

## An Integrated User Interface Style Guide for the ESF-CCS, RPS and CPCS display design

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### 1. Introduction

The human machine interface (HMI) design process is important to enhance the safety and reliability of a Nuclear Power Plant (NPP) operation. Various MMI activities are achieved with progress of MMI and environment of NPP. These activities are impossible to utilize when upgrade of environment because most of these activities emphasize hardware aspect. Also, the human factors guidelines mostly describe the human factors principles so the designer has to adapt them to apply them to his design.

The design-specific guideline that is specially dedicated to a unique system and derived from the general guidelines is called style guide. The style guide provides easy to use templates to help the user interface design, and these templates help ensure a consistent look and behavior throughout the design products. However, it could be difficult for a designer to select the human factors guideline items related to a target system and to derive a style guide from the items [1]. This paper describes human factors activities carried out to develop a style guide for the ESF-CCS, RPS and CPCS system.

### 2. Selecting the Development Scope of Style Guide

A style guide provides a formal standard in the development phase of a system. The design-centered style guides that were developed through eliciting general guidelines mainly for a unique system had considered the major style guides. These style guides provide to use easily templates for user interface design (form, elements etc.) and these templates help to communicate accurately designer's intention to users.

These templates can reinforce usability of systems through conceptual model design which consider user model judged by users and design model judged by developer. However, it is impossible without consideration of system to maximize usability. So, selecting the development scope by categories of style guide is necessary to grasp the purpose of systems.

In this paper, style guides can be classified as platform guide, general design guides, or corporate style guides for a specific application. Although they overlap in many ways, each has a different focus.

#### 2.1 Platform Guides

These style guides focus on rules for presentation elements, including visual design elements such as color, fonts or icons; page or screen layouts including spacing, justification and common items; and the correct usage for standard controls such as buttons, selections, radio button or check boxes. This focus is reasonable for style guides written for operating system platform. These guides must provide basic information for other groups using their tools to create software products, documenting the capabilities of the platform as well as

providing guidance to designers. The general pattern is also followed in sections of the ISO 9241[2].

#### 2.2 Design Guides

Design style guides often take a vast view, looking at the overall structure of a display page and how the user navigates through it as an important design element. They may also include a primary focus on the process for creating a usable interface design. Most of design guides offer excellent advice for a user-interface designer, but neither offers a definitive set of standards. Instead, they focus on establishing best-practices in design process and solutions for some common design problems.

Neither the platform style guide nor the design guide provides a perfect model for creating a corporate application style guide. The platform style guide is too detailed and spends too much time on platform fundamentals. In contrast, the design guide is too general and frequently need specifics rather than basic design.

#### 2.3 Corporate Application Guides

Corporate style guides are a mixture of platform guides and design guides. They are required to provide look and feel guidelines to ensure basic consistency (or compatibility) across the applications they serve. In addition to providing reference material, a corporate style guide also serves an educational purpose, illustrating both the conceptual approach to the user interface and, often, a process to ensure that usability is built into the design from the beginning.

### 3. Style Guide Development Procedure

#### 3.1 Analysis of human factors guidelines

If an application is selected, the review of the guidelines related to this is needed. The applied system needs to be considered for applicable guidelines because style guides a focus on a particular system. Therefore items related to the information display in Human Factors Guidance for Control Room and Digital Human-System Interface Design and Modification [3] and NUREG-0700 rev. 2 [4] which are typical guidelines in a field of nuclear were analyzed and compared.

The analysis results found that these human factors guidelines are appropriate for the fundamental guideline of an integrated style guide because the guideline of the EPRI is based on items of the NUREG-0700, also describe based on the international standards and various NRC documents. However, the guideline of the EPRI does not mention specifications (VDU resolution, Contrast, Flicker, Geometric stability, Image continuity, Image linearity etc.) related to VDU of display devices among NUREG-0700 items. The results found additional considerations in this guideline because these specifications are necessary for the contents of style guides.

### 3.2 Extraction of the design variables

1) Enumerate the types, detail categories, form and property for design variables by guidelines as following figure 1.

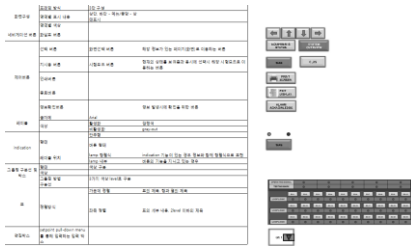


Figure 1. Extraction of the design variables

2) Extract the design variables for each module

(a) ESF-CCS design variables

- Display composition: frame type, display contents for each area, colors for each area
- Navigation button: arrow button
- Control button: select button, indicator light button, print button, close button, alarm acknowledge button
- Label: font, color
- Indication: type, location of label
- Grouping demarcation and box: type, color, grouping methods
- Table: demarcation, alignment methods
- Edit box: input box through set-point pull-down menu

(b) RPS-COM design variables

- Display composition: frame type, display contents for each area, colors for each area
- Navigation button: moving a page button, moving a step button
- Control button: select button, check button, indicator light button, print button, close button
- Display button: non-controllable button
- Label: font, color
- Indication: type, location of label
- Grouping demarcation and box: type, color, grouping methods
- Message box: message box displayed condition, message box selected by pull-down
- Table: demarcation, alignment methods
- Edit box: pop-up window, input box through set-point pull-down menu, keypad pop-up and Exit pop-up for user input

(c) CPCS design variables

- Display composition: frame type, display contents for each area, colors for each area
- Navigation button: arrow button
- Control button: select button, indicator light button, print button
- Label: font, color
- Indication: type, location of label
- Grouping demarcation and box: type, color, grouping methods
- Table: demarcation, alignment methods
- Edit box: pop-up window, input box through set-point pull-down menu

## 4. Display Design Using an Integrated Style Guide

### 4.1 Considerations in Display Design

The integrated style guides help to extract common elements of ESF-CCS, RPS-COM and CPCS displays

and to provide specific values for design variables. Also, these guidelines help to materialize unique properties (existing buttons, windows and etc. in the only one system) and to provide the same design types for common design variables. An integrated style guide restricts the physical size of a display because the LCD display of these systems is only 17 inches.

Table 1. Examples which common design variables applied in display design

Classification	Design variables	Example
Control button	Select button - do not select	
Control button	Select button - select	
Control button	Check button	
Editing box	Input box through set-point pull-down menu	

### 4.2 Example of Display Design by Style Guide

When designing a display, we have to consider a consistent visual design, information architecture, interaction design and function, and contents based on a unique conceptual model of system. Especially, if the integrated style guide emphasized properties which one system or module had, another style guide had to be developed for the use of other systems and modules. Figure 2 and 3 showed that display design improved by integrated style guide.



Figure 2. The existing display design (System overview page of RPS-COM)

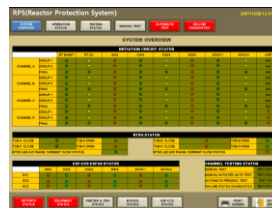


Figure 3. The improving display design (System overview page of RPS-COM)

## REFERENCES

- [1] Lee, H. C., Lee, D. Y., Oh, I. S., Lee, J. W., A user interface style guide for the reactor protection system cabinet operator module, NPIC & HMIT, 2004.
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