

In NEI 96-07, Section 3.11 defines *procedures* as follows:

"...Procedures include UFSAR descriptions of how actions related to system operation are to be performed and controls over the performance of design functions. This includes UFSAR descriptions of operator action sequencing or response times, certain descriptions...of SSC operation and operating modes, operational...controls, and similar information."

Because the human-system interface (HSI) involves system/component operation this portion of a digital modification is assessed in this Screen consideration. The focus of the Screen assessment is on potential adverse effects due to modifications of the interface between the human user and the technical device.

There are 3 basic elements of an HSI:

- **Displays:** the visual representation of the information operators need to monitor and control the plant.
- **Controls:** the devices through which personnel interact with the HSI and the plant.
- **User-interface interaction and management:** the means by which personnel provide inputs to an interface, receive information from it, and manage the tasks associated with access and control of information.

Operators must be able to accurately perceive, comprehend and respond to system information via the HSI to successfully complete their tasks. Specifically, nuclear power plant personnel perform four primary types of tasks:

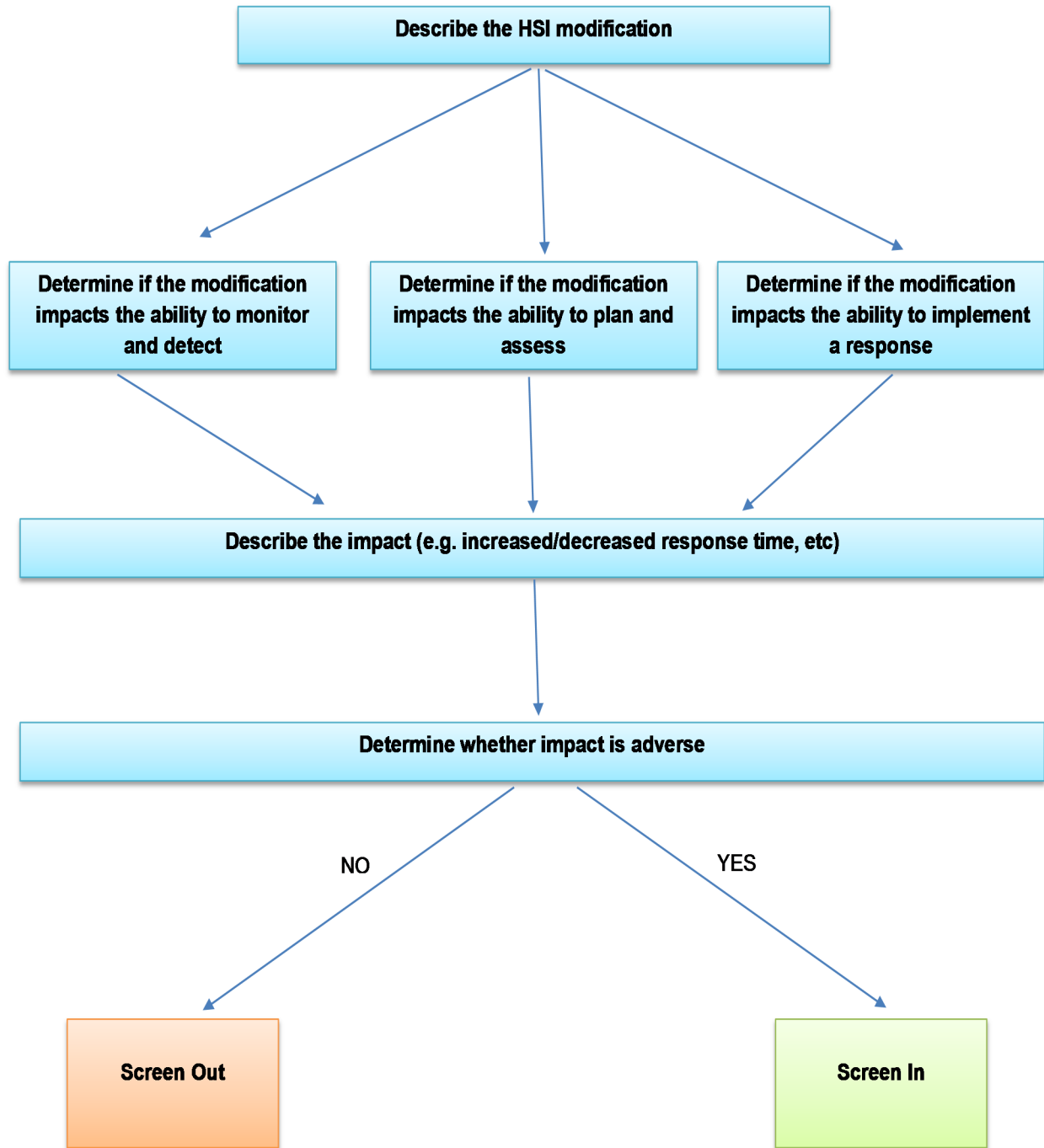
- (1) monitoring and detection (extracting information from the environment and recognizing when something changes),
- (2) situation assessment (evaluation of conditions),
- (3) response planning (deciding upon actions to resolve the situation) and
- (4) response implementation (performing an action).

To determine potential adverse impacts of HSI modifications on design functions, an analysis must be performed that assesses whether the proposed modification has a negative impact on these primary tasks. Examples of adverse effects include:

- increased possibility of mis-operation,
- increased difficulty in evaluating conditions,
- increased difficulty in performing an action,
- increased time to respond,
- creation of new potential failure modes.

This analysis process is depicted in Figure 1.

Figure 1. Process for evaluating the impact of a change to an HSI element



The following two tables are provided for illustrative purposes only and are not comprehensive job aids. Table 1 contains examples of modifications to HSI elements that should be addressed in the response to this Screen consideration. Table 2 contains example analyses for various modifications to assess the impact on an operator's ability to perform the four primary tasks.

Table 1. Example Human-System Interface Modifications that Should be Addressed in this Screen Consideration

HSI Element	Modification	Description/Example
Displays	Number of parameters	Increase/reduction in the amount of parameters displayed by and/or available from the HSI e.g., combining multiple parameters into a single integrated parameter, adding additional information about system performance
	Type of parameters	Change to the type of information displayed and/or available from the HSI
	Information presentation	Change to visual representation of information e.g. Increment of presentation modified from 10gpm to 1 gpm
	Information organization	Change to structural arrangement of data/information e.g. Information now organized by channel/train rather than by flow-path
User-Interface interaction and Management	Action Sequences	Change in number and/or type of decisions made and/or actions taken e.g. Replacing an analog controller that can be manipulated in one step with a digital controller that must be called-up on the interface and then manipulated
	Information/Data Acquisition	Changes that affect how an operator retrieves information/data. e.g., Information that was continuously displayed via an analog meter now requires interface interaction to retrieve data from a multi-purpose CRT
	Function Allocation	Changes from manual to automatic initiation (or vice versa) of functions. e.g. manual pump start to automatic pump start
Controls	Control Input	Change to the type/functionality of input device e.g., Replacement of a push button with a touch screen
	Control Feedback	Change to the information sent back to the operator in response to an action e.g. changing feedback from tactile to auditory

Table 2. Example Analyses Assessing Impact of Human-System Interface Modifications on Four Primary Operator Tasks

Modification(s)		ANALYSIS		
Description	Type(s)	Monitor/Detect	Assess/Plan	Respond
<p>Currently, a knob is rotated clock-wise to increase a control function and counter clock-wise to decrease the control function. This knob will be replaced with a touch screen. Using the touch screen, touching the "up" arrow will increase the control function and touching the "down" arrow will decrease the control function. The touchscreen control will be accessed by calling up a display, choosing the correct control, and manipulating that control. The current knob that provides tactile feedback to the operator as the mechanism is rotated through each setting increment. The touch screen cannot duplicate the "tactile feedback" of a mechanical device, however, a sound feature and associated components will be added to the digital design that will emit a clearly audible and distinct "tone" each time the control setting passes through the same setting increment that the tactile feature provided with the mechanical device.</p>	<ul style="list-style-type: none"> Control Input Information/Data Acquisition Control Feedback 	<p>Change from tactile feedback to auditory</p> <ul style="list-style-type: none"> May adversely impact the operator's ability to accurately monitor the changes he is making to the system. Since the means of controlling the design function has changed, new malfunctions can be postulated (e.g., high ambient sound levels that prevent the operator from hearing the feedback). 	<p>Change from tactile feedback to auditory</p> <ul style="list-style-type: none"> Altering the type of feedback may adversely impact the operator's understanding of the interaction with the system (e.g. does a higher tone represent increasing?) 	<p>Changes to response implementation- operator has to call up control and then take action</p> <ul style="list-style-type: none"> May have adverse impact on the time it takes the operator to respond Introduces the possibility of mis-operation by choosing the wrong control
<p>Currently, an existing presentation method to allow operators to determine system performance consists of indicators with a 10 gpm increment and a physical layout representing the flow path. A digital modification consolidates system information onto two flat panel displays (one for each redundant channel/train). In addition, the increment of presentation on the HSI will be improved from 10 gpm to 1 gpm and the HSI will now present the information layout by channel/train rather than by flow path.</p>	<ul style="list-style-type: none"> Information presentation Information Organization 	<p>Change to the increment of presentation should not affect the operator's perception of the information as the operator can still distinguish the minimum increment of 10 gpm</p>	<p>Change to the layout from flow path to channel/train</p> <ul style="list-style-type: none"> Altering the layout may adversely impact the operator's understanding of how the information relates to system performance 	<p>[Example does not include information necessary to assess impact on operator response implementation]</p>