RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.:	**353-8372**
SRP Section:	**18 – Human Factors Engineering**
Application Section:	**NUREG-0711 Section 8.4.3 HFE Design Guidance for HSIs**
Date of RAI Issue:	**12/22/2015**

Question No. 18-86

Regulations: 10 CFR 52.47(a)(8) and 10 CFR 50.34(f)(2)(iii)

Regulatory Guidance: NUREG-0700, Section 2.1, “General User Input Guidelines”

Evaluation: Section 2.1 contains general user input guidance. Several criteria were not addressed.

Question: Explain how the following guidance is captured within the style guide (or other design guidance documents).

- 2.1-8 Availability of information
- 2.1-15 Indicating completion of processing
- 2.1-16 indicating control lockout
- 2.1-21 Entries distinct from text
- 2.1-26 Guidance information
- 2.1-28 through 32 on stacked entries
- 2.1-34 Displayed context
- 2.1-55 through 59 on default values
- 2.1-67 Consistent location of interface management controls
- 2.1-68 Location of display page navigation controls
- 2.1-69 Set-up of computer-based systems

- 2.1-70 Reminders for interrupted tasks
- 2.1-71 Access to suspended tasks
- 2.1-72 Entry of data separators and delimiters

Response

Entry stacking functions and user key inputs are not available to the operators in the control room. Therefore, the related NUREG-0700 guidance from section 2.1 is not included in APR1400-E-I-NR-14012-P, “Style Guide” (i.e., guidance 2.1-28, 29, 30, 31, 32, 34, 55, 56, 57, 58, 59, and 72). Also, guidance 2.1-21 “Entries Distinct from Text” is already described in Section 3.1.3 g) of the Style Guide.

Related descriptions in the Style Guide will be revised to address other guidelines, as indicated in the attachment associated with this response. Section 3.1.3 b) “Periodic Feedback” of the Style Guide is updated to address guidance 2.1-15 “indicating completion of processing” of NUREG-0700. However, guidance 2.1-16 “Indicating Control Lockout” is not included from Section 3.1 of the Style Guide, since Section 3.3.5 c) per NUREG-0700 2.4.3-5 “Processing Delay” is applicable to the HSI design.

Impact on DCD

There is no impact on the DCD.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

Technical report APR1400-E-I-NR-14012-P/NP, Rev.0, “Style Guide,” Subsection 3.1.1, 3.1.2, and 3.1.3 will be revised, as indicated in the Attachment associated with this response.

3 INTERACTION

3.1 General Interaction Guidelines

3.1.1 General Organization Guidelines

a) Readily Usable Form - Data presented to the user should be in a readily usable and readable form, such that the user does not have to transpose, computer, interpolate or translate into other units, number bases or meaningful language. for example, reactor startup rate is displayed, and operators are not required to evaluate it from reactor power readings; likewise, reactor heat-up rate should be explicitly displayed, rather than evaluated by operators from the temperature readings.
b) Data Grouped by Function - Sets of data that are associated with specific questions or related to particular functions may be grouped together to signify those functional relationships.
c) Tabular Data - Tabular data should be displayed in rows and columns. If the data has order, the order should be retained and made evident. If the table has objects with attributes, the objects should be assigned to rows, the attributes to columns.
d) Spatial Demarcation - Empty screen areas, lines, and spaces should be the primary means of organizing and separating data. Critical information should have extra space used to demarcate its position, if possible. If empty space is not effective for the application, then straight, simple lines with minimal bends should be used for demarcation.
e) Integral and Configural Dimensions - When several pieces of information are closely related and need to be integrated in some dipsplays, the information can be presented using integral or configural dimensions. "Integral relationship" is defined by a strong interaction among dimensions such that the unique perceptual identities of individual dimensions are lost (e.g., box, triangle instead of lines). In a "configural relationship", each dimension maintains its unique perceptual identity, but new emergent properties are also created as a consequence of the interaction between them (e.g., symmetry, closure, and vertices).
f) Recurring Data Fields - Data fields that appear in multiple locations within a system should have consistent names, and should have consistent relative position within similar displays.
g) Selection of Dialogue Types - The selection of dialogue types should be based on anticipated task requirements, user skills, and anticipated system response time.
h) Minimal User Actions - User input actions should be simple, particularly for real-time tasks requiring fast user response.
i) Control by Simultaneous Users - When several users must interact with the system simultaneously, control entries by one user should not interfere with those of another.

3.1.2 General User Interface Guidelines

Insert "A" on the third page.

a) Consistent Procedures - Procedures for entering commands or information should be consistent in form and consequences.
b) Consistent Wording of Commands - All terms employed in the user-system interface, and their abbreviations, should be consistent in meaning from one transaction to another, and from one task to another.
c) Wording Consistent with User Guidance - The wording and required format of information or command entry functions should be consistently reflected in the wording of user guidance, including all labels, messages, and instructional material.
d) Minimal Demands on The User - Entry of information or commands should not require the user to remember special codes or sequences or to perform translations or conversions.
e) Unnecessary Entry of Information - A user should not be required to re-enter information already available to the system.
f) Logical Transaction Sequences - An information entry sequence should be designed so that its organization reflects the user's view of the task, and should provide all control options that may be required.
g) Control by Explicit User Action - Users should be allowed to control the processing of information or commands by explicit action.
h) Compatibility with User Expectations - The results of any entry should be compatible with user

expectations, so that the system changes in a "natural" way in response to user actions.

i) General List of Options - A general list of basic options should be provided and always be available to serve as a "home base" or consistent starting point for user input.
j) Displaying Option Codes - When users must select options by code entry, the code associated with each option should be displayed in a consistent and distinctive manner.
k) Organization and Labeling of Listed Options - The general options list should show control entry options grouped, labeled, and ordered in terms of their logical function, frequency, and criticality of use, following the general guidelines for menu design.
l) Indicating Appropriate Control Options - Users should be provided with a list of the control options that are specifically appropriate for any transaction.
m) Only Available Options offered - Only control options that are actually available for the current transaction should be offered to users.
n) Provide Further Available Action - Transactions should never leave the user without further available action and should provide next steps or alternatives.
o) Prompting Command Entries - Users should be provided with whatever information may be needed to guide command entries at any point in a sequence of transactions, by incorporating prompts in a display and/or by providing prompts in response to requests for HELP.
p) Highlighting Selected Data - When a user is performing an operation on some selected display item, that item should be highlighted.
q) Distinctive Interrupt Options - If different kinds of user interrupt are provided, each interrupt function should be designed as a separate control option with a distinct name.
r) User Transaction Interrupts - User interrupts and aborts should not modify or remove stored or entered data.
s) User Control of Entry - Users should be allowed to control the pace and sequence of their entry of information or commands.
t) User-Specified Transaction Timing - When appropriate to task requirements, users should be allowed to specify the timing of transactions.
u) Indicating Pause/Suspend Status - If PAUSE or SUSPEND options are provided, some indication of the status should be displayed whenever such an option is selected by a user.
v) Consistent Continue Option - At any step in a defined transaction sequence, if there is only a single appropriate next step, then a consistent control option to continue to the next transaction should be provided.
w) Data Manipulation - The user should be able to manipulate information without concern for internal storage and retrieval mechanisms of the system.
x) Offer Information Feedback - For every user action, there should be system feedback.
y) Design Dialogs to Yield Closure - Sequences of actions should be organized into groups with a beginning, middle, and end. The information feedback at the completion of a group of actions gives operators the satisfaction of accomplishment, a sense of relief, the signal to drop contingency plans and options from their minds, and an indication that the way is clear to prepare for the next group of actions.
z) Support Internal Locus of Control - System should give experienced operators the sense that they are in charge of the system and that the system responds to their actions. Surprising system actions, tedious sequences of data entries, inability or difficulty in obtaining necessary information, and inability to produce the action desired all build anxiety and dissatisfaction.

3.1.3 General User Input Guidelines

Insert "B" on the third page.

a) Feedback for User Entries - The computer should acknowledge every entry immediately.
b) Periodic Feedback - ~~When system functioning requires the user to stand-by, periodic feedback should be provided to indicate normal system operation.~~
c) Interrupt to End Control Lockout - In situations where control lockout does occur, an auxiliary means of control entry should be provided, such as a special function key, to abort a transaction causing extended lockout.
d) Entry via Primary Display - When data entry is a significant part of a user's task, entered data should appear on the user's primary display.
e) Entry of Corrections - The same explicit ENTER action should be required for entry of corrections

Insert "C" on the third page.

"A"

j) Consistent Location of Interface Management Controls - Controls used for interface management tasks should have consistent locations.
k) Location of Display Page Navigation Controls - Controls for navigating within a display page should be separate from the main body of the display screen.
l) Set-Up of Computer-Based Systems - Preset and automated set-up features should be used to ensure that users do not have to perform these functions while operating the plant.

"B"

aa) Availability of Information - Information necessary to accomplish a specific entry should be available to the user when that transaction action is appropriate.
bb) Guidance Information- - Users should be able to request guidance information regarding requirements for information of command entry.
cc) Reminders for Interrupted Tasks - The HSI should provide visual and/or auditory reminders for interrupted tasks.
dd) Access to Suspended Tasks - The HSI should provide simple mechanisms for retrieving displays and controls for tasks that have been suspended.

"C"

When system functioning requires the user to stand-by when an entry is lengthy or pending computer processing of prior entries, periodic feedback should be provided to indicate normal system operation, including an indication of subsequent completion.