

**Table 4-1  
Minimum Inventory HSI Design Requirements Matrix**

Functions/Tasks and Associated HSIs	HSI Design Requirements <sup>1</sup>		Applicable Regulatory and Industry Requirements and Guidance <sup>4</sup>	
	Safety Classification <sup>2</sup>	Accessibility <sup>3</sup>		
<b>1. Perform Credited Manual Actions (Section 4.1)</b>				
▶	Prompting alarms	Operating plants <sup>5</sup> : NSR New plants <sup>6</sup> : NSR*	SDCV	None <sup>6</sup>
	Confirming indications	SR See text for discussion of trend display vs. primary indicator	SDCV for at least one channel The SR HSI can be selectable if a NSR HSI is provided that is highly reliable and SDCV	IEEE 603 (§5.8.1, §5.8.4) Reg. Guide 1.97 Rev. 3 (Type A; Category 1) Reg. Guide 1.97 Rev. 4 (Type A)
	Controls & immediate feedback indications	SR	SDCV One-step accessible is acceptable if supported by appropriate HFE analyses	IEEE 603 (§6.2)
	Performance indications	SR* for primary indications Secondary indications can be NSR	Selectable	None
	Performance alarms	NSR <sup>5</sup>	SDCV	None
<b>2. Monitor Safety Functions and Back Up Automatic Success Paths (Section 4.2)</b>				
▶	Indications of the status of critical safety functions	SR*	SDCV for one of the redundant indications The SR HSI can be selectable if a NSR HSI is provided that is highly reliable and SDCV	Reg. Guide 1.97 Rev. 3 (Type B, Category 1) Reg. Guide 1.97 Rev. 4 (Type B)
	Alarms indicating challenges to critical safety functions	NSR <sup>5</sup>	SDCV	NUREG 0700
▶	Indications of the status of fission product barriers:  If following Reg. Guide 1.97 Rev. 3	SR*	SDCV for one of the redundant indications if Category 1 per Reg. Guide 1.97 Rev. 3 The SR HSI can be selectable if a NSR HSI is provided that is highly reliable and SDCV	Reg. Guide 1.97 Rev. 3 (Type C, Category 1)
	If following Reg. Guide 1.97 Rev. 4	SR*	Selectable	Reg. Guide 1.97 Rev. 4 (Type C)

Functions/Tasks and Associated HSIs		HSI Design Requirements <sup>1</sup>		Applicable Regulatory and Industry Requirements and Guidance <sup>4</sup>
		Safety Classification <sup>2</sup>	Accessibility <sup>3</sup>	
▶	Indications of safety system performance:  If following Reg. Guide 1.97 Rev. 3	SR* if Category 1 per Reg. Guide 1.97 Rev. 3	SDCV for one of the redundant indications if Category 1 per Reg. Guide 1.97 Rev. 3  The SR HSI can be selectable if a NSR HSI is provided that is highly reliable and SDCV	Reg. Guide 1.97 Rev. 3 (Type D, Category 1)
	If following Reg. Guide 1.97 Rev. 4	NSR	Selectable	Reg. Guide 1.97 Rev. 4 (Type D)
▶	Alarms on fission product barriers and safety system operation	NSR	SDCV	None
	Indications of safety system actuation status	NSR	SDCV display for high-level summary indications  Component-level details can be on selectable displays	IEEE 603 (§5.8.2)
	Alarms on safety system actuation failures	NSR	SDCV display for high-level summary alarms  Component-level details can be on selectable displays	None
	Manual system-level actuation controls	SR Dependent on a minimum amount of equipment	SDCV	Reg. Guide 1.62 IEEE 603 (§6.2a)
	Manual component-level controls	No specific requirements if not used for credited manual actions (item 1 above), or for preferred manual safety and non-safety success paths identified in EOPs (items 3 and 4 below).		None
D3 Points 1-3 – HSIs needed for specific manual actions credited in the D3 evaluation for coping with CCFs:				
▶	Prompting alarms	NSR* Independent of the protection system common cause failures (CCFs) they are intended to address	SDCV	No specific guidance
	Confirming indications		As determined by appropriate HFE analyses	BTP 7-19, Points 1-3
	Manual controls			

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D3 Point 4 – HSIs needed for monitoring safety functions and for system-level actuations for D3:				
	Safety function indications	NSR*	SDCV	BTP 7-19, Point 4
	Safety function alarms	Independent of the computer-based safety systems	As determined by appropriate HFE analyses	No specific guidance
	Controls for system-level actuations		SDCV	BTP 7-19, Point 4
<b>3. Carry Out Preferred Manual Safety Success Paths (Section 4.3)</b>				
	Prompting alarms	Prompting alarms are not required as actions are prompted by EOP execution		None
	Confirming indications	SR*	Selectable	IEEE 603 (§6.2c) Reg. Guide 1.97 Rev. 4 (Type D)
▶	Controls & immediate feedback indications	SR*	Selectable	IEEE 603 (§6.2c)
	Performance indications	SR*	Selectable	None
▶	Performance alarms	NSR <sup>5</sup>	SDCV	None
<b>4. Carry Out Preferred Manual Non-Safety Success Paths (Section 4.4)</b>				
	Prompting alarms	Prompting alarms are not required as actions are prompted by EOP execution		None
	Confirming indications	NSR	Selectable	
▶	Controls & immediate feedback indications			
	Performance indications			
	Performance alarms		SDCV	
<b>5. Perform Additional Post-Accident Monitoring (Section 4.5)</b>				
▶	Indications	SR* if Category 1 in Reg. Guide 1.97 Rev. 3 No qualification requirement if following Reg. Guide 1.97 Rev. 4	SDCV if Category 1 in Reg. Guide 1.97 Rev. 3 Selectable if following Reg. Guide 1.97 Rev. 4	Reg. Guide 1.97 (Type E)
	Alarms	NSR <sup>5</sup>	SDCV	None

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<b>6. Monitor Safety System Availability (Section 4.6)</b>				
▶	System-level indications	NSR	SDCV	10 CFR 50.34(f)(2)(v) Reg. Guide 1.47 IEEE 603 (§5.8.3)
	System-level alarms			
	Component-level indications			
	Component-level alarms			
<b>7. Monitor Plant Safety Parameters (Section 4.7)</b>				
▶	Safety parameter indications	NSR*	SDCV or one-step accessible display prompted by SDCV alarms (see next row)	10 CFR 50.34(f)(2)(iv) NUREG 1342 NUREG 0700
	Safety parameter alarms	NSR	SDCV	NUREG 0700
	Other prompting alarms for pre-emptive safety actions		SDCV	
	Other indications for pre-emptive safety actions		Selectable	
	Controls for pre-emptive safety actions	No additional requirements. Manual system-level actuation controls (in item 2 above) can be used to take pre-emptive actions.		
<b>8. Continue Operation Under Conditions of Failed/Degraded HSIs (Section 4.8)</b>				
<b>Note: The chosen concept of operations will determine which of the following operations need to be supported by additional, independent HSIs</b>				
Safely shut down the plant using preferred non-safety success paths:				
	Indications, alarms, and controls for preferred non-safety success paths	NSR, independent of the normally-used HSIs  Or implement on same platform as safety-related HSIs	Determine based on appropriate HFE analyses	None
Continue operation for a pre-determined time if conditions permit (extent of functionality and associated HSIs depends on the chosen concept of operations – <b>items below are examples</b> ):				
▶	Indications for pre-emptive safety actions	NSR, independent of the normally-used HSIs	Selectable	None
	HSI resources needed to perform required Tech Spec surveillances			

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Additional HSI resources needed to support continued operation based on chosen concept of operations	NSR, independent of the normally-used HSIs	Selectable	None

**9. Perform Other Important Tasks During Normal Operation With All HSIs Functioning (Section 4.9)**

▶ HSI resources needing enhanced accessibility – for example, key indications, alarms or controls supporting plant power production or investment protection; alarms requiring prompt operator action; indications important to maintaining situation awareness	NSR	SDCV or one-step accessible, based on appropriate HFE analyses	None (Note: This category is outside regulatory review.)
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**Notes:**

<sup>1</sup> Minimum requirements that are either explicitly stated in the regulatory documents or can be clearly inferred from them, are provided where applicable. In cases where the regulatory requirements or guidance documents are not very clear, subject to interpretation, or non-existent, additional guidance is provided as appropriate.

<sup>2</sup> This column identifies those HSIs that should be implemented using safety-related equipment. Those designated SR should be implemented as safety-related HSIs. Those designated SR\* should also be safety-related, but are good candidates for application of a graded approach to qualification, particularly software qualification, due to their lower level of safety significance. Those designated NSR are not required to be safety-related, i.e., they may be implemented using nonsafety-related equipment. Those designated NSR\* also are not required to be safety-related, but should have supplemented or augmented quality, consistent with past practices in operating plants for this category.

All of the safety related HSIs must, per regulation, be independent of the nonsafety HSIs. However, some HSIs have additional requirements for independence, diversity or simplicity – these requirements are included where applicable in the Safety Classification column.

<sup>3</sup> Accessibility relates to the amount of effort required by the user to access a specific HSI resource. The most accessible HSIs are those that are spatially dedicated and continuously visible (SDCV), requiring no action on the part of the user in order to access and use the HSI resource. The next most accessible are those that require only one action in order to access the control or information display, referred to here as “one-step accessible.” The least accessible are those that require multiple actions (e.g., navigating through a hierarchy of screens or a menu system) to access the needed resource. These are referred to as “selectable.”

<sup>4</sup> This column identifies regulatory and industry guidance documents, where available, that provide related guidance. In some cases there is no guidance, or the guidance that is available is not clear and requires interpretation. The table and accompanying text provide guidance to fill these gaps.

<sup>5</sup> Although there is no requirement that these alarms be safety related, consider providing alarm capability on the same safety related display that is used for the associated indications.

<sup>6</sup> The SRM to SECY-93-087 [18] states that alarms for manual actions required for the safety systems to accomplish their safety functions in Advanced Light Water Reactors (ALWRs) should meet 1E requirements. NUREG-0800 (SRP) Section 7.5 (III.1.O) [10] has similar provisions. NSR\* meets the intent of this requirement and is consistent with precedence in operating plants.