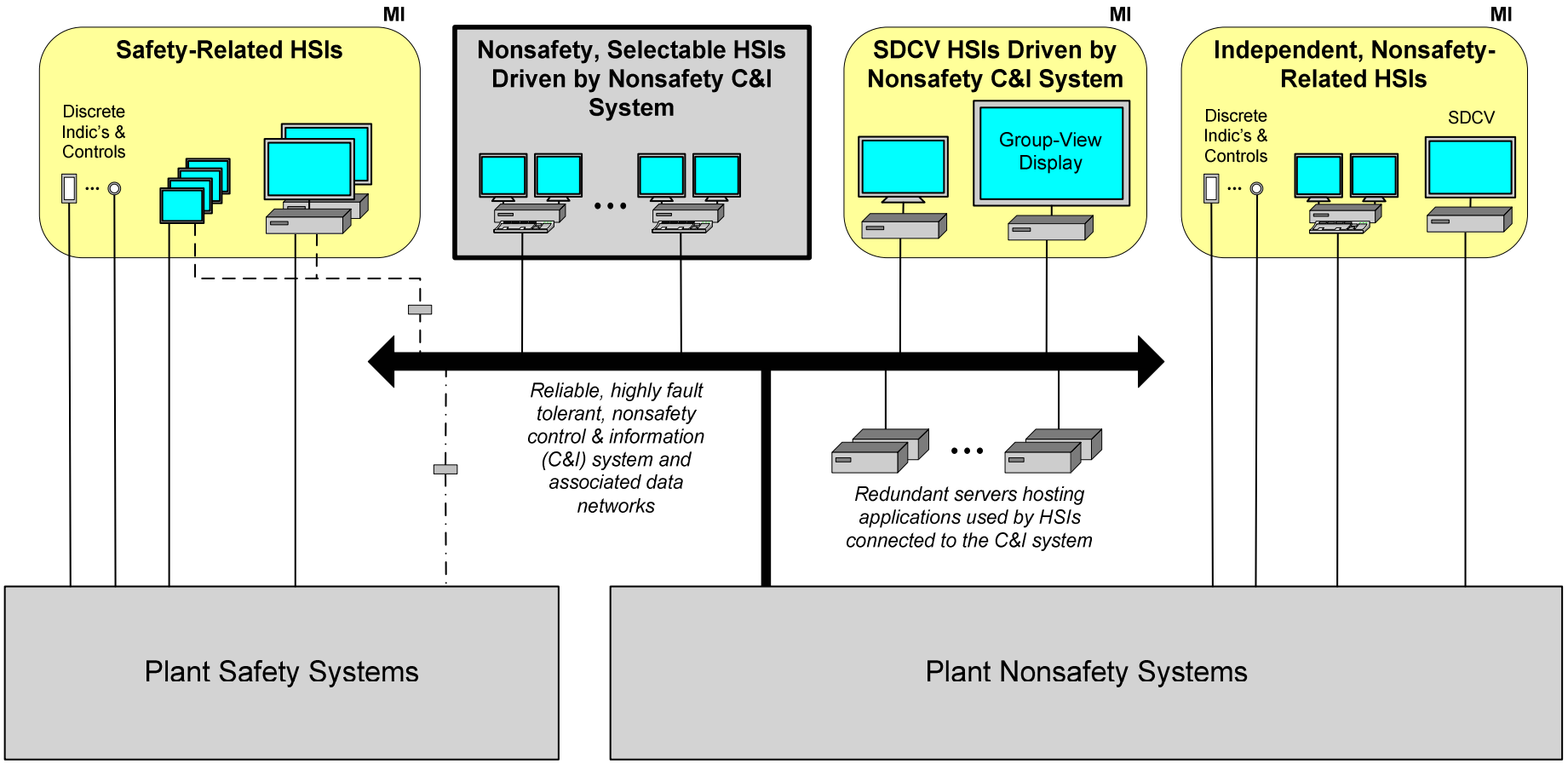
- Discuss one HSI type in each category of functions/tasks
- Marked with arrows on copy of Table 4-1

Questions?

BACKUP SLIDES

Updated Definition of "Minimum Inventory"

- Those HSIs (controls, displays, alarms) needed in addition to the nonsafety-related, selectable computer-based HSIs located in the main control room and normally used by the operators to monitor and control the plant
- These include:
  - Safety-related HSIs
  - Spatially dedicated, continuously visible (SDCV) HSIs
  - HSIs needed at the remote shutdown station to reach safe shutdown in the event of control room evacuation
  - Other HSIs needed for the plant's chosen concept of operations for handling failures of the normal HSIs during normal operation [discretionary]



MI — Different types of "minimum inventory HSIs" -- HSIs provided in addition to the nonsafety, selectable HSIs normally used by the operators for plant monitoring and control

SDCV — Spatially dedicated, continuously visible

HSIs — Human-system interfaces — as used here, these are controls, displays and alarms

– – – – – – Capability can be provided to monitor and control nonsafety systems from the safety-related HSIs, with suitable isolation to ensure they can still fulfill their safety-related functions if the nonsafety C&I system fails

— · — · — · — Some designs provide for control and monitoring of the safety systems using the normal, nonsafety HSIs, with features provided to ensure that the nonsafety HSIs cannot defeat needed safety functions